

PROJECT MANUAL

LINCOLN - ELIOT ELEMENTARY SCHOOL

NEWTON, MA

60% DESIGN DEVELOPMENT
OCTOBER 05, 2022

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PROJECT MANUAL

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SECTION 011100

SUMMARY OF WORK

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. This Section includes the following:

- 1. Work covered by the Contract Documents
- 2. Contract Method
- 3. Contract Conditions
- 4. Work under other contracts
- 5. Work Sequence
- 6. Owner-furnished products
- 7. Permits, inspection and testing required by Governing Authorities
- 8. Specification formats and conventions.
- 9. Reference standards.
- 10. Miscellaneous Provisions

- B. Related Sections include the following:

- 1. Section 013100 – PROJECT MANAGEMENT AND COORDINATION, for field engineering and coordination requirements.
- 2. Section 013119 – PROJECT MEETINGS, for pre-construction conference and regular site meetings.
- 3. Section 013200– CONSTRUCTION PROGRESS DOCUMENTATION, for requirements for preparing and submitting progress schedule, including preliminary submittal of sequencing plan.
- 4. Section 011400 – WORK RESTRICTIONS, for contractor's use of premises and other contract requirements during construction.
- 5. Section 015000 – TEMPORARY FACILITIES AND CONTROLS, for additional information on temporary measures required during construction.
- 6. Section 017400 – CONSTRUCTION WASTE MANAGEMENT, for removal of non-hazardous debris.
- 7. Section 017329 – CUTTING AND PATCHING, for requirements for cutting and patching.

1.3 WORK UNDER THIS CONTRACT

- A. Project Identification:

Lincoln - Eliot Elementary School

B. Project Location:

Newton, MA

C. Owner:

City of Newton

D. Architect:

Arrowstreet

E. General Description of the Work: Addition and renovation school building project and sitework.

1.4 CONTRACT METHOD

A. Project will be constructed under a single prime contract. This Contract shall be a General Contract for Construction, bid as required by Public Bid Laws.

1.5 CONTRACT CONDITIONS

A. This Contract is subject to applicable State and local laws and all amendments thereto. Where any requirements contained herein do not conform to statutes governing the Work of this Contract, the statutes shall govern.

B. This Project will be constructed for a political subdivision of the Commonwealth of Massachusetts, and is therefore exempt from State Sales and Use Tax. All bids shall be prepared and purchase of materials for the Project made on the basis of such exemption. After execution of the Contract, the Owner will furnish the Contractor with the exemption number to be used.

C. The provisions of the Federal Occupational Safety and Health Act (OSHA) apply to the execution of the Work of this Contract, in addition to all other laws, ordinances, rules, regulations, and orders of any Federal, State, or local public authority bearing on the performance of the Work.

D. Each and every provision of law and clause required by law to be inserted in this Contract shall be deemed to be inserted herein and the Contract shall be read and enforced as though it were included herein, and if, through mistake or otherwise, any such provision is not inserted, or is not correctly inserted, then upon application of either part the Contract shall forthwith by physically amended to make such insertion or correction.

1.6 WORK UNDER OTHER CONTRACTS

A. General: Cooperate fully with separate contractors so work on those contracts may be carried out smoothly, without interfering with or delaying work under this Contract. Coordinate the Work of this Contract with work performed under separate contracts.

1.7 WORK SEQUENCE

A. General: The Contractor's attention is directed toward the critical activities and limitations listed in this Article to highlight unusual conditions present in this Project.

1. The Contractor shall be responsible for scheduling the Work accordingly, and in conformance with requirements of all other specifications for the Project.
 2. Sequencing requirements shall be clearly identified on all construction schedules required under Section 013200 – CONSTRUCTION PROGRESS DOCUMENTATION.
- B. Documentation of Existing Conditions: Due to the historic nature of the building, the Contractor is required to prepare extensive documentation of the existing construction. The following work must be complete prior to commencement of demolition and construction on the site:
1. Photography: Documentation of existing exterior facades and interior surfaces. Refer to Section 013200 – CONSTRUCTION PROGRESS DOCUMENTATION.
 2. Field Engineering: Establishment of precise horizontal and vertical reference points of items identified below in this Section.
 3. This report must be submitted prior to commencement of the Work.
- C. Critical Submittals: No structural steel submittals will be reviewed by the Designer until product data and shop drawings for the following equipment has been submitted and approved:
1. Rooftop HVAC units.
 2. Fan coil units.
 3. Cooling tower.
 4. Generator.
- D. Weather Protection: The Contractor's attention is directed to the fact that extensive weatherproofing will be required to protect interior and exterior construction during the period the building is without a roof. Particular care is required, due to the Owner's intent to preserve the historic fabric of the building. For additional requirements, refer to Section 015000 – TEMPORARY FACILITIES AND CONTROLS.
- E. Air Barrier: Schedule the installation of materials comprising the exterior envelope to minimize exposure of construction materials to damage by ultraviolet light, wind and weather. Notify the Architect prior to concealment of air barrier, to permit inspection and testing. Refer to Section 014000 – QUALITY REQUIREMENTS, and individual technical specification sections for specific requirements.
- 1.8 OWNER-FURNISHED PRODUCTS
- A. Owner will furnish products indicated. The Work includes providing support systems to receive Owner's equipment and making plumbing, mechanical, and electrical connections.
1. Owner will arrange for and deliver Shop Drawings, Product Data, and Samples to Contractor.
 2. Owner will arrange and pay for delivery of Owner-furnished items according to Contractor's Construction Schedule.
 3. After delivery, Owner will inspect delivered items for damage. Contractor shall be present for and assist in Owner's inspection.
 4. If Owner-furnished items are damaged, defective, or missing, Owner will arrange for replacement.
 5. Owner will arrange for manufacturer's field services and for delivery of manufacturer's warranties to Contractor.

6. Owner will furnish Contractor the earliest possible delivery date for Owner-furnished products. Using Owner-furnished earliest possible delivery dates, Contractor shall designate delivery dates of Owner-furnished items in Contractor's Construction Schedule.
7. Contractor shall review Shop Drawings, Product Data, and Samples and return them to Architect noting discrepancies or anticipated problems in use of product.
8. Contractor is responsible for receiving, unloading, and handling Owner-furnished items at Project site.
9. Contractor is responsible for protecting Owner-furnished items from damage during storage and handling, including damage from exposure to the elements.
10. If Owner-furnished items are damaged as a result of Contractor's operations, Contractor shall repair or replace them.
11. Contractor shall install and otherwise incorporate Owner-furnished items into the Work.

B. Owner-Furnished Products to be Installed by the Contractor:

1. **TBD**

- C. Note that items labeled "N.I.C." on the Drawings will be furnished and installed by the Owner under a separate contract after the completion of the Work.

1.9 PERMITS, INSPECTION AND TESTING REQUIRED BY GOVERNING AUTHORITIES

- A. If the Contract Documents, laws, ordinances, rules, regulations or orders of any public authority having jurisdiction require any portion of the Work to be inspected, tested, or approved, the General Contractor shall give the Designer and such Authority timely notice of its readiness so the Designer may observe such inspection and testing.
- B. Prior to the start of construction, the General Contractor shall complete application for a Building Permit to the local building department. Such Permit shall be displayed in a conspicuous location at the project site.
- C. **Payment requirements for this permit fee are waived by the Owner. Waiver of permit fee in this instance shall not be understood to apply to other permit and fee requirements for the Project.**
- D. Exterior Wall Assemblies: NFPA 285 is applicable to this project. Exterior wall products are specified in multiple specification sections, and multiple products are listed as acceptable equals in those sections. Since not all products have been tested to meet NFPA 285 in all combinations, the Contractor shall coordinate with Subcontractors to ensure that the assembly of products meets NFPA 285 requirements. Provide documentation for exterior wall assemblies indicating compliance with NFPA 285 based on products proposed for use on this project.

1.10 REFERENCE STANDARDS

- A. For products specified by association or trade standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.
- B. The date of the standard is that in effect as of the bid date, except when a specific date is specified.

- C. Obtain copies of standards when required by Contract Documents. Maintain copy at job sit during progress of the specific work.

1.11 SPECIFICATION FORMATS AND CONVENTIONS

- A. Specification Format: The Specifications are organized into Divisions and Sections using the 50-division format and CSI/CSC's "MasterFormat 2004 Edition" numbering system.
 - 1. Section Identification: The Specifications use Section numbers and titles to help cross-referencing in the Contract Documents. Sections in the Project Manual are in numeric sequence; however, the sequence is incomplete because all available Section numbers are not used. Consult the table of contents at the beginning of the Project Manual to determine numbers and names of Sections in the Contract Documents.
 - 2. Division 1: Sections in Division 1 govern the execution of the Work of all Sections in the Specifications.
- B. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:
 - 1. Abbreviated Language: Language used in the Specifications and other Contract Documents is abbreviated. Words and meanings shall be interpreted as appropriate. Words implied, but not stated, shall be inferred as the sense requires. Singular words shall be interpreted as plural, and plural words shall be interpreted as singular where applicable as the context of the Contract Documents indicates.
 - 2. All instructions in the Specifications are addressed to the Contractor unless the responsibility of the Designer or Owner is clearly indicated.
 - a. Where products are listed or described in outline form, the phrase "The Contractor shall furnish these products" is implied.
 - b. Where installation instructions or performance criteria are listed or described in outline form, the phrase "The Contractor shall perform the Work in accordance with these requirements" is implied.
 - c. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.
- C. Definitions:
 - 1. Indicated: The word "indicated" refers to graphic representations, notes or schedules on Drawings, Paragraphs or schedules in Specifications, and similar requirements in Contract Documents. Terms such as "shown", "noted", "scheduled", and "specified" are used to help locate a reference. No limitation on location is intended except as specifically noted.
 - 2. Directed: Terms such as "directed", "requested", "authorized", "selected", "approved", "required", and "permitted", are hereby defined as "directed by Designer", "requested by Designer", "authorized by Designer", etc. No implied meaning shall be interpreted to extend the Designer's responsibility into the Contractor's area of construction supervision.
 - 3. Approve: The term "approved" when used in conjunction with the Designer's action on the Contractor's submittals, applications, and similar requests, is limited to the duties and responsibilities of the Designer as stated in GENERAL CONDITIONS. Such approval shall not release the Contractor from responsibility to fulfill Contract requirements unless otherwise provided in the Contract Documents.

4. Furnish: Supply and deliver to the Project Site, ready for unloading, unpacking, assembly, installation, and similar operations.
5. Install: Operations at Project Site, including unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.
6. Provide: To furnish and install, complete and ready for intended use.
7. Installer: The Contractor or entity engaged by the Contractor, either as an employee, subcontractor, or sub-subcontractor for performance of a particular construction activity, including installation, erection, application, and similar operations. Installers are required to be experienced in the operations they are engaged to perform.
8. Owner: The Awarding Authority.
9. Authority having Jurisdiction: Any State, Local, or legal authority, as defined by statute.

D. "Or Equal", "Or Equivalent": clause:

1. Where products or materials are prescribed by manufacture name, trade name or catalogue reference, the word "or approved equal" shall be understood to follow.
2. An item shall be considered equal or equivalent to the named item, if all of the following conditions are met:
 - a. It is at least equal in appearance, quality, durability, strength and design.
 - b. It meets or exceeds all performance requirements specified.
 - c. It performs the function of the item to an equal or superior standard as does the named item.
3. All deviations from products specified shall be submitted as substitutions. For related procedures, refer to Section 013300 – Submittal Procedures.

1.12 MISCELLANEOUS PROVISIONS

- A. Discovery: If during the excavation or other work, articles of unusual value, or of historical or archaeological significance are encountered the ownership of such articles is retained by the Owner, and information regarding their discovery shall be immediately furnished to the Designer.
1. If the nature of the article is such that the work cannot proceed without danger of damaging same, work in that area shall be immediately discontinued until the Designer has decided the proper procedure to be followed.
 2. Any time lost thereby shall be a condition for which the time of the Contract may be extended.
 3. All costs incurred after discovery in the salvaging of such articles shall be borne by the Owner.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 011400
WORK RESTRICTIONS

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. The Work of this Section includes, but is not limited to, requirements for the following procedures:
 - 1. Contractor responsibility for Architect's additional services.
 - 2. Construction Documents, Project Electronic Files and graphic reproduction of Contract Documents.
 - 3. Interpretation and modification of Contract Documents.
 - 4. Contractor's reports.
 - 5. Storm water pollution protection plan
 - 6. Cleaning materials
 - 7. Safety and disposal requirements.
 - 8. Conduct of the Work.
 - 9. Hours of work.
 - 10. Contractor use of premises.
 - 11. Existing Utilities.
 - 12. Noise control.
 - 13. Safety and disposal requirements and accident prevention.
 - 14. Welding and cutting.
 - 15. Municipal police services
 - 16. Storage of materials off-site
 - 17. Dust control.
 - 18. Cleaning during construction.
 - 19. Debris control and removal of rubbish.
 - 20. Pollution control.
 - 21. Owner's occupancy requirements
- B. Related work includes, but is not limited to, the following work under other Sections:
 - 1. Section 013200 – CONSTRUCTION PROGRESS DOCUMENTATION: Preparation and execution of construction schedule.
 - 2. Section 013100 – PROJECT MANAGEMENT COORDINATION: Procedures and responsibilities for coordinating the Work.
 - 3. Section 013300 – SUBMITTAL PROCEDURES. Submittal procedures.
 - 4. Section 015000 – TEMPORARY FACILITIES AND CONTROLS, for additional information on temporary measures required during construction.

5. Section 017400 – CONSTRUCTION WASTE MANAGEMENT, for removal of non-hazardous debris including provisions for recycling and disposal.
6. Section 017700 – CLOSEOUT PROCEDURES: Procedures for completing the Work.
7. Section 017839– PROJECT RECORD DOCUMENTS: Preparation of record drawings and other documents.
8. Section 018119 – INDOOR AIR QUALITY REQUIREMENTS, for procedures for maintaining good indoor air quality in completed building.

1.3 SUBMITTALS

- A. General: Refer to Section 013300 – SUBMITTAL PROCEDURES, for submittal provisions and procedures.
- B. Layout of Temporary Construction Facilities: Submit location plan showing office, trailer and storage layout.
- C. Logistics Plan:
 1. Contractor shall submit to the Owner's Project Manager, at the Pre-construction Meeting, a detailed Logistics Plan, which shall include:
 - a. Delivery Hours and Delivery Routes
 - b. Gate location, and wheel washing location.
 - c. Hours of Work
 - d. Trailer Area, and Layout of trailers
 - e. Parking locations for use of Owner and Contractor within the area of work
 - f. Temp fencing, erosion control, and metering locations
 - g. Location for stockpiling of soil
 - h. Location for stockpiling plowed snow
 - i. Locations for waste management containers.
 - j. Protection of existing curbs and walkways.
 - k. Lighting Plan
 2. Refer to Section 015000 – TEMPORARY FACILITIES AND CONTROLS, for specifications for temporary construction and other items to be shown on Logistics Plan.
 3. No work shall commence until the Logistics Plan has been approved.
- D. Reports:
 1. Documentation of off-site storage facilities.
 2. With each Application for Payment, submit the following reports, compiled on a monthly basis:
 - a. Contractor's Reports
 - b. Proof of submission of Certified weekly payrolls to Owner.
- E. Storm Water Pollution Prevention Plan Documentation: Submit copies of the following documents for information and record purposes only, including one extra copy of each submittal, for the Owner's use in keeping the **<Municipality>** Conservation Commission informed of the progress of the Work:
 1. Storm Water Pollution Prevention Plan (SWPPP)

2. Notice of Intent (NOI)
3. Notice of Termination (NOT).
4. Updates to SWPPP

1.4 CONTRACTOR RESPONSIBILITY TO THE OWNER FOR ARCHITECT'S ADDITIONAL SERVICES

- A. The Contract between the Owner and the Architect contains provisions for additional services that may be required of the Architect during construction due to unforeseen conditions.
 1. Where such additional services become necessary due to the activities of the Contractor, as determined by the Owner's Project Manager, costs for such services will be the responsibility of the Contractor, and will be deducted from the Contract Amount.
- B. Additional services for which the Contractor is responsible for cost to the Owner may include the following activities of the Architect:
 1. Review of Requests for Information and Change Order Requests for work determined to be covered in the Contract Documents. Refer to related Articles in this Section.
 2. Continuation of construction administration beyond the dates specified for Final Completion of the Work: Refer to Section 013200 – CONSTRUCTION PROGRESS DOCUMENTATION.
 3. Review of re-submitted submittals and Substitution Requests that have been rejected: Refer to Section 013300 – SUBMITTAL PROCEDURES.
 4. Re-inspection of incomplete work: Refer to Section 017700 – CLOSEOUT PROCEDURES.
 5. Design services for the resolution of non-conforming work.

1.5 CONSTRUCTION DOCUMENTS

- A. The General Contractor and each Subcontractor shall retain copies of the Contract Documents issued to them for bidding purposes.
 1. The Owner will furnish to the General Contractor, without additional charge, an additional ten (10) complete sets of the Contract Documents, including Drawings and Specifications, for use during the construction period.
 2. The Owner will furnish to each Sub-Contractor, without additional charge, two (2) additional copies of those Drawings and Specifications directly related to the work of their respective trades for use during the construction period.
 3. Extra sets returned by bidders and not required for other purposes, as determined by the Owner's Project Manager, will be made available to Contractor and Subcontractors for the Work.
- B. All other hard copies of the Contract Documents required by the Contractor or Subcontractors for use during the construction period shall be purchased by the party requiring same. Owner's Project Manger will furnish approximate costs of such additional copies and will transmit originals to local printing companies with whom he regularly does business, but will not receive bills for such printing through his account. All negotiations for such printing shall be between Contractor and Printer.
 1. Refer to provisions in this Section, for electronic copies of documents to be made available for the Contractor's use during construction.

2. Refer to Section 017839 – PROJECT RECORD DOCUMENTS, for additional sets to be provided by the Owner to the Contractor for the purpose of maintaining record prints of the Work as construction proceeds.

1.6 PROJECT ELECTRONIC FILES

A. Definitions:

1. Contract Documents: Printed hard copies of drawings and other documents, as defined in the General Conditions and listed in the signed copy of the Form of Agreement between Owner and Contractor.
 - a. In case of conflict between the Contract Documents and documents obtained through electronic means, the Contract Documents shall govern.
2. Project Electronic Files: Electronic copies of electronic documents for the Project, comprising drawings listed on Document 011401 – Electronic Release Form.

B. General Procedures: At the Pre-Construction Meeting, the Architect will present to the Contractor one compact disc (CD) with Project Electronic Files, for use in the preparation of coordination and record documents for the Project.

1. Release Forms Required:

- a. The Contractor shall sign a copy of Document 011401 – Electronic Release Form, to be filled out and issued by the Architect.
 - b. By signing the release form, the Contractor is acting on behalf of all their subcontractors for the Work of this Project.
2. Additional copies of the compact disc with Project Electronic Files will be available from the Architect at an additional cost.

C. Electronic File Format:

1. Editable Files: Electronic files for drawings listed on Document 011401 – Electronic Release Form will be furnished in “*.DWG” format.
2. Printable, Non-Editable Files: Electronic files for all Drawings in the Bid Set and for Drawings issued as Addenda will be furnished in “*.PDF” format (Adobe Acrobat Reader, version 6.0).
3. The Architect does not warrant that these electronic documents are compatible with any software or hardware other than those on which they were produced.

D. Permitted Use of Project Electronic Files: Use of electronic files by the Contractor and Sub-Contractors is limited to the following activities:

1. Project Electronic Files may be used as a guide only for the preparation of Coordination Drawings and Record Drawings to be submitted as a requirement for the Project.
2. Project Electronic Files may be used as a guide only for preparation of shop drawings. Exact copies of Contract Documents will not be accepted if submitted for these purposes, unless specifically permitted by an individual specification Section.

- E. Responsibilities of Contractor: Use and reproduction of Project Electronic Documents are subject to the following conditions:
1. The use of Project Electronic Files, reproduced either electronically or by other graphic reproduction methods, does not in any way alter the responsibilities of the Contractor for final system coordination. The Contractor shall incur all liability in this respect.
 2. The Contractor and all Subcontractors are responsible for checking the dimensions and completeness of the Project Electronic Files, and for determining any possible errors and omissions, as required by the General Conditions.
 3. The Contractor is responsible for updating Project Electronic Files as necessary to incorporate changes to the Work shown in Addenda and documents issued during construction.
 4. In no event shall the Architect or any other Person or Firm involved in the creation, production or distribution of the reproducible or electronic documents, be liable to the persons utilizing the documents, on account of any claim for damages. Each Person or Firm utilizing these documents agrees to release, indemnify, hold harmless and defend the Architect, its officers, employees and consultants from an against all liability arising out of such firm's use of the electronic or reproduced documents or information referred to herein.
- F. Ownership of Documents: By transferring copies of Project Electronic Files, the Architect does not in any way convey the copyright in the designs contained therein, nor do they convey a license to copy or use them for any purpose except as required for the construction of the Project.
- G. License for Software: By transferring copies of Project Electronic Files, the Architect does not in any way convey transfer license to use the software on which the documents were prepared. Each entity using Project Electronic Files is responsible for obtaining licenses as needed for its use of those files.

1.7 GRAPHIC REPRODUCTION OF CONTRACT DOCUMENTS

- A. Reproduction of Contract Documents issued for the Project, by graphic reproduction methods, shall be subject to the conditions outlined for reproduction of Project Electronic Files.

1.8 INTERPRETATION AND MODIFICATION OF CONSTRUCTION DOCUMENTS

- A. Refer to General and Supplementary Conditions for general information on Change Orders, Work Change Directives, Field Orders and Architect's written amendments and clarifications. The intent of this Article is to provide for additional procedures to be followed during construction.
- B. Requests for Information: Each time the Contractor or Subcontractor has a reasonable question on the interpretation of the Contract Documents, they shall submit in writing a Request for Information (RFI) to the Architect for response.
1. The Contractor shall examine field conditions carefully and review the Drawings and Specifications thoroughly prior to issuing an RFI.
 2. The Contractor shall keep a log of RFI's, numbering them in the order in which they are issued.

3. Each RFI shall contain a clear statement of the question, references to relevant Contract Documents and additional background information as needed to facilitate the Architect's review.
 4. All requests for information from Subcontractors shall be made through the Contractor and addressed to the Architect, and the Architect will distribute them as needed to the appropriate Consultants. A copy of each RFI shall be given to the Clerk of the Works.
 5. RFI's shall be issued in a timely manner to permit a thorough review and preparation of a response by the Architect and their Consultants.
 6. The Architect will prepare a written response to each RFI within 10 workdays, or sooner if the Contractor provides a realistic date when the response will be needed.
- C. Proposal Requests: During construction, it may become necessary or desirable to modify the Contract Drawings or Specifications in response to concealed existing conditions, changes in the Owner's program or other unforeseen circumstances.
1. Where such a modification may involve a change in the Contract price or time, the Architect will prepare a Proposal Request describing the modification under consideration, including sketches or drawings, specifications and other information to permit pricing by the Contractor.
 2. Copies of each Proposal Request and its attachments will be distributed to the Owner, Clerk of the Works and Contractor.
 3. The Contractor shall respond in a timely manner with a Proposed Change Order detailing the estimated costs and change in Contract duration, for review by the Architect and approval by the Owner.
 4. A Proposal Request will not constitute direction to proceed with the modification unless accompanied by a Work Change Directive and an estimated price.
- D. Change Order Requests: If the Contractor is required to perform Work that they consider to represent a change in the cost of the Project, they may submit Change Order Requests for such work.
1. Each Change Order Request shall be accompanied by a document describing the modification under consideration, including sketches or drawings, specifications and other information to permit review of pricing by the Architect and Owner.
 2. Distribute copies of each Change Order Request and its attachments to the Owner, Clerk of the Works and Architect.
 3. The Architect and Owner will respond in a timely manner with a Proposed Change Order incorporating the Change Order Request if it is approved.
 4. Verbal approval of a Change Order Request will not constitute direction to proceed with the modification unless accompanied by a Change Order, or a Construction Change Directive with an estimated price.
- E. Architect Review of Contractor-Generated Requests for Information and Change Order Requests: The Architect will review and prepare written responses to the Contractor's Requests for Information and Change Order Requests that are submitted in accordance with the requirements of this section.
1. If the Contractor submits an excessive number of requests for information that are incomplete, or for which the information requested is available from a careful study and comparison of the Contract Documents, field conditions, other Owner-provided information, Contractor-prepared or other prior Project correspondence or documentation,

then the Contractor shall be responsible to the Owner for costs for Additional Services of the Architect to review those requests for information.

2. If the Architect determines that the Work covered by a Change Order Request is covered by the scope of the Contract Documents, the Contractor shall be responsible to the Owner for costs for Additional Services of the Architect to evaluate proposals and prepare Instruments of Service associated with such Change Order Request.
3. Refer to other paragraphs in this Section for procedures required in cases where Contractor is responsible to the Owner for costs for Additional Services of the Architect.

1.9 CONTRACTOR'S REPORTS

- A. A daily report summarizing the work performed, weather conditions, number of workers, amount and kinds of equipment, unusual occurrences, and the like shall be submitted by the Contractor's Field Superintendent to the Architect, the Owner, the Clerk of the Works, each working day covering the work performed on the previous working day.
- B. Form of the daily report shall be as approved by the Architect.
- C. Attention is directed to recent amendments to MGL Chapter 149, Section 27B requiring submission of certified weekly payrolls directly to the Awarding Authority by every contractor and subcontractor doing public work.

1.10 STORM WATER POLLUTION PREVENTION PLAN

- A. Storm Water Pollution Prevention, General: The General Contractor shall submit and execute a Storm Water Pollution Prevention Plan (SWPPP) in accordance with requirements of the National Pollutant Discharge Elimination System (NPDES), administered by the United States Environmental Protection Agency (EPA). The purpose of this plan is to prevent pollution of storm water due to construction activities, throughout the period of construction.
 1. Contractor responsibilities include:
 - a. Temporary construction and maintenance of storm water control and pollution abatement features.
 - b. Construction practices that prevent pollution of storm water.
 - c. Record keeping.
 - d. Periodic inspections
 - e. Modification of the SWPPP as required to address unanticipated conditions.
 - f. Notification to the Owner and Architect of changes in SWPPP required due to changes in the Work.
 - g. Preparation and filing of Notice of Intent and Notice of Termination.
 2. The SWPPP shall conform to the requirements of the **<Municipality>** Conservation Commission where applicable, as stated in Document **<Number>** – ORDER OF CONDITIONS and associated attachments.
 3. Refer to Document **<Number>** – ORDER OF CONDITIONS, Section **<Number>** – EROSION AND SEDIMENT CONTROL and Section **<Number>** – WETLAND PROTECTION AND MITIGATION for additional requirements for control of storm water during construction.
- B. Storm Water Pollution Prevention Plan: Prepare a plan that complies with the requirements of the NPDES General Permit for Storm Water Discharges From Construction Activities,

developed by the United States Environmental Protection Agency in accordance with the provisions of the Clean Water Act, 33 U.S.C. §1251 et sequ., as amended by the Water Quality Act of 1987, P.L. 100-4. The SWPPP shall include text and drawings with the following information:

1. Identification and contact information for all Contractors at the project site whose activities may have an impact on storm water pollution.
 2. Description of construction site and activities, with identification of potential sources of storm water pollution.
 3. Description of pollution control measures that will be implemented and maintained during construction to stabilize slopes and prevent pollution from entering storm water.
 4. Additional information as required by EPA.
- C. Notice of Intent: After the SWPPP has been completed, the Contractor shall prepare, sign and file a Notice of Intent (NOI) with EPA, using a copy of the Notice of Intent for Storm Water Discharges Associated with Construction Activity Under an NPDES General Permit attached to this Section.
- D. Notice of Termination: When site conditions have been stabilized, vegetation has been established and sources of construction-related pollution of storm water have been removed, the Contractor shall prepare, sign and file a Notice of Termination (NOT) with EPA, in accordance with NPDES General Permit for Storm Water Discharges From Construction Activities.
- E. On-Site Records: The Contractor shall maintain up-to-date records of SWPPP documentation in their site office. Required records include:
1. Copy of completed SWPPP
 2. Copies of NOI and NOT as filed with EPA.
 3. Inspection reports
 4. Maintenance reports
 5. Construction activity reports
 6. Spill records
 7. Additional record copies in accordance with NPDES General Permit for Storm Water Discharges From Construction Activities.

PART 2 - PRODUCTS

2.1 CLEANING MATERIALS

- A. Use only those materials which will not create hazards to health or property and which will not damage surfaces. Refer to Section 018119 – Indoor Air Quality Requirements for additional requirements.
- B. Use only those cleaning materials and methods recommended by manufacturer or surface material to be cleaned.
- C. Use cleaning materials only on surfaces recommended by cleaning material manufacturer.

PART 3 - EXECUTION

3.1 CONDUCT OF WORK

- A. The Contract Site shall be as shown on the Drawings, and shall include the entire area bound by the "Contract Limit" or "Limit of Work" lines as well as all areas outside of the Limit of Work Lines when required for performance of work under this Contract.
- B. Contractor shall take all steps necessary to protect existing conditions to remain. Damage to existing work caused by Contractor's operations under this Contract shall be repaired at Contractor's expense.
- C. Any street, paving, curb and/or sidewalk damaged as the result of work under this Contract, whether within or outside the limits of the Work, shall be repaired and/or replaced with new matching construction by the Contractor at his expense and in a manner satisfactory to the Architect and authorities having jurisdiction.
- D. Protection of Curbs and Walkways: Where existing curbs or walks are to remain, or after new curbs or walks are constructed and trucking is required over them, they shall be suitably protected as shown on approved Logistics Plan.
- E. Trenching and other work outside construction limits shall be expedited to the fullest and carried out with minimum of inconvenience to normal operations of Owner and public traffic. Walks, paved or landscaped areas over which temporary driveways cross shall, upon completion of the Work, be restored to their original condition with new construction. Temporary roadways shall be bridged over trenched areas.
- F. Provide continuous, lawful, safe, adequate and convenient access to the site. Contractor shall construct and maintain in good, safe, usable condition temporary roads, capable of supporting emergency vehicles, and appurtenances as required, and when no longer required, remove temporary construction and restore such areas to their original condition, or as otherwise specified in the Contract Documents.
- G. Conduct of Construction Personnel: Smoking is not permitted on project property, including the construction site.

3.2 HOURS OF WORK

- A. Hours of work shall be from **[7:00 AM until 6:00 PM]**, excluding Sundays, and Holidays, unless otherwise approved by the Owner.
- B. The Contractor shall comply with applicable local ordinances.

3.3 CONTRACTOR USE OF PREMISES

- A. General: Contractor shall have full use of premises for construction operations, including use of Project site, during construction period.
 - 1. Confine operations at the site to areas permitted by laws, by-laws, permits and contract limit lines.
 - 2. Do not unreasonably encumber the site with materials or equipment.

3. Coordinate with Owner and Architect work in connection with adjacent occupied buildings or areas, driveways, walks, and other facilities which would prevent access thereto or interrupt, restrict, or otherwise infringe upon use thereof.
- B. General: Contractor will have limited use of premises for construction operations as indicated on Drawings by the Contract limits.
- C. Use of Site: Limit use of premises to areas within the Contract limits indicated on Drawings. Do not disturb portions of Project site beyond areas in which the Work is indicated.
1. Schedule any work that will obstruct adjacent streets in accordance with the requirements of the Owner.
 2. Maintain access to existing walkways, streets and other adjacent occupied or used facilities. Do not close or obstruct walkways, streets or other occupied or used facilities without written permission from Owner and other authorities having jurisdiction.
 3. Owner Occupancy: Allow for Owner occupancy of portions of Project site, including adjacent occupied buildings, and use by the public.
 4. Driveways and Entrances: Keep driveways loading areas, and entrances serving premises clear and available to Owner, Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or storage of materials.
 - a. Schedule deliveries to minimize use of driveways and entrances.
 - b. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.
 5. Site Access: Owner will designate access roads to site and will define limits within which Contractor shall control movements of his personnel. Access to the site shall generally be via existing roadways and paved surfaces which Contractor shall maintain and restore to original condition.
- D. Use of Existing Building: Maintain existing building in a weather tight condition throughout construction period. Repair damage caused by construction operations. Protect building and its occupants during construction period.
- E. Contractor Parking: Parking of Contractor's vehicles and those of his Subcontractors will be allowed only within Limit of Work area located where shown on Drawings. Contractor shall be responsible for parking arrangements, regulation and control of such parking and resulting traffic. Each Subcontractor shall make arrangements with Contractor for required parking of his vehicles.
- F. On-Site Delivery and Storage of Construction Materials: Do not permit materials and fabricated work to be stacked on, or be transported over, floor and roof construction in such a manner as to stress any construction beyond the designed live loads. Assume full responsibility for protection and safekeeping of products stored on premises. Obtain and pay for use of additional storage or work areas needed for operations. Limit use of site to work and storage of materials for this project.
1. Maintain clean, dry storage areas for construction materials and minimize their exposure to dust. Refer to Section 018119 – Indoor Air Quality Requirements and individual Division 3 through 50 Sections for additional requirements.

2. Do not store foamed polystyrene, polyurethane or like materials within the building. Take proper precautionary measures regarding the Storage of such materials outside the building.
- G. Contractor shall be responsible for adequate site drainage during the entire construction period and shall use any appropriate temporary means that does not adversely affect construction progress or abutting property. Refer to Section
- H. Contractor shall take all necessary safety precautions and maintain an adequate level of fire protection at all times.
- I. Do not use areas outside the Limit of Work area for temporary storage or structures without specific written permission from the Architect and Owner.

3.4 EXISTING UTILITIES

- A. Existing Utility Interruptions: 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 Owner not less than two days in advance of proposed utility interruptions.
 2. Do not proceed with utility interruptions without Owner's written permission.
- B. Immediately repair any active existing utility lines (cables, conduit, ducts, and piping), damaged during the course of construction. Protect and maintain such active existing utilities in use, until relocation of same has been completed or utilities have been cut, capped, or prepared for new service connections, as applicable. Perform such repair and protection work at no additional cost to the Owner.
- C. If any existing active utility not indicated on the Drawings is unintentionally damaged, and such utility is to remain, immediately repair the damage and restore the utility to its original integrity. Reimbursement of cost for performing such repair will be made by an adjustment in the Contract Price in accordance with the General Conditions of the Contract.
- D. Any adjustment as outlined above shall be based on the assumption that the Contractor has performed in a prudent manner at the time such damage occurred. If extra expense is incurred in protecting and maintaining any utility line not shown on the Drawings, nor revealed by a "Dig-Safe" inspection, an adjustment in the Contract Price shall be made.
- E. The Owner will cooperate and assist the Contractor in locating and identifying underground utilities. Contractor shall cooperate and participate in "Dig Safe" programs, notifying proper authorities before proceeding.
- F. If it becomes necessary to interrupt power, water line, sewer, gas or other utilities to adjacent buildings, notify the Architect and Owner's Project Manager at least four (4) days in advance. Schedule such interruptions at such times as will minimize disruption and inconvenience to users.

3.5 NOISE CONTROL

- A. Develop and maintain a noise-abatement program and enforce strict discipline over all personnel to keep noise to a minimum. Submit noise abatement program to Owner's Project Manager and Architect for review prior to use of noise generating equipment.
- B. Execute construction work by methods and by use of equipment that will reduce noise and which will provide minimum interference with neighborhood activities.
 - 1. Employ construction methods and equipment that will produce the minimum amount of noise.
 - 2. Equip air compressors with silencers, and power equipment with mufflers.
 - 3. Handle vehicular traffic and scheduling to reduce noise.
- C. Do not allow radio and electronic entertainment equipment to be operated at volume that makes ordinary conversation difficult at ten (10) feet from such equipment.

3.6 SAFETY AND DISPOSAL REQUIREMENTS

- A. Standards: Maintain project in accordance with State Building Code and local ordinances.
- B. Hazards Control: Store volatile wastes in covered metal containers and remove from premises. Prevent accumulation of wastes which create hazardous conditions. Provide adequate ventilation during use of volatile and noxious substances.
- C. Disposal: Conduct cleaning and disposal operations to comply with local ordinances and anti-pollution laws. Do not burn or bury rubbish and waste materials on project site. Do not dispose of hazardous wastes such as solvents, mineral spirits, oil, paint, paint thinner in storm or sanitary drains. Do not dispose of wastes into streams or waterways.

3.7 ACCIDENT PREVENTION

- A. Comply with all Federal, State and municipal recommendations and requirements for safety and accident prevention, those of the Associated General Contractors of America and the American National Standards Institute (ANSI Standard A10.2). Conduct regular, frequent inspections of the site for compliance with safety regulations.
- B. Neither the Owner nor the Architect will be responsible for providing a safe working place for the Contractor, Subcontractors, or their employees, or any individual responsible to them for the Work.

3.8 WELDING AND CUTTING

- A. Where electric or gas welding or cutting work is done above or within ten (10) feet of combustible material or above space that may be occupied by persons, use interposed shields of incombustible material to protect against fire damage or injury due to sparks and/or hot metal.
- B. Place tanks supplying gases for gas welding or cutting at no greater distance from the work than is necessary for safety, securely fastened and maintained in an upright position where practicable. Such tanks, when stored for use, shall be remote from any combustible material and free from exposure to the direct rays of the sun or high temperatures. Storage shall be secured under lock and key, to prevent unauthorized use of gas and equipment.

- C. Maintain suitable fire extinguishing equipment near all welding and cutting operations. When operations cease for the noon hour or at the end of the day, thoroughly wet down the surroundings adjacent to welding and cutting operations. Properly protect any new materials, stored or installed, that are subject to water damage.
- D. Station a worker equipped with suitable fire extinguishing equipment near welding and cutting operations to see that sparks do not lodge in floor cracks or pass through floor to wall openings or lodge in any combustible material. Keep the worker at the source of work which offers special hazards for a minimum of thirty (30) minutes after the job is completed to make sure that smoldering fires have not been started.
- E. Place a qualified electrician in charge of installing and repairing electric and arc welding equipment.

3.9 MUNICIPAL POLICE SERVICES

- A. Make all necessary arrangements with the municipal police department in advance of times when regular, off-duty, or reserve police officers will be needed for traffic control or protection due to operations performed under this Contract.
- B. Pay police officers in accordance with rates established by the municipality for such services:
- C. Extend the Worker's Compensation Insurance and Employer's Liability Insurance required under the General Contract to cover police used on the Project.

3.10 STORAGE OF MATERIALS OFF SITE

- A. The Contractor, Subcontractors and Sub-subcontractors shall obtain prior written approval from the Owner through the Architect for permission to store materials to be incorporated in the Work, for which Progress Payments will be requested, at off-site locations. Any and all charges for storage, including insurance, shall be borne solely by the Contractor. Before approval, Owner will require proper proof of insurance and a letter in which is furnished:
 - 1. The names of the Contractor and/or Subcontractor or subordinate Subcontractor leasing the storage area.
 - 2. The location of such leased space.
 - 3. Description of the leased area: The entire premises or certain areas of a warehouse giving the number of floors or portions thereof.
 - 4. The date on which the material is first stored.
 - 5. The value of the material stored.
 - 6. Transfer of title for such materials in a form acceptable to the Owner.
- B. Requirements for storage facility at which materials will be stored off-site:
 - 1. The storage facility shall be a bonded warehouse.
 - 2. The Contractor shall permit access to the storage facility to the Clerk of the Works upon request.
- C. Contractor, Subcontractors and subordinate Subcontractors shall provide prior to the request for payment for such stored materials, adequate advanced notice, to the Architect so that the Owner or Architect can inspect, at their convenience, the materials being stored at any location.

- D. Each sealed carton shall be marked with the Project name, the Owner's name and the Architect's name as they appear in the Agreement.
- E. A perpetual inventory shall be maintained for all materials held in storage for which payment has been requested.
- F. Payment for materials stored off site shall be at the sole discretion of the Owner. Any additional costs to the Owner resulting from storage of material off site for which payment is requested, such as, but not limited to, travel expenses and time for inspectors shall be back charged to, and paid by, the Contractor.

3.11 DUST CONTROL

- A. Maintain the construction site, stockpiles, access, detour, and haul roads, staging and parking area used for the Work, free of dust which would cause a hazard or a nuisance to those at the site or adjacent sites.
- B. Provide environmentally safe and positive methods and dust control materials to minimize raising dust from construction operations, and provide positive means to prevent air-borne dust from dispersing into the atmosphere.
- C. Wet down dry materials and rubbish to lay dust and prevent blowing dust.
- D. Clean interior spaces prior to the start of finish painting and continue cleaning on an as-needed basis until painting is finished.
- E. Schedule operations so that dust and other contaminants resulting from cleaning process will not fall on wet or newly-coated surfaces, including paint, coatings, sealants, caulking, adhesives.
- F. Furnish, erect, and maintain for the duration of the work period, temporary fire-retardant dust proof coverings and partitions as required to prevent the spread of dust beyond the immediate area where work is being performed.
- G. These provisions do not supersede any specific requirements for methods of construction or applicable regulations or general conditions set forth elsewhere in the Contract with regard to performance obligations of the Contractor.

3.12 CLEANING DURING CONSTRUCTION

- A. Execute cleaning during progress of work and at Substantial Completion, as required by General Conditions and as herein specified.
- B. Maintain premises and public properties free from accumulations of waste, debris and rubbish caused by operations. At completion of work, remove waste materials, rubbish, tools, equipment, machinery, and surplus materials, and clean all exposed surfaces; leave project clean and ready for occupancy.
- C. Cleaning shall be in addition to cleaning specified under other sections and shall include all surfaces, interior and exterior in which or to which the Contractor has had access.
- D. Refer to Sections of the Specifications for cleaning of specific products.

- E. Execute cleaning to ensure that the building, the site, and adjacent properties are maintained free from accumulations of waste materials and rubbish and windblown debris, resulting from construction operations.
- F. Provide on-site containers for collection of waste materials, debris and rubbish.
- G. Remove waste materials, debris and rubbish from the site periodically and dispose of at legal areas off site.
- H. Handle materials in a controlled manner with as few handling as possible. Do not drop or throw materials from heights.
- I. Schedule cleaning operations so that dust and other contaminants resulting from cleaning processes will not fall on wet newly painted surfaces, uncured caulking, sealants, adhesives, etc.

3.13 DEBRIS CONTROL AND REMOVAL OF RUBBISH

- A. Ensure that each Subcontractor engaged in the Work bears full responsibility for cleaning up during on a daily bases and immediately upon completion of his work, and removes all rubbish, waste, tools, equipment, and appurtenances caused by and used in the execution of his work; but this shall in no way be construed to relieve the General Contractor of primary responsibility for maintaining a clean building and site free of debris, leaving all work broom clean and in a condition satisfactory to the Architect, Project Manager, and Owner.
- B. Provide at least one tightly built chute serving each level which shall lead down to angle offset and sliding panel chute at a convenient loading point for trucks or dumpsters.
- C. Do not permit any material to be thrown from open floors, windows or roof of the building.
- D. Immediately after unpacking, remove all packing materials, case lumber, excelsior, wrapping and other rubbish, flammable and otherwise, from the building and premises.
- E. Initiate and maintain a specific program to prevent the accumulation of debris at the construction site, storage and parking areas, or along access roads and haul routes:

Provide containers for deposit of debris and schedule periodic collection and disposal of debris. Prohibit overloading of trucks to prevent spillage on access and haul routes.

- F. Contractor shall make provisions for snow and ice removal, as required. In addition Contractor shall provide wheel-washing stations at site egress gates, as directed by the Project Manager, to maintain clean neighborhood streets.

3.14 POLLUTION CONTROL, GENERAL

- A. Provide methods, means and facilities required to prevent contamination of soil, water and atmosphere by the discharge of noxious substances from construction operations.
- B. Remediation of Spills: Provide equipment and personnel, perform emergency measures required to contain any spillages, and to remove contaminated soils or liquids. Excavate and dispose of contaminated earth off site and replace with suitable uncontaminated compacted fill and topsoil, in accordance with the requirements of Section 310000 - EARTHWORK.

- C. Take special measures to prevent harmful substances from entering public waters. Prevent disposal of wastes, effluents, chemicals, or other such substances adjacent to streams or in sanitary or storm sewers.
- D. Provide systems for control of atmospheric pollutants. Prevent toxic concentrations of chemicals. Prevent harmful dispersal of pollutants into the atmosphere.
- E. Refer to construction phasing plans for information and to the Order of Conditions for sequence of operations for erosion control.

3.15 STORM WATER POLLUTION PREVENTION PLAN IMPLEMENTATION

- A. Execute Storm Water Pollution Prevention Plan described in SWPPP as submitted to the EPA, in accordance with Federal and local regulations.

3.16 OWNER'S OCCUPANCY REQUIREMENTS

- A. Full Owner Occupancy: Owner will occupy adjacent buildings during entire construction period. Cooperate with Owner during construction operations to minimize conflicts and facilitate Owner usage. Perform the Work so as not to interfere with Owner's day-to-day operations. Maintain existing street and site access at all times, unless otherwise indicated.
 - 1. Maintain access to existing walkways, streets and other adjacent occupied or used facilities. Do not close or obstruct walkways, streets or other occupied or used facilities without written permission from Owner, and authorities having jurisdiction.
 - 2. Provide not less than 72 hours' notice to Owner of activities that will affect Owner's operations.
- B. Owner Occupancy of Completed Areas of Construction: Owner reserves the right to occupy and to place and install equipment in completed areas of building, before Substantial Completion, provided such occupancy does not interfere with completion of the Work. Such placement of equipment and partial occupancy shall not constitute acceptance of the total Work.
 - 1. Architect will prepare a Certificate of Substantial Completion for each specific portion of the Work to be occupied before Owner occupancy.
 - 2. Obtain a Certificate of Occupancy from authorities having jurisdiction before Owner occupancy.
 - 3. Before partial Owner occupancy, mechanical and electrical systems shall be fully operational, and required tests and inspections shall be successfully completed. On occupancy, Owner will operate and maintain mechanical and electrical systems serving occupied portions of building.
 - 4. On occupancy, Owner will assume responsibility for maintenance and custodial service for occupied portions of building.
- C. If the Project is substantially complete by the specified date for Substantial Completion, the Owner at his election may from time to time, or permanently, occupy the building or any portion thereof as the work is completed to such a degree as will, in the opinion of the Owner, permit the use of the building or other portions of the Project for the purpose for which they are intended.
- D. The Owner will, prior to any such partial occupancy, give notice to the Contractor thereof and such occupancy shall be predicated upon the following conditions:

1. In the case of partial occupancy prior to the stipulated completion date, the Owner shall secure endorsement from the Contractor's insurance carrier and consent of the surety permitting occupancy of the building or use of the Project during the remaining period of construction.
2. In the case of partial occupancy after the stipulated completion date, the Contractor shall extend all the necessary insurance coverage as stipulated until the date of Final Acceptance of the Project. Owner's use and occupancy prior to final Acceptance shall not relieve the Contractor of his responsibility to maintain the insurance coverage as required by the Contract Documents.
3. In case of such partial occupancy, the guarantee period called for by the Contract Documents shall commence on the date of Substantial Completion of the Phase containing the guaranteed Work.
4. Occupancy of the building or any portion thereof by the Owner, shall not constitute an acceptance of the Work or of work not performed in accordance with the Contract Documents or relieve the Contractor of responsibility to perform any work required by the Contract but not completed at the time of occupancy.
5. If the Owner occupies the building as a result of the Contractor's failure to substantially complete the work by the specified date, the Contractor shall pay maintenance costs on the portion of the building occupied under this Agreement until Substantial Completion.
6. The Contractor shall be required to furnish heat, electricity and water used in the occupied portion of the building, from the time of the occupancy by the Owner until Substantial Completion.

END OF SECTION

FORM 011401

ELECTRONIC RELEASE FORM

To: **[Contractor]**
[Street]
[Town, State]

Date: **[Date documents are transmitted]**

Project: Lincoln - Eliot Elementary School

RE: Project Electronic Files

Project Electronic Files are made available to the undersigned with the following conditions:

The undersigned agrees to accept from Arrowstreet the electronic files for the referenced project, as listed in the attached table, without any warranties, guarantees and/or representations of any nature whatsoever regarding the correctness, accuracy and/or completeness of any information contained therein.

The undersigned further agrees that such information shall be used as reference material only and then only for the referenced project and not for any other projects or future additions to the referenced project, without express written consent from Arrowstreet for each instance.

The undersigned further agrees to release, indemnify, hold harmless and defend Arrowstreet with respect to any claims, costs, losses, damages and/or liabilities arising out of, or relating to the use, misuse, modification, interpretation, misinterpretation and/or misrepresentation of any such information.

The undersigned further agrees to the requirements and limitations for the use of Project Electronic Files as stated in Section 011400 - Work Restrictions.

Sincerely,
Arrowstreet

Accepted and Agreed to:

(General Contractor)

By: _____

Title: _____

Attachment: List of Project Electronic Files

List of Project Electronic Files

File Format	Drawing number	Drawing title
PDF	All drawings listed on Drawing List- Volume 1 & 2	Entire Bid Set of Drawings
PDF	Addenda	All Addenda issued
DWG	C1.1	Site Utility Plan
DWG	LA.2 through LA.7	Landscape Plans
DWG	A2.1 through A2.3	Architectural Floor Plans
DWG	A3.1 through A3.3	Architectural Reflected Ceiling Plans
DWG	A2.4a through A2.4b	Architectural Roof Plans
DWG	FS1 through FS2	Foodservice Drawings
DWG	S2.1 through S2.4	Structural Framing Plans
DWG	P1.0 through P1.4	Plumbing Plans
DWG	H2.1 through H2.4	Mechanical HVAC Plans
DWG	H3.1 through H3.4	Mechanical Piping Plans
DWG	E1.1 through E2.3	Electrical Lighting Plans
DWG	E2.1 through E2.4	Electrical Power Plans
DWG	FA 1.1 through 1.3	Fire Alarm Floor Plans
DWG	T1.1 through 1.3	Technology Floor Plans
DWG	PV1.0 through PV 2.1	Photovoltaic Plans

Additional Electronic Files for Use during Construction:

File designation	Document number	Document title
013301.PDF	Document 013301	Substitution Request Form

END OF FORM

SECTION 012300

ALTERNATES

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. This Section includes administrative and procedural requirements for alternates.

1.3 DEFINITIONS

- A. Alternate: An amount proposed by Bidders and Filed Sub-Bidders, and stated on the appropriate Bid Form for certain work defined in the Bidding Requirements that may be added to or deducted from the Base Bid amount if Owner decides to accept a corresponding change either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.
 - 1. The cost or credit for each alternate is the net addition to or deduction from the Contract Sum to incorporate alternate into the Work. No other adjustments are made to the Contract Sum.

1.4 PROCEDURES

- A. Each General Bidder and each Sub-Bidder shall examine the Alternates generally defined herein and in the Drawings and Specifications and determine any modifications to his work caused by any Alternate whether or not his particular trade Section is mentioned herein.
- B. Listing of Alternates on Bid Forms:
 - 1. Each Filed Sub-Bidder shall enter in the FORM FOR SUB-BID only the amount of the addition or subtraction necessitated by the Alternate that pertains to the work of his trade.
 - 2. General Bidders shall enter a single amount in the appropriate space provided in the FORM FOR GENERAL BID, which total amount shall consist of the Filed Sub-Bidders' amounts and the amount for all work to be performed by the General Contractor.
 - 3. Work of Sections that are affected by Alternates but which are not designated as Filed Sub-Bid Sections shall be included in the work of the General Contractor.
- C. Alternates will be considered in numerical sequence as required by Chapter 149, Section 44G of the Massachusetts General Laws.

1.5 COORDINATION

- A. Coordination: Modify or adjust affected adjacent work as necessary to completely integrate work of the alternate into Project.
 - 1. Include as part of each alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation whether or not indicated as part of alternate.
 - 2. The amount listed for each alternate shall include all costs related to coordination, modification and adjustments of the Work associated with that alternate.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 GENERAL

- A. Notification: Immediately following award of the Contract, notify each party involved, in writing, of the status of each alternate. Indicate if alternates have been accepted, rejected, or deferred for later consideration. Include a complete description of negotiated modifications to alternates.
- B. Execute accepted alternates under the same conditions as other work of the Contract.
- C. Schedule: A Schedule of Alternates is included at the end of this Section. Specification Sections referenced in schedule contain requirements for materials necessary to achieve the work described under each alternate.

3.2 SCHEDULE OF ALTERNATES

- A. Alternate No. 1: **<Description>**

END OF SECTION

SECTION 012400
SCHEDULE OF VALUES

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 summary

- A. The Work of this Section includes requirements for the following procedures:
 - 1. Preparation and submittal of the Preliminary and Final Schedule of Values
- B. Related work includes, but is not limited to, the following work under other Sections:
 - 1. Requirements for construction schedules: Section 013200 – Construction Progress Documentation.
 - 2. General procedures for submittals: Section 013300 – Submittal Procedures.

1.3 definitions

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

1.4 submittals

- A. Prepare and submit the following submittals in accordance with the requirements of Section 013300 – Submittal Procedures.
- B. Schedule of Values:
 - 1. Schedule of Values shall be typewritten on 8-1/2 by 11 inch white paper.
 - 2. Submit to the Architect three (3) copies of each Schedule of Values within 7 days of receipt of Notice to Proceed.
- C. List of Subcontractors and Sub-subcontractors: Attached to the Preliminary Schedule of Values shall be a list of the names, addresses (and whether individual, partnership or corporation) of each Subcontractor or Sub-Subcontractor who is to perform all or any part of each subdivision. In the event any Subcontractors, or Sub-subcontractors are not known at the time said schedule is prepared, an amended or supplementary list containing the names of the Subcontractors and

Sub-Subcontractors involved and indicating their division of the Work shall be furnished to the Architect as soon as the information is available. A code number for identification on requisitions shall be used to identify the Contractor, each of the Subcontractors and subordinate Subcontractors, and shall be shown in each requisition where any part of the Work performed by the Contractor, such Subcontractor, Sub-Subcontractors or material supplier is incorporated in the amount of the requisition for which payment is requested.

- D. Monthly Updates: Submit to the Owner with the Schedule of Values on a monthly basis such schedules of quantities and costs, payrolls, reports, estimates, records, and other data as the Owner may request concerning work performed or to be performed under this Contract. The Schedule of Values shall be submitted at the same time as the updated CPM Schedule showing the current status of the work, as required under Section 013200 – Construction Progress Documentation.

1.5 SCHEDULE REQUIREMENTS

- A. General: Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with the Project CPM Schedule. Provide line items for principal subcontract amounts, where appropriate, and for portions of the work designated in this Section.
- B. Format and Content: Use the Project Manual table of contents as a guide to establish line items for the Schedule of Values. Provide at least one line item for each Specification Section. Identify each line item by Specification Number and Title, and by portion of the Work of that Section where the Work of a Section is allocated to more than one line item.
- C. The Schedule of Values shall be arranged in vertical columns identified with titles, including Names Of Items; Original Amounts, Percent Completed To Date; Previous Payments; Current Requests; and Balance Not Yet Requested. A summary of the total amount due to date and the amount of the five percent retained shall be included in the statement which shall be signed by the Contractor. A separate sheet shall be included with each requisition showing status of work covered by approved Change Orders. The Schedule of Values shall be revised if later found by the Architect to be inaccurate.
- D. In preparing the Schedule, each sub-division or classification of the Work shall be identified by code number referring to each individual Section (or Sub-Section where applicable) of the Specifications. The Schedule of Values shall be prepared in accordance with AIA Documents G702 and G703.
- E. Initial values will be recognized to be an accurate accounting of the value of the work. Upon request by the Architect, support values given with data that will substantiate their correctness.
- F. Identify quantities of designated materials or materials stored on which payment is expected to be made.
- G. Use monthly submissions of Schedule of Values only as basis for Contractor's Application for Payment.

1.6 PREPARING SCHEDULE OF VALUES

A. General Procedures:

1. Prepare Preliminary Schedule of Values for review by Architect, Owner and Owner's Project Manager.
2. Incorporate requested modifications to produce a Final Schedule of Values, which will become the basis for documenting the progress of the Work with each Application for Payment.
3. Update Final Schedule of Values as necessary to reflect changes in the Work.

B. Itemize separate line item cost for each of the general cost items as specified in this Section.

C. Breakdown installed costs into:

1. Delivered cost of product
2. Total installation cost, with overhead and profit.
3. Construction phase.
4. Note that the Owner is exempt from Sales and Use Tax for all materials incorporated into the Work.

D. For each line item which has installed value of more than \$20,000.00 breakdown costs to list major products, components, or operations under each line.

E. Sum of costs of all items listed in schedule shall be equal to total Contract Sum.

F. Each item shown on an Application for Payment Schedule of Values shall also appear on the CPM Schedule.

1.7 line items for schedule of values

A. Work Covered in Division 1: Itemize separate line item cost for each of the following general cost items:

1. Builder's Risk Insurance
2. Performance and Payment Bonds for General Contractor and Filed Subcontractors.
3. Field engineering; photographic documentation.
4. Coordination; project management.
5. Preparation of schedule and periodic updates.
 - a. If periodic updates of schedule are not performed in a timely manner, the amount shown on the Schedule of Values for this line item shall be forfeit.
6. Weather protection; temporary fence.
7. Temporary heat, water, power and lighting.
8. Temporary office facilities; temporary sanitary facilities.
9. Construction aids, including staging, scaffolding, shoring.
10. Project sign.
11. Indoor air quality provisions.
12. Construction waste management.
13. Cutting and patching; selective demolition

14. Final cleaning.
 15. Punchlist preparation and response.
 16. Maintenance of as-built documents for architectural and site work; preparation of closeout documents.
 17. Commissioning activities.
 18. Overhead.
 19. Other items of work as requested by the Architect or Owner.
- B. Work Covered in Divisions 2 through 50: Provide at least one separate line item for each Section of the Specifications. Section line items shall be further subdivided into separate line items as follows:
1. Subdivide each line item into separate line items for individual floors of the project where applicable.
 2. Identify material costs separately from labor costs.
 3. Provide separate line items for the following where applicable:
 - a. Submittals
 - b. Maintenance of as-built documents for mechanical and electrical work
 - c. Preparation of closeout documents
 - d. Operations and Maintenance Manuals;
 - e. Training
 - f. Other items of work as requested by the Architect or Owner.
 4. For mechanical and electrical work, provide the following additional separate line items where applicable:
 - a. Commissioning activities other than demonstration of FPT to the Commissioning Firm
 - b. Commissioning activities associated with demonstration of FPT to the Commissioning Firm
 5. For each line item which has installed value of more than \$20,000.00 break down costs to list major products, components, or operations under each line.

PART 2 - PRODUCTS [NOT USED]

PART 3 - EXECUTION [NOT USED]

END OF SECTION

SECTION 013100

PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. The Work of this Section includes, but is not limited to, requirements for the following procedures:
 - 1. Responsibility for coordination of the Work.
 - 2. Surveying and engineering.
 - 3. Coordination Drawings.
- B. Related work includes, but is not limited to, the following work under other Sections:
 - 1. Survey information available to bidders: Section 003100 – AVAILABLE PROJECT INFORMATION.
 - 2. General requirements for submittals: Section 013300 – SUBMITTAL PROCEDURES.

1.3 SUBMITTALS

- A. Prepare and submit documentation in accordance with Section 013300 – SUBMITTAL PROCEDURES.
- B. Drawings:
 - 1. Survey of existing project conditions: Submit a set of reproducible drawings and certificate signed by registered engineer or land surveyor, certifying that elevations and locations of improvements are in conformance, or non-conformance with Contract Documents.
 - 2. Survey of base plate elevations and anchor bolt locations.
 - 3. Survey of as-built conditions: Certified survey showing all as-built dimensions, locations, angles and elevations of construction, to be submitted at Substantial Completion of the Work.
 - 4. Coordination Drawings as described in this Section.
- C. Certifications required for Work described in this Section:
 - 1. Field Engineering: Submit name and address of surveyor and professional engineer to Architect.

1.4 COORDINATION

- A. General: The Contractor shall be responsible for the proper fitting of all work and the coordination of the operations of all trades, Subcontractors, material installers and equipment engaged upon the Work. He shall perform or cause Subcontractors to perform all cutting, fitting, adjusting and patching necessary to make the several parts of the Work come together properly and to fit the Work to receive or be received by that of other contractors.
- B. Project Supervision: The Contractor shall give his personal supervision to the Work and shall assign the following site staff for the Project:
 - 1. Full-time Superintendent: A superintendent licensed in the Commonwealth of Massachusetts, with the authority to act on behalf of the Contractor. The Superintendent shall supervise the Work at all times throughout the duration of the Project.
 - 2. Quality Control Monitor: A member of Contractor's full-time on-site staff assigned to monitor the quality of the Work. The Quality Control Monitor may also be assigned to oversee and document construction waste removal.
 - 3. The Contractor shall also provide an adequate staff for the proper coordination and expediting of the Work.
- C. Coordination with Subcontractors: The Contractor shall be in charge of the entire Work and shall be responsible for the prompt coordination of all trades, including his own forces and his various Subcontractors, as well as the Owner's separate contractors, if they are on the job during the Contractor's operations, and shall become fully familiar with all work required under the Contract.
 - 1. The above notwithstanding, each Subcontractor shall assume responsibility for the correctness and adequacy of his work. Each Subcontractor shall be responsible for and pay for all damage done by his work and his workers.
 - 2. No Subcontractor shall be permitted on the site without the Superintendent present to supervise the Work.
- D. Care shall be given to the proper scheduling, delivery, and installation of items to be built into rough construction which will affect the latter portions of the Work, such as anchors, pipe sleeves, inserts, conduit, pipes, lugs, clips, brackets, braces, hangers, bolts, miscellaneous metal, and similar items. These items are not necessarily specified under the trade Section under which they are to be installed. The Contractor shall ascertain that all are properly installed in their correct locations at the proper time, so as to prevent cutting and patching of finished work.
- E. The Contractor shall be fully responsible for coordination of general construction work with that of Subcontractors for PLUMBING, ELECTRICAL, HEATING AND VENTILATING and all other specialized trades. He shall investigate, together with the Subcontractors involved, the routing of pipe, ductwork, and conduit with particular attention to interference of structural members, other pipes, ducts, and conduit cuts, headroom conditions, door and window openings and swings, pipe chases, and similar features of the building which may affect installation and proper functioning of such items.
- F. Changes in design locations which may be necessary in the routing of pipes and ducts, or in the location of any mechanical, electrical or other equipment or in the location of other building elements, shall be anticipated and made prior to installation. Additional compensation will not

be allowed for costs incurred as a result of the Contractor's failure to anticipate the necessity for such changes.

- G. There shall be no change or variation in ceiling height, wall layout, shaft, chase, furring or other dimensions shown on Drawings without the specific written approval of the Architect.
- H. The Contractor's responsibility for the coordination of all work under the Contract shall be complete, and shall extend to all modifications in the Work, whether or not such modifications entail a change in the Contract Price. Where the Contract Documents allow an optional material or method of performing a portion of the Work, or where the Contractor is ultimately allowed or directed to perform a part of the Work using a substitute material or method, the Contractor shall provide all other coordination and additional work that such change necessitates, without any additional cost to the Owner.

1.5 SURVEYING AND ENGINEERING, GENERAL

- A. The Contractor shall employ a project engineer who is a qualified land surveyor registered to practice in the Commonwealth of Massachusetts, who shall establish and maintain grades and levels and permanent bench marks. In addition, the Contractor shall designate one person from within his organization, with engineering experience, who shall do the usual engineering work required, including leveling, checking, and verifying wall and partition lines, elevations, etc.
- B. Prior to commencement of any excavation or filling work on the site, the project engineer shall check locations of all structures and other fixed items with regard to property lines and other existing conditions. The Contractor shall be fully responsible for reporting to the Architect discrepancies between the dimensions and/or locations indicated on the Contract Drawings and those as they actually exist on the site.
- C. After verification of all dimensions and locations, the Contractor shall submit to the Architect such verification in written form bearing the professional stamp of the surveyor. Failure to do so shall mean that the Contractor assumes responsibility for all corrective measures required at no addition to the Contract amount.
- D. The Contractor shall lay out the Work and shall be responsible for all lines, elevations, and measurements of the building, grading, paving and other work under the Contract. He shall exercise proper precaution to verify the dimensions shown on the Drawings before laying out the Work and will be held responsible for any error resulting from his failure to exercise such precaution.

1.6 FIELD ENGINEERING REQUIREMENTS

- A. General: Provide professional field engineering services, establish grades, lines and levels, by use of recognized engineering survey practices.
 - 1. The Contractor's attention is directed to the fact that Drawings have been prepared based on the assumption that all existing walls are set in orthogonal relationship to each other. The Contractor will be responsible for verifying the precise angle between existing walls, and bring to the attention of the Architect any conditions that deviate from orthogonal.
 - 2. Submit surveys and documentation as described herein.
- B. Scope of Field Engineering:

1. Architectural features in the existing construction for which precise vertical and horizontal reference points are required include, but are not limited to, the following:
 - a. Top of foundation wall.
 - b. Windowsill heights at each floor level.
 - c. Top of decorative masonry cornice and existing roof edge at perimeter of building.
 - d. Horizontal layout of existing masonry openings in all exterior walls.
 - e. All other reference points shown on Drawings.
2. Site features:
 - a. Existing grades, including grades immediately adjacent to existing building.
3. Structural elements: For each column, a precise base plate elevation and horizontal location shall be established. After the anchor bolts have been set in the foundations and leveling plates have been set in grout, the top surface of each leveling plate shall be surveyed to determine the following locations. Submit survey data to the Architect for review and approval prior to fabrication of structural steel.
 - a. Elevation of top surface of each leveling plate.
 - b. Precise position of the center of each anchor bolt in each leveling plate.
- C. Qualifications of Surveyor or engineer: Qualified engineer or registered land surveyor, acceptable to Architect and the Owner.
 1. Registered professional engineer of the discipline required for the specific service on the Project, licensed in the Commonwealth of Massachusetts.
- D. Survey Reference Points:
 1. Datum: Location of control datum to be used as reference point for horizontal and vertical survey measurements is shown on Drawings.
 2. Locate and protect control and reference points prior to starting site work, and preserve all permanent reference points during construction.
 - a. Make no changes or relocations of control points without prior written notice to Architect.
 3. In the event that any reference point is lost or destroyed, or requires relocation due to necessary changes in grades or construction, perform the following actions without delay:
 - a. Report change to Architect immediately.
 - b. Replacement of reference point shall be performed by surveyor, as directed by Architect.
 4. Project Survey Requirements:
 - a. Establish a minimum of two permanent benchmarks on the site, referenced to data established by survey control points.
 - b. Establish lines and levels, locate and lay out by instrumentation and other appropriate means.

- c. Verify layouts periodically using the same means as those by which they were established.

E. Records:

- 1. Maintain a complete, accurate log of all control and survey work as it progresses.
- 2. Prepare and submit a survey of existing conditions and a final survey of as-built conditions containing all relevant horizontal and vertical dimensions and reference point data.

1.7 COORDINATION DRAWINGS

- A. The Contractor shall be responsible for the coordination of all mechanical and electrical work with architectural requirements including ceiling layouts. Well in advance of commencing work in any area and before materials are fabricated or work begun, he shall submit to the Architect complete Coordination Drawings in the form of reproducible transparencies in a scale not less than $1/4" = 1'-0"$. Congested areas and sections through shafts shall be at a scale not less than $3/8" = 1'-0"$.
- B. Coordination Drawings shall indicate the necessary offsets for all ductwork, piping, conduit, and other items to clear the work of all other trades, and structure, and to maintain the required ceiling height, ceiling layout and partition layout.
- C. Prepare Coordination Drawings as follows:
 - 1. The background for coordination drawings shall show the reflected ceiling plan.
 - 2. Contractor shall require HEATING AND VENTILATING Subcontractor to prepare original Drawings showing all ductwork, hot water and other heating lines, based on approved Sheet Metal Fabrication Drawings and related mechanical submittals.
 - 3. Contractor shall have transparencies made there from, and shall distribute them to the Architect and the Plumbing Subcontractor for the next step.
 - 4. Contractor shall then require PLUMBING Subcontractor to indicate all his equipment and plumbing lines on these transparencies.
 - 5. Contractor shall then require FIRE PROTECTION Subcontractor to indicate his equipment and piping on these transparencies.
 - 6. Contractor shall require the ELECTRICAL Subcontractor to indicate his equipment and conduit lines on the same Drawings.
 - 7. Contractor shall resolve conflicts and then submit these transparencies to the Architect for review.
 - 8. Submit complete final set of coordination drawings for record purposes.
- D. Coordination Drawings shall bear the signature of all subcontractors involved indicating that all space conditions have been satisfactorily resolved. In addition, the Drawings shall bear the Contractor's stamp bearing the notation "Drawings Have Been Checked and Coordinated with all Trades". Drawings without these notations, or Drawings submitted more than 120 days after the execution of the Contract, will not be accepted or reviewed by the Architect.
- E. If any space conflicts cannot be resolved by the Contractor, he shall immediately notify the Architect.

- F. Coordination Drawings are for the Contractor's and Architect's use during construction and shall not be construed as replacing any Shop, "As-Built", or other Record Drawings required elsewhere in these Contract Documents.
- G. Architect's review of Coordination Drawings shall not relieve General Contractor from his overall responsibility for coordination of all work performed pursuant to the Contract or from any other requirements of the Contract.
- H. Access panel coordination: Show locations and sizes of all access panels for all trades on Coordination Drawings.

PART 2 - PRODUCTS [NOT USED]

PART 3 - EXECUTION [NOT USED]

END OF SECTION

SECTION 013119
PROJECT MEETINGS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. The Work of this Section includes, but is not limited to, requirements for the following procedures:
 - 1. Organizational meetings.
 - 2. Project meetings.
 - 3. Pre-Installation conferences
 - 4. Post-construction meetings
- B. Related work includes, but is not limited to, the following work under other Sections:
 - 1. Requirements for construction schedules: Section 013200 Construction Progress Documentation.

PART 2 - PRODUCTS

2.1 ORGANIZATIONAL MEETINGS

- A. General: The Owner's Project Manager will schedule pre-construction organizational meetings, periodic Project meetings, specially called meetings throughout the progress of the Work, and post-construction meetings. Representatives of the Contractor shall attend all such meeting. Subcontractors shall attend as indicated below and as requested by the Architect or the Owner's Project Manager.
- B. Pre-Construction Meeting: Immediately following award of Contract, the Architect will call one or more preliminary organizational meetings, during which detailed procedures will be worked out for submission and review of Shop Drawings and samples, format and extent of the Progress Schedule and Schedule of Values, format and methods for progress payment requisitions, channels of communication between Owner, the Owner's Project Manager, Architect's and Contractor's personnel, and other routines to be followed during construction. The Architect will then issue a directive summarizing such procedures.
- C. Exterior Envelope Meeting: Attendance by Architect, Contractor, major subcontractors. Agenda shall include as applicable: Review of exterior wall details, wall construction, sample panel preparation, cleaning, control and expansion joints, cold weather procedures.

1. **[NFPA 285: Review and confirm that products proposed for the exterior wall assemblies comply with NFPA 285 as a tested assembly. Submit manufacturer's certifications that exterior assemblies have been tested and comply with NFPA 285 promptly following the exterior envelope meeting.]**

- D. Roofing/Flashings Meeting: Attendance by Architect, Contractor, roofing subcontractor, and representative of roofing manufacturer. Agenda shall include as applicable: Preparation of roof decks, flashing and blocking details, roofing procedures and inspections, bonds and guarantees, weather conditions during roofing, protection of roof membrane during construction.
- E. Interior Finishes Meeting: Attendance by Architect, Contractor, major subcontractors. Agenda shall include as applicable: Quality of workmanship, environmental conditions for application of finishes, drywall details, millwork details, condition of surfaces to receive finishes, tile work, painting work, samples and test areas and approvals, coordination with mechanical and electrical interfaces and penetrations, indoor air quality.

2.2 PROJECT MEETINGS

- A. The Architect shall schedule and meet regularly with the Owner, the Owner's Project Manager and the Contractor at the site of the Work during the course of the Contract for the purpose of progress review, coordination of Shop Drawing schedules, sample submittals, and other items of work requiring such coordination. The dates of such meetings shall be as mutually agreed upon between the Owner, the Owner's Project Manager, Contractor and the Architect. Contractor shall require Subcontractors to attend such meetings if requested by the Architect.
- B. The **[Owner's Project Manager] [Architect] [Contractor]** shall take minutes of such meetings and shall distribute copies of the minutes to all concerned.
- C. Contractor's and Subcontractor's representatives attending such meetings shall include the job superintendent or other responsible party approved by the Architect. Such representatives shall be empowered to make, at these meetings, definite decisions binding upon their respective employers regarding all matters pertaining to work under this Contract.
- D. The Contractor shall furnish the Owner, the Owner's Project Manager and the Architect, in writing, the names, addresses, and telephone numbers of Contractor's and principal Subcontractors' personnel to be contacted in the event of an out-of-hours emergency at the building site. He shall also maintain a similar list readily visible from the outside of the field office.

2.3 PREINSTALLATION CONFERENCES

- A. Pre-Installation Conferences: Conduct pre-installation conferences at site prior to construction activities that require coordination.
 1. Schedule the conference to occur after submittals have been approved for the materials or systems.
 2. Installers, manufacturer's representatives, and fabricators of materials or systems affected shall be required to attend. Advise Designer of scheduled meeting dates.
 3. Do not allow affected work to proceed if the conference cannot be successfully concluded. Initiate actions necessary to resolve impediments to performance of the work and reconvene the conference at the earliest feasible date.

- B. Work for which pre-installation conferences will be required include the following. Additional pre-installation conferences may be required by specifications in Sections 2 through 50, and by the Owner or Architect during the progress of the Work:
 - 1. Air barrier system.
 - 2. Roofing.
- C. Refer to individual specifications sections for additional requirements.

2.4 POST-CONSTRUCTION MEETINGS

- A. Not less often than every three months, starting with the date of Substantial Completion and continuing for one year thereafter, representatives of the Contractor and the Subcontractors for FIRE PROTECTION, PLUMBING, HVAC, and ELECTRICAL Work shall meet with the Architect and Owner's Project Manager at the site in accordance with an agreed-upon schedule in order to inspect the Work and to plan correction of any deficiencies or failures discovered during this period.
- B. Representatives of the Contractor and Subcontractors attending such meetings shall be the same persons, or shall have the same powers and authority, as those attending job meetings prior to the date of Substantial Completion.
- C. Post-Warranty Meeting: Refer to Section 018100 - COMMISSIONING, for meeting to be held with Commissioning Agent.

END OF SECTION

SECTION 013200

CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 SUMMARY

- A. The Work of this Section includes, but is not limited to, requirements for the following procedures:
 - 1. Time for Completion and Liquidated Damages.
 - 2. Sequencing requirements.
 - 3. Phasing requirements.
 - 4. Requirements for scheduling closeout activities.
 - 5. Critical Path Method Schedule preparation and submission.
 - 6. Photographic documentation of construction.
- B. Related work includes, but is not limited to, the following work under other Sections:
 - 1. Section 011400 – WORK RESTRICTIONS: Hours of work and related scheduling criteria.
 - 2. Section 012400 – SCHEDULE OF VALUES: Allocation of portions of the Work as line items in applications for payment.
 - 3. Section 013100 – PROJECT MANAGEMENT AND COORDINATION: Contractor responsibility for coordinating the Work.
 - 4. Section 013119 – PROJECT MEETINGS: Scheduling construction-related meetings.
 - 5. Section 013300 – SUBMITTAL PROCEDURES: Coordination of submittal schedule with construction.
 - 6. Section 014000 – QUALITY REQUIREMENTS: Special sequencing requirements required for inspection of building components prior to concealment.
 - 7. Section 017700 – CLOSEOUT PROCEDURES: Requirements for Substantial Completion and Final Completion.

1.3 SUBMITTALS

- A. Preliminary Construction Schedule: Within 10 calendar days following receipt of the Notice to Proceed, submit a CD containing an electronic copy (PRX) and two paper copies for review by the Owner, Project Manager and the Architect. This preliminary schedule shall include the project contract dates, milestones, long lead items, major work activities and a critical path to completion. (approximately 100 to 150 schedule activities)
 - 1. Acceptance of the Preliminary Construction Schedule by the Owner, Project Manager and Architect shall be a prerequisite to certification of the first Application for Payment.

- B. Complete and Detailed Construction Schedule: Within 45 calendar days following receipt of the Notice to Proceed, and at least 15 calendar days prior to submitting the second Application for Payment, submit a CD containing an electronic copy(PRX) and two paper copies of the complete and detailed schedule, to show entire schedule for entire construction period.
 - 1. Acceptance of the Complete and Detailed Construction Schedule by the Owner, Project Manager and Architect shall be a prerequisite to certification of the second Application for Payment.
 - C. Monthly Schedule Update: With each monthly Application for Payment, submit a schedule update of the accepted Complete and Detailed Construction Schedule accompanied by a written narrative reporting on the progress of the Work and a CD containing an electronic copy(PRX) and two paper copies of the Monthly Schedule Update.
 - 1. Acceptance of the Updated Schedule each month by the Owner, Project Manager and Architect shall be a prerequisite to certification of the monthly Application for Payment.
 - D. Daily Construction Field Reports: Submit two copies of the current week's field reports to the Owner's Project Manager and the Architect at the end of each week. (Electronic submission is acceptable)
 - E. Special Reports: Submit two copies of special reports of unusual events at the site directly to Owner's Project Manager and a copy to the Architect, on the day of the occurrence. Distribute additional copies of report to parties affected by the occurrence.
 - F. Construction Photographs: Submit construction photographs as specified herein.
- 1.4 TIME FOR COMPLETION AND LIQUIDATED DAMAGES
- A. It is understood and mutually agreed, by and between the Contractor and the Owner, that the date of beginning and the time for completion for each phase are essential conditions of this Contract, and it is further mutually understood and agreed that the Work embraced in this Contract shall be commenced by the date specified therein.
 - B. The Contractor agrees that said Work shall be prosecuted regularly, diligently, and uninterruptedly at such rate of progress as will insure full completion thereof within the time specified. It is expressly understood and agreed, by and between the Contractor and the Owner, that the time for the completion of the Work in each phase described herein is a reasonable time for the completion of the same, taking into consideration the usual industrial and climatic conditions prevailing in this locality.
 - C. It is further agreed that time is of the essence of each and every portion of the Contract and of the Contract Documents wherein a definite and certain length of time is fixed for the performance of any act whatsoever; and where under the Contract an additional time is allowed for the completion of any work, the new limit fixed by such extension shall be of the essence of this Contract. Provided, that the Contractor shall not be charged with liquidated damages for any excess cost when the delay in completion of the Work is due:
 - 1. To any preference, priority, or allocation order duly issued by the Government;
 - 2. To unforeseeable causes beyond the control and without the fault or negligence of the Contractor, including, but not restricted to: Acts of God, or of the public enemy; acts of the

- Owner; acts of another Contractor in the performance of a Contract with the Owner; fires, floods, epidemics, quarantine restrictions, strikes, and freight embargoes.
3. To any delays of Subcontractors or suppliers occasioned by any of the clauses specified in subparagraphs 1. and 2. of this Paragraph.
- D. Provided, further, that the Contractor shall, within ten (10) days from the beginning of such delay, unless the Owner shall grant a further period of time prior to the date of final settlement of the Contract, notify the Owner, in writing, of the causes of the delay, who shall ascertain the facts and extent of the delay and notify the Contractor within a reasonable time of its decision in the matter.
- E. If the Contractor shall neglect, fail or refuse to substantially complete the Work within the time herein specified or any proper extension thereof granted by the Owner, the Contractor does hereby agree, as part of the consideration for the awarding of this Contract, to pay to the Owner the amount specified in the Agreement, not as a penalty but as liquidated damages for such breach of contract as herein set forth, for each and every calendar day that the Contractor shall be in default after the time stipulated in the Contract for completing the Work.
- F. The said amount is fixed and agreed upon by and between the Contractor and the Owner because of the impracticability and extreme difficulty of fixing and ascertaining the actual damages the Owner would in such event sustain, and said amount is agreed to be the amount of damages which the Owner would sustain and said amount shall be retained from time to time by the Owner from current periodic estimates. This remedy to the Owner shall be cumulative to the remedies available to the Owner under law.
- G. Work Executed after Substantial Completion: The Architect will continue to execute their administrative responsibilities for the Contract, as provided in the General Conditions, beyond the specified date of Final Completion.
1. If, due to delays on the Contractor's part in the completion of the Work, the Architect is required to continue in this role beyond the specified date for Final Completion, the Contractor shall be responsible to the Owner for costs for Additional Services of the Architect to perform additional administration duties, until the Work is complete.
2. Refer to Section 011400 – Work Restrictions, for procedures required in cases where Contractor is responsible to the Owner for costs for Additional Services of the Architect.
- H. Liquidated Damages: Refer to INSTRUCTIONS TO BIDDERS, for provisions for, and amounts of, Liquidated Damages.
- 1.5 PHASING
- A. The project shall be phased in accordance with the phasing plans as described on the architectural drawings and in Document 002113 - INSTRUCTIONS TO BIDDERS and Section 011100 – SUMMARY OF WORK.
- 1.6 SEQUENCING REQUIREMENTS
- A. Exterior Envelope Construction and Inspection: Schedule the installation of materials comprising the exterior walls and roofs to minimize exposure of construction materials to damage by ultraviolet light, wind and weather. Notify the Architect prior to concealment of air barrier, to permit inspection and testing. Refer to Section 014000 – QUALITY REQUIREMENTS, and individual technical specification sections for specific requirements.

- B. Indoor Air Quality Provisions: Refer to Section 018119 – INDOOR AIR QUALITY REQUIREMENTS, for the following activities that will have an impact on scheduling:
 - 1. Sequencing required to minimize adsorption of airborne contaminants on new surfaces.
 - 2. Sequence of building flush-out with respect to completion, testing and balancing of mechanical systems.
- C. Commissioning: Refer to the Commissioning Section, for inspections, testing and related activities to be performed by Commissioning Agent during and after construction.

1.7 SCHEDULING REQUIREMENTS FOR CLOSEOUT

- A. General: Closeout scheduling shall be carefully coordinated with activities required for Commissioning and the approved Indoor Air Quality Management Plan. The following sequence of activities is a summary of requirements of many trades. Refer to other Division 1 Sections and Technical Sections for additional information as indicated.
 - 1. The Contractor's attention is brought to the fact that no HVAC system shall be started up before the completion of all major finishes, casework installation and final cleanup.
- B. Initial Closeout Activities:
 - 1. Commissioning Coordination Meeting: Schedule meeting well in advance of anticipated date for start-up of mechanical and electrical systems. At this meeting, the Commissioning Firm will distribute Pre-Functional Performance Test (PFPT) checklists, and scheduling requirements will be reviewed. Refer to Section 013119 – PROJECT MEETINGS.
 - 2. Confirmation of Completion of Finishes, Casework and Cleaning: The Contractor submit a letter confirming that all major finishes have been applied, all casework is installed and final cleanup has been completed.
- C. System Start-Up, Building Flush-out and Testing and Balancing.
 - 1. The HVAC system shall be started up with new filters as specified in Section 230000 – Heating, Ventilating and Air Conditioning.
 - 2. Building Flush-Out: As part of the Indoor Air Quality Plan, the HVAC system shall be run for 28 calendar days with 100 percent fresh air. Disable carbon dioxide sensors during this time. Refer to Section 230000 – Heating, Ventilating and Air Conditioning for additional requirements for system operation.
 - 3. Testing and Balancing: After the building flush-out is complete, replace HVAC system filters, adjust HVAC system for normal operation and conduct tests for balancing the system.
- D. Substantial Completion: When system start-up and the related activities specified above have been completed on all mechanical and electrical systems, notify the Architect that the Project is Substantially Complete. Refer to Section 017700 – PROJECT CLOSEOUT, for additional requirements for Substantial Completion.

PART 2 - PRODUCTS

2.1 CRITICAL PATH METHOD SCHEDULE (CPM) GENERAL

- A. The purpose of the Construction Schedule shall be to:
1. Assure adequate planning, scheduling and reporting during execution of the work by the Contractor;
 2. Assist the Contractor, Architect, Project Manager and Owner in monitoring the progress of the work and evaluating proposed changes to the Contract and the Construction schedule;
 3. Assist the Owner, Project Manager, Architect and the Contractor in the preparation and evaluation of the Contractor's monthly progress payments.
- B. The Construction Schedules shall employ the Critical Path Method (CPM) for the planning, scheduling and reporting of the work to be performed under the contract and shall meet the following requirements:
1. The schedule shall be produced utilizing the most current version of Primavera Project Planner software system or equivalent and the data fully transferable to Primavera Project Planner.
 2. The type of schedule shall be time scaled Precedence Diagramming Method (PDM) with Finish to Start with zero (0) lag dependency relationship.
 3. Activity duration shall be in units of whole working days and shall be limited to a minimum of one (1) and a maximum of twenty (20) working days for each activity.
 4. The schedules and the corresponding completion dates shall meet the contract duration (remaining contract duration for the monthly updates) of the project. Failure by the Contractor to include any element of work required for performance of the Contract shall not excuse the General Contractor from completing all work within the Contract Time. Under no circumstances, shall the Contractor be entitled to an equitable adjustment in the event of failing to achieve an early completion schedule.
 5. The Contractor shall review the planned activity coding and activity ID format with the Project Manager prior to the development of the Detailed Construction Schedule. At a minimum, the Project Manager will require the following coding: Area, Location/Phase/Shift, Work Type/Trade, CSI Code, and a separate code for each subcontractor.
 6. Proposed durations assigned to each activity shall be the Contractor's best estimate of time required to complete the activity considering the scope and resources planned for the activity, utilizing the appropriate workday calendar.
 7. Seasonal weather conditions shall be considered and included in the planning and scheduling of all work influenced by high or low ambient temperatures and/or precipitation to ensure completion of all work within the Contract time. Seasonal weather conditions shall be determined by an assessment of average historical climatic conditions based upon the preceding ten (10) year records published for the locality by the National Ocean and Atmospheric Administration (NOAA).
 8. The OPM's acceptance of the Construction Schedule shall not relieve the Contractor of responsibility for timing, planning and scheduling of the Work, nor impose any duty on the Architect or Owner with respect to the timing, planning or scheduling of the Work.

2.2 PRELIMINARY CONSTRUCTION SCHEDULE

- A. Within 10 calendar days following receipt of Notice to Proceed, prepare and submit for review prints and CD of the Preliminary Construction CPM Schedule covering the first 90 days of construction. The schedule shall be neatly organized and plotted, time-scaled from left to right on standard size sheets. The Preliminary Construction Schedule shall cover the following phases and/or activities:
 - 1. Proposed mobilization, procurement and planned construction within the first 90 days after Notice To Proceed.
 - 2. Include a summary bar for major areas of the remainder of the Work and a cash requirement prediction based on indicated activities.
- B. The Preliminary Schedule shall be incorporated into the Complete and Detailed Schedule including all revisions directed by the Owner, Project Manager and Architect.

2.3 COMPLETE AND DETAILED CONSTRUCTION SCHEDULE

- A. Prepare and submit a comprehensive, fully developed Complete and Detailed CPM Construction Schedule within 45 days after Notice to Proceed and at least 15 days prior to the second Monthly application.
 - 1. The Complete and Detailed schedule shall incorporate the accepted Preliminary Construction Schedule with the Owner/Project Manager/Architect's comments
 - 2. Schedule shall be neatly organized and plotted time scaled from left to right on Project standard size sheets with suitable notation relating the interface points among sheets.
 - 3. The General Contractor's Schedule shall consist of, but not be limited to, the following:
 - a. Proposed procurement, submittal preparation, submittal review, fabrication & delivery, construction, testing, commissioning, and permitting activities.
 - b. Proposed durations for activities.
 - c. Proposed sequencing of activities (predecessors & successors).
 - d. Milestone events as required by the Contract Documents and Division 1 of the Specifications.
 - 4. The following shall be depicted on the Schedule for each activity:
 - a. Concise description of the work represented by the activity (maximum forty-eight (48) characters). The work related to each activity shall be limited to one work trade and one area. All descriptions shall include area designations.
 - b. In developing the Schedule, the Contractor shall be responsible for assuring that subcontractor and supplier work at all tiers, as well as its own work, is included in the Schedule.
 - c. The Schedule as developed shall show the sequence and interdependence of activities required for complete performance of the work. The Contractor shall be responsible for assuring that all work sequences are logical and the Schedule shows a coordinated plan of the work.
 - d. Each activity shall have only one responsible party and will be coded accordingly.
 - 5. For the purposes of utilizing schedule targets, activity id's shall not be modified.
 - 6. The schedule shall employ retained logic.
 - 7. Any float suppression techniques identified shall be corrected by the Contractor.

8. The Contractor shall utilize logic, durations, and appropriate calendar assignment to forecast dates, not activity constraints.

2.4 MONTHLY SCHEDULE UPDATE REPORTS

- A. Monthly Schedule Update Report: Evaluate the status of the work as of the 25th of each month to show actual progress and to identify problem areas. Update the Complete and Detailed Construction schedule and print a schedule summary. Include approved Change Orders and Construction Change Directives within the updated schedule
- B. The Contractor shall furnish sufficient forces, offices, facilities and equipment at no additional cost to the Owner, and shall work such hours as necessary, within any local restrictions or agreements incorporated into the Contract, to ensure the prosecution of the work in accordance with the current monthly Project Schedule Update. Should the monthly update show that the Contractor is fourteen (14) or more work days behind schedule, the Contractor shall prepare a Recovery Schedule at no additional cost to the Owner explaining and displaying how the General Contractor intends to reschedule the work in order to regain compliance with the contract. The provision of this paragraph may include the Contractor increasing the hours of work, the number of shifts, overtime operations and/or the amount of construction plant and equipment or working on Saturdays, Sundays and holidays, within agreed working hours or variance granted, provided the General Contractor gives reasonable notice to the Owner.

2.5 RECOVERY SCHEDULE

- A. When directed by the Project Manager/Architect, the Contractor shall develop a Recovery Schedule with a detailed narrative for all the remaining work based on the last accepted Monthly Schedule Update. The Recovery Schedule shall represent the Contractors current work sequence plan and shall forecast completion of the remaining work within remaining contract durations. The Recovery Schedule narrative shall enumerate the Contractor's work plan including increases to crew sizes and/or extended shifts to complete work within remaining contract durations. The Recovery Schedule shall conform to requirements set forth in Paragraph 1.04 (Complete and Detailed Construction Schedule).
- B. The Contractor shall be responsible to develop mitigation measures for all delays, regardless of the responsibility for the delays, and to identify all time and cost impacts to the work associated with those mitigation measures. Whenever it is possible for the Contractor to mitigate delay without added cost, the Contractor shall do so. The Contractor shall mitigate all delays as efficiently and economically as possible, with the objective of minimizing both the time and cost impact of the delay, regardless of the responsibility of the delay.
- C. Unless circumstances otherwise require, the Contractor shall not pursue mitigation action for which it expects the Owner/Architect to be liable, prior to notifying the Owner/Architect and receiving Owner/Architect authorization to proceed with the mitigation action. Any action taken by the Contractor prior to receiving approval from the Owner/Architect shall be at the Contractor's risk.

2.6 DAILY CONSTRUCTION REPORTS

- A. Prepare a daily construction report, recording events at the site. Report the following information, as applicable.
 1. List of subcontractors at the site, and approximate count of personnel.

2. High and low temperatures, general weather conditions (when exterior work is in progress)
3. Meetings and significant decisions.
4. Accidents, unusual events, and emergency procedures.
5. Stoppages, delays, shortages, losses.
6. Meter readings and similar recordings.
7. Services connected, disconnected.
8. Orders and requests of governing authorities.
9. Change Orders received, implemented.
10. Equipment or system tests and start-ups.
11. Partial Completions, occupancies.
12. Substantial Completions authorized.

- B. At the end of each week, compile the daily reports for the preceding week. Have the Contractor's Superintendent sign the daily reports and prepare a brief outline of the Work anticipated for the coming work week. Submit 1 copy to the Owner/Owner's Project Manager and place 1 copy in the Project Record Documents file.

2.7 CONSTRUCTION PHOTOGRAPHS

- A. Digital Images: Provide images in JPG format, produced by a digital camera with minimum sensor size of 8 megapixels, and at an image resolution of not less than 3200 by 2400 pixels.
- B. Photographer: Engage a qualified photographer to take construction photographs.
- C. General: Take photographs using the maximum range of depth of field, and that are in focus, to clearly show the Work. Photographs with blurry or out-of-focus areas will not be accepted.
1. Maintain key plan with each set of construction photographs that identifies each photographic location.
- D. Digital Images: Submit digital images exactly as originally recorded in the digital camera, without alteration, manipulation, editing, or modifications using image-editing software.
1. Date and Time: Include date and time in file name for each image.
 2. Field Office Images: Maintain one set of images accessible in the field office at Project site, available at all times for reference. Identify images in the same manner as those submitted to Architect and Owner.
- E. Preconstruction Photographs: Before **[commencement of excavation]** **[commencement of demolition]** **[starting construction]**, take photographs of Project site and surrounding properties, including existing items to remain during construction, from different vantage points, as directed by Architect.
1. Flag construction limits before taking construction photographs.
 2. Take 20 photographs to show existing conditions adjacent to property before starting the Work.
 3. Take 20 photographs of existing buildings either on or adjoining property to accurately record physical conditions at start of construction.
 4. Take additional photographs as required to record settlement or cracking of adjacent structures, pavements, and improvements.

- F. Periodic Construction Photographs: Take [20] **<Insert number>** photographs [monthly, coinciding] [weekly, with timing each month adjusted to coincide] **<Insert time interval>** with the cutoff date associated with each Application for Payment. Select vantage points to show status of construction and progress since last photographs were taken.
- G. Final Completion Construction Photographs: Take 20 color photographs after date of Substantial Completion for submission as project record documents. Architect and Owner will inform photographer of desired vantage points.

PART 3 - EXECUTION

3.1 SCHEDULING THE WORK

- A. The Contractor shall perform the Work in accordance with the approved CPM Schedule.
 - 1. If during the progress of the job the Contractor misses a start date of an activity on the critical path, the Contractor shall, within five (5) working days, advise the Architect in writing of action proposed to bring the Work up to schedule, and shall submit a revised CPM Schedule indicating such action, together with a typed list of such revisions.
 - 2. If the Contractor fails to submit a revised schedule within the specified time or if the Architect is not convinced of the efficacy of the measures proposed, the Owner may, at its option, require the Contractor to accelerate the progress of the Work, without additional cost to the Owner, by increasing the work force or the hours of work, or by other reasonable means approved by the Architect.

END OF SECTION

SECTION 013300
SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. The Work of this Section includes, but is not limited to, requirements for the following procedures:
 - 1. Submittal schedule
 - 2. Product data
 - 3. Shop drawings
 - 4. Samples
 - 5. Colors and finishes
 - 6. Calculations
 - 7. Informational submittals
 - 8. Action on submittals.
 - 9. Substitution requests.
- B. Related work includes, but is not limited to, the following work under other Sections:
 - 1. Availability and restrictions for use of electronic copies of Contract Document: Section 011400 – Work Restrictions.
 - 2. Specific requirements for submittal of construction schedules: Section 013200 Construction Progress Documentation.
 - 3. Specific requirements for submittal of schedule of values: Section 012400 – Schedule of Values.
 - 4. Requirements for submittal of coordination drawings: Section 013100 – Project Management and Coordination.
 - 5. Submittal of final record drawings and other documents: Section 017839 – Project Record Documents.

1.3 DEFINITIONS

- A. Action Submittals: Written and graphic information that requires Architect's responsive action. Action submittals include product data, shop drawings and samples.
- B. Informational Submittals: Written information that does not require Architect's responsive action. Submittals may be rejected for not complying with requirements. Informational submittals include calculations and other informational submittals described in this Section.

- C. Substitutions: Changes in products, materials, equipment and methods of construction from those required by the Contract Documents, as proposed by the Contractor and not considered "or equal". Refer to definition of "or equal" in Section 011100 – Summary of Work.

1.4 SUBMITTALS

A. Submittal Schedule:

1. Within 21 calendar days after signing the Agreement, prepare and submit for the Architect's approval a schedule of Shop Drawings, Product Data and Samples required to be submitted for the Work.
 - a. The schedule shall indicate by trade the date by which final approval of each item must be obtained, and shall be revised as required by conditions of work, subject to the Architect's approval.
 - b. The schedule shall be derived from the Contractor's CPM Schedule.
2. The Architect's review, including Consultant's review period, will not exceed 21 working days (excluding weekends & holidays) from the date on which the Architect receives the submission. Contractor shall strictly adhere to the established dates set forth by the Schedule of Submittals specified above in paragraph 2.01 A.
3. Each submittal shall be made no later than 60 days prior to the time for incorporation of the item into the Work, or earlier under the following conditions:
 - a. As required to furnish and deliver to the site the specific item or items required, with sufficient time to allow proper examination and review of such submittals.
 - b. If the item in question is to be incorporated in the work prior to the expiration of 60 calendar days from the time of execution of the Contract, the aforesaid written notice shall be submitted to the Architect immediately following the execution of the Contract.
 - c. Substitutions: Each request for a substitution shall be made no later than 90 days prior to the time for incorporation of the item into the Work.
4. No item, material, article, system or piece of equipment requiring approval of the Architect shall be ordered or installed until such approval has been obtained.
5. Contractor shall provide the Owner's Project Manager and Clerk of the Works with software and training for programs used to schedule, and track Shop Drawings, Samples, and RFI's.

- ##### B. Product List for Color Selection: To facilitate the preparation of the color schedule, the Contractor shall submit, within forty-five (45) calendar days following date of Award of Contract, unless otherwise extended by the Architect, a list of the names of the manufacturers whose products he proposes to use.

1. List products for which color, finish, pattern, texture, or other related information is a consideration, including, but not limited to the following:
 - a. Exterior materials: Face brick; exterior concrete masonry units; factory-finished metal siding; factory finish for doors, windows and louvers.
 - b. Casework finishes: Solid and veneer wood with transparent finish; plastic laminate.
 - c. Interior finishes: Ceramic tile, acoustical ceiling tile, resilient flooring, carpet, paint.

- d. Specialties available in a choice of colors: Toilet partitions; lockers; operable panel finishes.
 - e. Other items for which the above properties affect the design.
- 2. Products listed shall be as specified, unless substitution has been approved.
- C. Substitution Requests: Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
 - 1. Substitution Request Form: Use facsimile of form provided at end of Section.
 - 2. Documentation: Show compliance with requirements for substitutions listed on the Substitution Request form, and additional requirements as may be requested by the Architect or as otherwise applicable.
- D. Product Data, Shop Drawings, Samples, Schedules and other Submittals: Refer to individual Specification Sections for submittals required.
- E. Confirmation of contract between Contractor and printing company for reproduction of shop drawings as specified in this Section.

PART 2 - PRODUCTS

2.1 SUBMITTAL PREPARATION, GENERAL

- A. Preparation of Submittals: To receive consideration by the Architect, submittals shall be accompanied by a letter of transmittal. Each submittal shall contain the following information on the Drawing title block or a cover sheet stapled to the submittal:
 - 1. Project identification
 - 2. Architect's name
 - 3. Date of preparation of submission, and of revision if applicable
 - 4. Submittal number and title of item the Drawings refers to
 - 5. Architect's Drawing numbers and Specification paragraph number used as a reference in preparing submittal
 - 6. Contractor's and Subcontractor's names, & addresses and phone numbers
 - 7. Name of person or firm preparing Drawings
 - 8. Statement on stamp of approval by the Contractor, signifying that he has seen and examined the submittal and that requirements of the General Conditions have been complied with
- B. Each submittal cover sheet shall contain a clear space approximately 80 square inches for stamps and Architect's comments. Each drawing shall contain a similar space as an additional border on the right or bottom.
- C. Distribution:
 - 1. Contractor shall electronically deliver submittals to the Architect and its consultants in a format acceptable to the Architect.
 - 2. Simultaneously, Contractor shall deliver 1 hard copy print to the Architect and its consultants.

3. Architect and consultants will review submittals, and the Architect will post reviewed submittals on FTP site and/or email to Contractor.
4. Architect will hand deliver Owner Representative and Contractor hard copies at the weekly site meeting.
5. Contractor is responsible for distribution to all trades.

2.2 PRODUCT DATA

- A. Manufacturers' Product Literature: For standard manufactured items, submit manufacturer's catalog sheets with illustrated cuts of the items to be furnished.
 1. Include scale details, sizes, dimensions, performance characteristics, capacities and other pertinent information.
 2. Each submittal of product data shall be accompanied by an appropriate transmittal form with specific reference to the applicable paragraph in the Specifications.
 3. Indicate clearly on such printed matter which of several items is being submitted for approval.
- B. If catalog cuts of standard manufactured items show different types, options, finishes, performance requirements, or other variations, those features that the Contractor proposes to furnish shall be clearly circled or otherwise indicated, and all irrelevant diagrams, notes, or other information deleted or canceled.
 1. If any variations from the catalog description are proposed or required, such variations shall be clearly noted on the cut by the Contractor.
 2. Wiring diagrams shall be produced to address specific project requirements. Catalog cuts of wiring diagrams will not be acceptable.

2.3 SHOP DRAWINGS

- A. The Contractor shall prepare shop drawings showing such features as required by the Technical Specifications Sections, to demonstrate an understanding of the particular conditions unique to this Project.
 1. Prepare shop drawings at a scale of at least twice the scale of contract drawings showing the same work.
 2. Reproduction of Contract Documents in any form will not be accepted for use as Shop Drawings, unless specifically allowed in writing by the Architect for a particular portion of the Work.
 3. Refer to Section 011400 –WORK RESTRICTIONS for permissible use of electronic documents for the purpose of preparation of shop drawings. Use of Project Electronic Files for shop drawing preparation will be subject to the requirements specified in that Section.
- B. Shop Drawings related to various units comprising a proposed assembly shall be submitted simultaneously so that such units may be checked individually and as an assembly.
- C. Shop Drawing Distribution:
 1. Shop Drawings shall be submitted through the Contractor directly to the applicable consultant and the Architect.

2. Drawings submitted directly from Subcontractors, manufacturers or vendors, or directly to the Architect's consultants, will be returned to the Contractor without action.
 3. The Architect will forward copies of submittals to the Clerk of the Works when so requested for their use. However, it is the responsibility of only the Architect and their Consultants to review and respond to submittals.
- D. Each drawing and print shall have a clear space approximately 80 square inches as an additional border on the right or bottom for stamps and Architect's comments.
- E. Shop Drawings shall clearly indicate all details, sectional views, arrangements, working and erection dimensions, kinds and quality of materials and their finishes, and other information necessary for proper checking and for fabrication and installation of the items, and shall include all information required for making connections to other work and/or adjacent materials.
- F. If any information on previously submitted Shop Drawings, aside from notations made by the Architect is revised in any way, such revision shall be circled or otherwise graphically brought to the Architect's attention. If approved Drawings are subsequently revised, they shall be resubmitted to the Architect with all revisions clearly marked for the Architect's attention. Whenever drawings are revised, the latest revisions shall be circled or otherwise indicated to distinguish them clearly from all previous revisions (and from the information on the original drawing).

2.4 SAMPLES

- A. Submit samples as required under the various Sections of the Specifications. Each sample shall be accompanied by a transmittal and cover sheet as required for all submittals.
- B. Before submitting samples, consult with Architect to determine whether samples are to be submitted to Architect's office, field, or other location.
- C. Samples shall be submitted in triplicate, unless otherwise specified or directed by the Architect.
- D. Samples may be submitted to Architect directly from manufacturers, vendors, suppliers, Subcontractors, or others, but a separate transmittal letter shall be submitted through the Contractor in each such case.
- E. Approved samples of major or expensive items or assemblies, if in good condition and meeting all requirements of the Contract, may be properly marked for identification and used in the Work, provided that all shipping and handling charges are paid by the Contractor.
- F. Each sample shall have a label indicating the material represented, its place of origin, and the names of the producer, the Architect, the Contractor, the Subcontractor and the building or Work for which the material is intended. Samples shall be marked to indicate the Drawing numbers or Specification Paragraph requiring the materials represented.
- G. Approval of samples for color, texture, and other aesthetic qualities shall not be construed as approval of other characteristics.
- H. Approved samples, unless specifically stated by the Contractor as slated for incorporation in the Work, will be kept on file (and accessible for inspection) by the Architect until Final Acceptance of the Project. Any sample not reclaimed by the Contractor within thirty (30) days after

Substantial Completion of the Project will be considered unclaimed material, and may be disposed of by the Architect.

2.5 COLORS AND FINISHES

- A. The Architect will prepare a master color schedule indicating the required color, finish, pattern, material, texture, and other pertinent information in connection with interior and exterior finishes.
- B. Color chips shall be submitted for all items having color unless otherwise directed or approved by the Architect. Upon the expiration of such 45-day period, the Architect will proceed with color selection and preparation of final color schedule.
- C. The Architect will select the colors and finishes of a manufacturer within the framework of the Specifications, for each item where the Contractor fails to submit the name of a specific manufacturer within the allotted time, and the Contractor shall provide such materials without additional compensation.

2.6 CALCULATIONS

- A. Calculations Based on Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, submit calculations demonstrating that products and systems comply with specific performance and design criteria indicated.
 - 1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect.
- B. Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit three copies of a statement, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.
 - 1. Indicate that products and systems comply with performance and design criteria in the Contract Documents.
 - 2. Include list of codes, loads, and other factors used in performing these services

2.7 INFORMATIONAL SUBMITTALS

- A. General: Informational submittals comprise written information that does not require Architect's responsive action. Submit to the Architect two copies, or more if specified, for each informational submittal. The Architect will distribute copies to the Owner for their records.
- B. Informational submittals required for the Work include, but are not limited to, the following:
 - 1. Storm Water Pollution Prevention Plan Documentation, as specified in Section 011400 – WORK RESTRICTIONS
 - 2. Calculations for Contractor-engineered work, as specified in particular specification sections in Divisions 2 through 50.
 - 3. Research/evaluation reports and test data as specified in particular specification sections in Divisions 2 through 50.
 - 4. Certifications and other qualification data, as specified in particular specification sections in Divisions 2 through 50.

5. Maintenance data, as specified in particular specification sections in Divisions 2 through 50.
6. Confirmation of contract with printing company as specified in this Section.

PART 3 - EXECUTION

3.1 CONTRACTOR ACTION ON SUBMITTALS

- A. Should the Architect in checking shop drawings or other submittals make changes which the Contractor deems will increase the Contract Price, the Contractor shall so inform the Architect in writing within fourteen (14) days following receipt of the checked submittals and prior to starting fabrication of the item or items. Failing this, the Contractor shall be deemed to have waived all claims for extra compensation for the work involved.
- B. Notes or other information on submittals that are contrary to provisions of the Contract Documents shall be deemed to be addressed to the applicable Contractor, Subcontractor, material supplier or other parties involved, and shall have no force or effect with respect to this Contract, even though the Shop Drawing or Sample involved is approved by the Architect. In particular the terms "By Others", "N.I.C." or words of similar meaning and import on submissions shall not be deemed to imply that the referenced items are to be omitted from this Contract.
- C. The Contractor shall obtain and distribute copies of approved Shop Drawings and other Submittals to his subcontractors and material suppliers needing such information, at no additional cost to the Owner.
- D. The Contractor shall keep on the site, in good order, a complete up-to-date set of all approved Shop Drawings and other Submittals.
- E. Contractor shall assume full liability for delay attributed to insufficient time for delivery and/or installation of material or performance of the Work when approval of pertinent Shop Drawings is withheld due to failure of the Contractor to submit, revise, or resubmit Shop Drawings in adequate time to allow the Architect reasonable time, not to exceed twenty-one (21) working days (excluding weekends & holidays), for normal checking and processing of each submission and resubmission. The Architect will not be limited to twenty-one (21) days when the Shop Drawing Schedule has not been submitted or is not current.

3.2 ARCHITECT ACTION ON SUBMITTALS

- A. Product Data and Shop Drawings: After reviewing product data submittals, the Architect will mark each submittal with one of the following responses
 1. The Architect will annotate the transparency or an original copy and apply a stamp including the following information: "Reviewed as required by the Construction Contract Documents and approved, but only for conformance to the design concept of the Work, and subject to further limitations and requirements contained in the Contract Documents."
 2. "Rejected". Two copies of each rejected submittal will be returned to the Contractor. Rejected copies shall be resubmitted in the same manner until approval is obtained.
 3. The stamp will also contain notes indicating possible actions, namely; "rejected"; "revise and resubmit"; and "furnish as corrected". Architect will check one of the actions.
 4. Corrections or comments made on the submittals during this review shall not relieve Contractor from compliance with requirements of the Contract Drawings and

Specifications. This check is only for review of general conformance with the design concept of and general conformance with the information given in the Contract Documents. The Contractor is responsible for confirming and correlating all quantities and dimensions; selecting fabrication processes and techniques of construction; coordinating his work with that of all other trades; and performing his work in a safe and satisfactory manner.

5. For Submittals marked "Rejected", or "Revise and Resubmit", the Architect will have prints made from the marked reproducible Drawings at the Contractor's expense. Such prints shall be used for record purposes and for comparison with subsequent resubmissions. One will be retained by the Architect, one furnished to the applicable consultants, if any, and the transparency returned to the Contractor. Such procedures shall be followed until the Shop Drawing is marked "Furnish as Corrected", or "Reviewed as required by the Construction Contract Documents and approved, but only for conformance to the design concept of the work, and subject to further limitations and requirements contained in the Contract Documents."
 6. Submittals marked "Furnish as Corrected" shall be treated in the same manner as Drawings marked "Reviewed as required by the Construction Contract Documents...and requirements contained in the Contract Documents." The Architect's comments shall be considered part of the original Drawings. Should the Contractor disagree with such comments, he shall so notify the Architect in writing within fourteen (14) days after receipt of such Drawings and before commencing work on the items in question. Failing this, the Contractor shall be deemed to have accepted full responsibility for implementing such comments at no additional cost to the Owner.
 7. Transparencies for all Drawings marked "Furnished as Corrected" or "Reviewed as required by the Construction Contract Documents..." will be returned to the Contractor.
 8. Before the transparency is returned by the Architect with the stamp "Reviewed as required by the Construction Contract Documents..." or "Furnish as Corrected", the Architect will have made at the Contractor's expense, four (4) prints of the corrected original for the Architect's and Owner's use.
- B. Informational Submittals: Architect will review each informational submittal and will review it for general compliance with submittal requirements
1. Architect will process and distribute each informational submittal as for other submittals.
 2. Compliant informational submittals will be marked "Reviewed" and stamped copies will be distributed to Owner's Project Manager, Clerk of the Works and Contractor.
 3. Informational submittals that do not comply with submittal requirements specified herein and in the section whose work they cover will be returned without any action or stamp. Re-submittal will be required.
- C. Repeated Re-submittals: The Architect will review the initial submittal for each product, and one re-submittal if revisions are required.
1. If the first re-submittal is rejected or requires further revision, the Contractor shall be responsible to the Owner for costs for Additional Services of the Architect to perform review of an extensive number of repeated submittals, until a submittal for that product is accepted by the Architect with no need for further revision.
 2. Refer to Section 011400 –WORK RESTRICTIONS, for procedures required in cases where Contractor is responsible to the Owner for costs for Additional Services of the Architect.

3.3 SUBSTITUTIONS

- A. Definition: Substitutions are changes proposed by Contractor for products, materials, equipment, and methods of construction differing from those required by the Contract Documents.
- B. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:
 - 1. Substitution is requested by completing a copy of Form 013301 – SUBSTITUTION REQUEST FORM, attached to the end of this Section.
 - 2. Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include compensation to Architect for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.
 - 3. Requested substitution does not require extensive revisions to the Contract Documents.
 - 4. Requested substitution is consistent with the Contract Documents and will produce indicated results.
 - 5. Substitution request is fully documented and properly submitted.
 - 6. Requested substitution will not adversely affect Contractor's Construction Schedule.
 - 7. Requested substitution has received necessary approvals of authorities having jurisdiction.
 - 8. Requested substitution is compatible with other portions of the Work.
 - 9. Requested substitution has been coordinated with other portions of the Work.
 - 10. Requested substitution provides specified warranty.
 - 11. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.
- C. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within 7 working days of receipt of a request for substitution. Architect will notify Contractor of acceptance or rejection of proposed substitution within 15 working days of receipt of request, or 7 working days of receipt of additional information or documentation, whichever is later.
 - 1. Use product specified if Architect cannot make a decision on use of a proposed substitution within time allocated.
- D. Review of Substitution Requests: The Architect will review Substitution Requests that are submitted in accordance with the requirements of this section, and are shown to be of benefit to the Project.
 - 1. If a request for substitution is incomplete, the Contractor shall be responsible to the Owner for costs for Additional Services of the Architect to perform additional review, until the substitution has been either accepted with no need for further revision, or rejected.
 - 2. If a request for substitution is shown to be of benefit to the Contractor only and not to the Project, the Contractor shall be responsible to the Owner for costs for Additional Services of the Architect to perform review, redesign or coordination due to such substitution.

3. Refer to Section 011400 –WORK RESTRICTIONS, for procedures required in cases where Contractor is responsible to the Owner for costs for Additional Services of the Architect.

E. Form of Acceptance of Substitution: Change Order

END OF SECTION

ATTACHMENT: FORM 013301 – SUBSTITUTION REQUEST FORM

FORM 013301

SUBSTITUTION REQUEST FORM

Project: Lincoln - Eliot Elementary School

To: Arrowstreet

We hereby submit for your consideration the following product as a substitution for the item specified for the above referenced project:

Drawing Number: _____ Drawing Title: _____

Specification Section: _____ Section Title: _____

Paragraph: _____ Specified Item: _____

Proposed Substitution: _____

Attach complete information on changes to Drawings and Specifications, including related work on other Drawings and under other Sections of the Specifications necessary for the proper installation of the proposed substitution, including proper coordination and finishing.

Submit with request complete Product Data, samples and other data necessary to substantiate that the proposed item is equal to or exceeds the specified item in all respects. Include a comparison chart showing material features and properties of the specified item and the proposed substitute, paying particular attention to requirements specifically mentioned in the Specifications or shown on the Drawings, and guarantee/warranty information. Clearly mark manufacturer's literature to indicate equality in performance. In the case of operating equipment or systems, provide information as to servicing and maintenance requirements, and anticipated service life in the indicated application.

Fill in the blanks below (attach additional sheets as necessary):

A. Does the substitute affect dimensions shown on the Drawings: Yes ☐ No ☐
(if yes, clearly indicate changes on enclosures)

B. Will the undersigned pay for changes to the building design, including architectural/engineering detailing costs caused by the requested substitution: Yes ☐ No ☐
(if no, please explain)

C. What effect does the substitution have on other Contracts or other trades? ____

D. What effect does the substitution have on construction schedule? ____

E. Manufacturer's warranties of the specified and proposed items are: Same ☐ Different ☐

Explain: _____

F. Itemized comparison of specified item with proposed substitute is attached.

G. This substitution will amount to a credit or extra cost to the Owner of: ____

_____ Dollars

(\$_____).

Notes:

Submission of this form by the Contractor will not require the Owner to accept the proposed substitution unless the substituted product or system meets the requirements of Massachusetts General Law, Chapter 30, Section 39M and is acceptable to the Architect.

The Owner's acceptance of any substitution will not change the Contract Price, unless the Owner, Contractor and any other required parties execute a Change Order in accordance with the terms and provisions of the Contract Documents.

Refer to Section 013300 – SUBMITTAL PROCEDURES, for additional requirements for the submittal and processing of substitution requests.

Submitted By: _____
(signature)

Title: _____

Firm: _____

END OF FORM

SECTION 014000

QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. This Section includes administrative and procedural requirements for
 - 1. Quality assurance
 - 2. Quality control
- B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.
 - 1. Specific quality-assurance and -control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.
 - 2. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and -control procedures that facilitate compliance with the Contract Document requirements.
 - 3. Requirements for Contractor to provide quality-assurance and -control services required by Architect, Owner, or authorities having jurisdiction are not limited by provisions of this Section.

1.3 DEFINITIONS

- A. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.
- B. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Services do not include contract enforcement activities performed by Architect.
- C. Mockups: Full-size, physical assemblies that are constructed on-site. Mockups are used to verify selections made under sample submittals, to demonstrate aesthetic effects and, where indicated, qualities of materials and execution, and to review construction, coordination, testing, or operation; they are not Samples. Approved mockups establish the standard by which the Work

QUALITY REQUIREMENTS

will be judged.

- D. Laboratory Mockups: Full-size, physical assemblies that are constructed at testing facility to verify performance characteristics.
- E. Preconstruction Testing: Tests and inspections that are performed specifically for the Project before products and materials are incorporated into the Work to verify performance or compliance with specified criteria.
- F. Product Testing: Tests and inspections that are performed by an NRTL, an NVLAP, or a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with industry standards.
- G. Source Quality-Control Testing: Tests and inspections that are performed at the source, i.e., plant, mill, factory, or shop.
- H. Field Quality-Control Testing: Tests and inspections that are performed on-site for installation of the Work and for completed Work.
- I. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.
- J. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations.
 - 1. Using a term such as "carpentry" does not imply that certain construction activities must be performed by accredited or unionized individuals of a corresponding generic name, such as "carpenter." It also does not imply that requirements specified apply exclusively to trades people of the corresponding generic name.
- K. Experienced: When used with an entity, "experienced" means having successfully completed a minimum of five previous projects similar in size and scope to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

1.4 CONFLICTING REQUIREMENTS

- A. General: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer uncertainties and requirements that are different, but apparently equal, to Architect for a decision before proceeding.
- B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Architect for a decision before proceeding.

1.5 SUBMITTALS

- A. Qualification Data: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.
- B. Testing and Inspection Log: Submit updated copy of log each month with the Application for Payment.
- C. Reports: Prepare and submit certified written reports that include the following:
 - 1. Date of issue.
 - 2. Project title and number.
 - 3. Name, address, and telephone number of testing agency.
 - 4. Dates and locations of samples and tests or inspections.
 - 5. Names of individuals making tests and inspections.
 - 6. Description of the Work and test and inspection method.
 - 7. Identification of product and Specification Section.
 - 8. Complete test or inspection data.
 - 9. Test and inspection results and an interpretation of test results.
 - 10. Record of temperature and weather conditions at time of sample taking and testing and inspecting.
 - 11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
 - 12. Name and signature of laboratory inspector.
 - 13. Recommendations on retesting and reinspecting.
- D. Permits, Licenses, and Certificates: For Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.

1.6 QUALITY ASSURANCE

- A. General: Qualifications paragraphs in this Article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.
- B. Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.
- C. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- D. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services

of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that are similar to those indicated for this Project in material, design, and extent.

- F. Specialists: Certain sections of the Specifications require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged for the activities indicated.
 - 1. Requirement for specialists shall not supersede building codes and regulations governing the Work.
- G. Testing Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, as documented according to ASTM E 548; and with additional qualifications specified in individual Sections; and where required by authorities having jurisdiction, that is acceptable to authorities.
 - 1. NRTL: A nationally recognized testing laboratory according to 29 CFR 1910.7.
 - 2. NVLAP: A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.
- H. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.
- I. Preconstruction Testing: Where testing agency is indicated to perform preconstruction testing for compliance with specified requirements for performance and test methods, comply with the following:
 - 1. Contractor responsibilities include the following:
 - a. Provide test specimens representative of proposed products and construction.
 - b. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.
 - c. Provide sizes and configurations of test assemblies, mockups, and laboratory mockups to adequately demonstrate capability of products to comply with performance requirements.
 - d. Build site-assembled test assemblies and mockups using installers who will perform same tasks for Project.
 - e. Build laboratory mockups at testing facility using personnel, products, and methods of construction indicated for the completed Work.
 - f. When testing is complete, remove test specimens, assemblies, mockups, and laboratory mockups; do not reuse products on Project.
 - 2. Testing Agency Responsibilities: Submit a certified written report of each test, inspection, and similar quality-assurance service to Architect, with copy to Contractor. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.
- J. Mockups: Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:

1. Build mockups in location and of size indicated or, if not indicated, as directed by Architect.
2. Coordinate the work of multiple subcontractors as needed to build complete mockups of multi-component systems.
3. Notify Architect seven days in advance of dates and times when mockups will be constructed.
4. Demonstrate the proposed range of aesthetic effects and workmanship.
5. Obtain Architect's approval of mockups before starting work, fabrication, or construction.
 - a. Allow seven days for initial review and each re-review of each mockup.
6. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
7. Demolish and remove mockups when directed, unless otherwise indicated.

- K. Laboratory Mockups: Comply with requirements of preconstruction testing and those specified in individual Sections in Divisions 2 through 50.

1.7 QUALITY CONTROL – owner responsibilities

- A. General: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.

1. Testing, inspections and commissioning performed by the Owner or the Owner's agents in no way reduce the responsibility of the Contractor to meet performance requirements, descriptive criteria and all other requirements of the specifications, nor do these activities on the part of the Owner relieve the Contractor from performing Quality Assurance and Quality Control measures specified.

- B. Tests and Inspections: The Owner reserves the right to employ consultants and testing agencies to test the performance of the Work and to inspect the Work for conformance with the Contract Documents.

1. Notice for Testing: The Contractor shall give the Owner a minimum 24-hour notice when installations that require testing are ready for testing or inspection.
 - a. Earlier notice shall be given where specified in a given technical section of the Specifications.
 - b. If the Owner's testing agency arrives at the site to test the performance of the work, and determines that the installation is not ready for testing or inspections, then the Contractor shall be responsible for the costs of the testing agency's site visit
2. Availability of Test Results: The results of such tests and inspections will be made available to the Architect and Contractor.
3. Correction of Work:
 - a. Where results demonstrate deficiencies in the Work, the Contractor shall take all actions necessary to correct the Work in a timely manner at their own expense.
 - b. When the Contractor considers the Work to be corrected, further tests and inspections will be performed by the Owner's consultants and testing agencies at the

Contractor's expense.

- C. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspecting they are engaged to perform.
- D. Costs for retesting and reinspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to Contractor, and the Contract Sum will be adjusted by Change Order.

1.8 QUALITY CONTROL – contractor responsibilities

- A. Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.
 - 1. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform these quality-control services.
 - a. Contractor shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.
 - 2. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspecting will be performed.
 - 3. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
 - 4. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
 - 5. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.
- B. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Division 1 Section "Submittal Procedures."
- C. Retesting/Reinspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.
- D. Testing Agency Responsibilities: Cooperate with Architect and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.
 - 1. Notify Architect and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
 - 2. Determine the location from which test samples will be taken and in which in-situ tests are conducted.
 - 3. Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
 - 4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
 - 5. Do not release, revoke, alter, or increase the Contract Document requirements or ap-

6. prove or accept any portion of the Work.
Do not perform any duties of Contractor.
- E. Associated Services: Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:
 1. Access to the Work.
 2. Incidental labor and facilities necessary to facilitate tests and inspections.
 3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
 4. Facilities for storage and field curing of test samples.
 5. Delivery of samples to testing agencies.
 6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
 7. Security and protection for samples and for testing and inspecting equipment at Project site.
- F. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and -control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.

Schedule times for tests, inspections, obtaining samples, and similar activities.
- G. Schedule of Tests and Inspections: Prepare a schedule of tests, inspections, and similar quality-control services required by the Contract Documents. Submit schedule within 30 days of date established for the Notice to Proceed.
 1. Distribution: Distribute schedule to Owner, Architect, testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.
- H. Air Leakage Testing:
 1. Air leakage (determined by pressurization testing) must be less than 2.5 square inches/100 square feet surface area leakage ratio (CGSB, calculated at a 10 Pa pressure differential); or 1.25 square inches/100 square feet leakage ratio (ASTM, calculated at a 4 Pa pressure differential); or 0.25 CFM/square foot of building enclosure surface area at a 50 Pascal air pressure differential. The calculation of the building enclosure area includes the foundation or below-grade surface areas. If the house is divided into multiple conditioned zones, such as conditioned attics or conditioned crawl space, the blower door requirement must be met with the access to the space open, connecting the zones.
 2. Blower Door Test for Overall Air Infiltration:
 - a. Target: 1127 CFM 50 / 3.6 ACH 50 (cfm 50 = cubic feet per minute at 50 Pa).
 3. Provide blower door testing assemblies equal to Minneapolis Blower Door by the Energy Conservatory.
 - a. Model 3 Blower Door Fan
 - 1) Maximum Flow:

- a) 6,300 CFM at free air (2,973 l/s, 10,700 m3/h).
 - b) 5,350 CFM at 50 Pa (2,524 l/s, 9,090 m3/h).
- 2) Minimum Flow: 300 CFM with Ring B (141 l/s, 510 m3/h).
 - a) 85 CFM with Ring C (40 l/s, 144m3/h).
 - b) 30 CFM with Rings D (14 l/s, 51 m3/h).
 - c) 11 CFM with Rings E (5 l/s, 18 m3/h).
- b. Dimensions: 20 in. (50 cm) inlet diameter, 10.25 in (26 cm) length.
- c. Weight: 33 lbs. (15 kg) with Flow Rings A & B.
- d. Flow Accuracy: +/- 3% using DG-700 or APT system, Rings D & E +/- 4% or 1 CFM.
- e. Calibration: Meets ASTM Standard E779-03, E1554-07, CGSB-149.10-M86, EN 13829, ATTMA Technical Standard 1 and NFPA 2001.
- f. Power 110V or 220V.
- g. Adjustable Frame and Frame Material:
 - 1) Extruded Aluminum.
 - 2) Frame Material Width: 28 in. to 40 in. (71 cm to 101 cm).
 - 3) Height: 52 in. to 96 in. (132 cm to 244 cm).
 - 4) Seal: EPDM flexible gasket.
 - 5) Panel Material: Nylon w/built-in vinyl window.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 TEST AND INSPECTION LOG

- A. Prepare a record of tests and inspections. Include the following:
 - 1. Date test or inspection was conducted.
 - 2. Description of the Work tested or inspected.
 - 3. Date test or inspection results were transmitted to Architect.
 - 4. Identification of testing agency or special inspector conducting test or inspection.
- B. Maintain log at Project site. Post changes and modifications as they occur. Provide access to test and inspection log for Architect's reference during normal working hours.

3.2 REPAIR AND PROTECTION

- A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.
 - 1. Provide materials and comply with installation requirements specified in other Specification Sections. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible.

2. Comply with the Contract Document requirements for Section 017329 – CUTTING AND PATCHING.
- B. Protect construction exposed by or for quality-control service activities.
- C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION

SECTION 015000

TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. The Work of this Section includes, but is not limited to, requirements for the following:

1. Temporary facilities and services.
2. Temporary water.
3. Weather protection
4. Temporary heating and ventilating
5. Temporary humidity control.
6. Temporary electricity and lighting
7. Temporary telephone
8. Temporary sanitary facilities
9. Temporary fire protection
10. Temporary stairs and ladders
11. Temporary hoists and chutes
12. Staging and scaffolding
13. Temporary use of elevators
14. Temporary enclosures
15. Protection of work, property and the public
16. Security of the work
17. Rodent control.
18. Water control
19. Snow and ice control
20. Construction fence
21. Project signs
22. Temporary offices

1.3 SUBMITTALS

- A. General: Refer to Section 013300 – SUBMITTAL PROCEDURES, for submittal provisions and procedures.
- B. Informational Submittals: Submit the following plans for temporary protection and facilities as specified in this Section:
 1. Weather protection plan
 2. Temporary humidity control procedures
 3. Temporary heating plan

TEMPORARY FACILITIES AND CONTROLS

4. Temporary fire protection plan.

1.4 TEMPORARY FACILITIES AND SERVICES

- A. Contractor shall be responsible for arranging and providing temporary facilities and general services at the site as specified herein and as otherwise required for proper and expeditious prosecution of work. Except as otherwise specified, the Contractor shall pay costs for all temporary facilities and general services until Final Acceptance of the Work and shall remove same at completion of the Work.
- B. All such services and facilities shall comply with applicable Federal, State and local regulations.
- C. Contractor shall make all connections to existing services and sources of supply, shall provide all necessary installations, labor, materials, and equipment, in a manner subject to the approval of the Architect and the Owner, shall remove temporary installations and conditions when no longer required, and shall restore the services and sources of supply to proper operating condition as approved by the Architect.
- D. Discontinuance of any temporary service prior to the completion of any portions of the Work shall not render the Owner liable for any additional cost resulting therefrom.
- E. Should a change in location of any temporary equipment be necessary in order for the Work to progress properly, Contractor shall remove and relocate such equipment as required without additional cost to the Owner.
- F. Temporary Parking Lot: Construct temporary parking lot shown on approved Logistics Plan for temporary use of Owner and Contractor during construction. Demolish temporary parking lot and restore area for permanent use as shown on Drawings.

1.5 TEMPORARY WATER

- A. Furnish potable water for construction purposes for trades at a point within 10 feet of building being constructed. Make arrangements and pay charges for water service installation, maintenance, and removal thereof, and pay costs of water for all trades.
- B. After installation, permanent water supply and distribution system may be used as source of water for construction purposes, provided that the Contractor pays applicable municipal water costs and assumes responsibility for damage to water distribution system and pays costs of restoration of system where so damaged.
- C. Temporary pipe lines and connections from the permanent service line, either outside or within the building, necessary for the use of the Contractor and his Subcontractors shall be installed, protected and maintained at the expense of the Contractor.
- D. In addition to temporary lines and connections, the Contractor, if required by the Owner, shall at the Contractor's expense install a temporary meter in a frostproof box in such location and in such manner as may be approved by the Architect.
- E. Provide an adequate supply of drinking water from approved sources of acceptable quality, satisfactorily cooled, for Contractor's employees and those of his Subcontractors. Where required, furnish drinking water in suitable containers and provide single-service cups for use of

employees. Drinking water dispensers shall be conveniently located in building where work is in progress.

- F. At completion of construction work, temporary water service equipment and piping shall be removed by Contractor.

1.6 WEATHER PROTECTION

- A. It is the intent of these Specifications to require the Contractor to provide temporary enclosures and heat to permit construction work to be carried on during the months of November through March in compliance with Massachusetts General Laws. These Specifications are not to be construed as requiring enclosures or heat for operations that are economically infeasible to protect in the judgment of the Architect. Included in this category, without limitation, are such items as site work, excavation, pile driving, steel erection, erection of certain exterior wall panels, roofing, and similar operations.
- B. "Weather Protection" shall mean the temporary protection of that work adversely affected by moisture, wind and cold, by covering, enclosing and/or heating. This protection shall provide adequate working areas during the months of November through March as determined by the Architect and consistent with the approved construction schedule to permit the continuous progress of all work necessary to maintain an orderly and efficient sequence of construction operations. The Contractor shall furnish and install all "weather protection" material and be responsible for all costs, including heating required to maintain temperature of 40 degrees F. at the working surface. This provision does not supersede any specific requirements for methods of construction, curing of materials or to performance obligations of the Contractor.
- C. Within 30 calendar days after award of Contract, the Contractor shall submit in writing to the Architect for approval, three (3) copies of his proposed methods for weather protection.
- D. Installation of weather protection shall comply with all safety regulations including provisions for adequate ventilation and fire protection.
- E. Determination of extent of work to be performed during winter months shall be by the Contractor, with Owner's approval provided that work shall proceed at such a rate as to insure Substantial Completion on or before the stipulated date in accordance with the Progress Schedule.
- F. Be responsible for providing protection against damage to materials and work installed in freezing weather by providing special heat and coverings to prevent damage by the elements, in a manner approved by the Architect. Protect the ground surfaces under footings, under pipelines, under masonry, under concrete and other work subject to damage, against freezing or ice formation. If low temperature makes it impossible to continue operations safely in spite of cold weather precautions, cease work, and so notify the Architect.

1.7 TEMPORARY HEATING AND VENTILATING

- A. Within thirty (30) calendar days after commencement of work under this Contract, the Contractor shall submit in writing to the Architect for approval, three (3) copies of his method and time schedule for heating during construction, which shall concur with his general Progress Schedule.

- B. Temporary weather-tight enclosures and temporary heating shall be provided by the Contractor as required during construction to make the building weather-tight and to protect work from freezing and frost damage. All costs of closing in buildings, and all costs of temporary heat shall be paid for by the Contractor until Substantial Completion.
- C. Contractor shall provide for temporary heating and shall pay fuel costs for heating directly to the utility company. Contractor may not tie into the Owner's permanent heating and ventilating system. In areas of building where work is being conducted, temperature shall be continuously maintained as specified in Sections of Specifications but not less than 50 degrees F. nor more than 75 degrees F.
- D. Furnish and install one accurate recording Fahrenheit thermometer at a place designated by the Owner, located as directed by the Owner in order to determine that the specified temperatures are being maintained.
- E. When work has progressed sufficiently for installation of glazing, Contractor may, if approved by Architect, use glazed windows in place of temporary enclosures. Permanent windows shall be protected against damage from mortar, cement, plaster, etc., and from damage by other trades; and upon completion of work shall be thoroughly cleaned, damaged component parts including glass shall be satisfactorily repaired or replaced, and windows left in perfect condition, prior to Substantial Completion.
- F. Where building systems are inoperable, temporary heating shall be by smokeless portable unit heaters, steam generators or forced warm air heaters (UL, Factory Mutual, Fire Marshall approved), located outside building or vented to the outside. Contractor shall pay for fuel, maintenance and attendance required in connection with temporary heat. Surfaces, interior or exterior, damaged by use of these space heaters shall be replaced by new materials or be refinished to the satisfaction of the Architect without additional cost to the Owner. Use of oil burning "salamanders" is forbidden and nonvented open flame heaters will not be permitted inside after the building is closed in. Do not use propane-fueled heaters inside building or near stockpiles of combustible materials.
- G. When new heating system, or suitable portion thereof, is in operating condition, such system may be used for temporary heating, provided that the Contractor obtains written approval of Architect and Owner.
- H. Use of permanent air handling facilities for construction heating purposes will not be permitted.
- I. Make periodic inspections of the equipment and controls to insure proper operation of the system, as conditions require, and report any failings. Installation and operation of weather protection and heating devices shall comply with all safety regulations including provisions for adequate ventilation and fire protection.
- J. Upon conclusion of temporary heating period, Contractor shall remove temporary piping, temporary radiators, other equipment and pay costs in connection with repairing damaged caused by installation or removal of temporary heating equipment and shall thoroughly clean and recondition those parts of permanent heating system used for temporary service.
- K. Provide adequate ventilation as required to keep temperature of building within 10 degrees of ambient outdoor temperature when such. ambient temperature exceeds 70 degrees F., and to prevent accumulation of excess moisture in building. Refer to Section for Indoor Air Quality Control, for additional requirements for ventilation during construction

1.8 TEMPORARY HUMIDITY CONTROL

- A. Humidity Control of Enclosed Building: The contractor shall install the following equipment to monitor and regulate relative humidity as required for the installation of all interior products. Humidity control equipment shall include, but not be limited to, the following:
 - 1. Hygrometer: Provide one device to measure temperature and relative humidity in each construction area.
 - 2. Dehumidifier, as required to maintain humidity of enclosed areas below 70%:
 - 3. Fans: As required to eliminate significant variation in humidity levels within enclosed spaces.
- B. Schedule for Humidity Control: Relative humidity shall be maintained within the limits set by manufacturers of all interior materials and equipment. Refer to individual specification sections in Divisions 6, 9, 10, 11 and 12 for additional environmental requirements. No interior construction product shall be installed or applied prior to enclosure of building and installation of temporary humidity control measures.
- C. Within 30 calendar days after award of Contract, the Contractor shall submit in writing to the Architect for approval, three (3) copies of his proposed methods for humidity control.

1.9 TEMPORARY ELECTRICITY AND LIGHTING

- A. Make arrangements as required with local electric company for temporary electric service, pay expenses in connection with installation, operation, and removal thereof, and pay cost of energy consumed by all trades until Substantial Completion of the building. Contractor shall make payments for electrical service directly to the electric company.
- B. Take care not to overload equipment and lines. Provide and relocate temporary electric meters as required.
- C. Power: Provide power distribution as required throughout new structure 120/208 volt, 3 phase, 60 cycle AC. Termination of power distribution shall be at one location in each major section of building, approximately at center. Termination shall be provided complete with circuit breakers, disconnect switches and other electrical devices as required to protect power supply system. Submit plan showing electrical distribution locations for Architect's approval.
- D. Lighting: Temporary lighting system shall be furnished, installed and maintained by Contractor as required to satisfy minimum requirements of safety and security. Temporary lighting system shall afford general illumination in building areas and supply not less than one (1) watt per square foot of floor area for illumination in areas of building where work is being performed. Provide adequate outdoor lighting to illuminate staging, stockpiles, trenches, projections, office trailers etc., to the satisfaction of the Architect, and general illumination throughout adequate for watchmen and emergency personnel.
- E. Safety: All temporary equipment and wiring for power and lighting shall be furnished and installed in conformity with the National Electrical Code and in accordance with local ordinances and requirements of the municipal power authority. All temporary wiring and accessories shall be maintained in a safe manner and utilized so as not to constitute hazard to persons or property and shall be removed after they have served their purposes.

- F. When permanent electrical power and lighting systems are in operating condition, they may be used for temporary power and lighting for construction purposes, provided that Contractor obtains written approval of Architect and Owner. If permanent lighting fixtures are used in temporary light, provide new lamps for fixtures used for temporary light before Substantial Completion of the Work.
- G. At completion of construction work, or at such time as Contractor makes use of permanent electrical installation, temporary wiring, lighting and other temporary electrical equipment and devices shall be removed by Contractor.

1.10 TEMPORARY TELEPHONE

- A. Arrange with local telephone company to provide direct line telephone service at each construction site. Provide:
 - 1. One direct line instrument in Field Office for the Contractor with electronic answering machine.
 - 2. Two direct line instruments in Field Office of the Clerk of the Works equipped with electronic answering machine; plus one direct line for facsimile machine in office. Turn over keys to Clerk of the Works and Architect.
 - 3. Two (2) Nextel Motorola i530 Mobile Phones with Nextel National 500 Plans for use by the Clerk of the Works.
 - 4. High Speed internet access and router via DSL, Broadband, Cable, or equal with unlimited internet access to the Field offices of the Contractor and Clerk of the Works.
 - 5. Other instruments at the option of the Contractor, or as required by regulations.
 - 6. Each Subcontractor shall make his own arrangements for telephone service.
- B. Pay for installation and removal of temporary telephones and facsimile lines and for all calls and fixed charges in connection therewith; including unlimited long-distance calling.
- C. Temporary telephone services shall be maintained until Substantial Completion of the Work.

1.11 TEMPORARY SANITARY FACILITIES

- A. Contractor shall provide an adequate number of toilet facilities with chemical type toilets and temporary lighting rented from and serviced by an approved company, as necessary for all persons engaged on the Work. Provide separate facilities for male and female workers.
- B. Toilets shall be erected in location approved by the Architect, shall be maintained by the Contractor in a clean and orderly condition in compliance with all local and State health requirements, and shall be removed at Substantial Completion of the Work.
- C. Permanent toilet facilities shall not be used by the Contractor, Subcontractors or any persons engaged by them during the course of work under this Contract.

1.12 TEMPORARY FIRE PROTECTION

- A. Provide and maintain adequate temporary fire protection in the form of barrels of water with buckets, fire bucket tanks, fire extinguishers, or other effective means of extinguishing fire, ready for instant use, distributed around the Project and in and about temporary inflammable structures during construction of the Work.

- B. Within 30 calendar days after award of Contract, the Contractor shall submit in writing to the Architect, three (3) copies of his proposed methods for fire protection that have been reviewed and approved by the local Fire Department. Post a copy of the approved fire protection plan in the Field Office for reference.
- C. Gasoline and other flammable liquids shall be stored in and dispensed from UL listed safety containers in conformance with National Board of Fire Underwriter's recommendations. Storage shall not be within building.
- D. Make arrangements for periodic inspection by local fire protection authorities and insurance underwriter's inspectors. Cooperate with said authorities and promptly carry out their recommendations.
- E. Tarpaulins used during construction work shall be made of material that is resistant to fire, water, and weather. Tarpaulins shall have UL approval and comply with FS-CCC-D-746.
- F. Torch-cutting and welding operations performed by Subcontractors shall have approval of Contractor before such work is started and chemical extinguisher shall be available within sight and not over ten (10) feet from location where such work is in progress.
- G. Do not light fires in or about premises.

1.13 TEMPORARY STAIRS AND LADDERS

- A. Each trade shall provide its own ladders where such ladders do not exceed a height of eight feet. Where ladders over eight feet, or stairs, steps or ramps of any height are required, the Contractor shall provide the entire installation, including the first eight feet.
- B. All such apparatus, equipment and construction shall meet all requirements of Federal, State and local laws applicable thereto.
- C. As soon as permanent stairs are erected, Contractor shall provide temporary protective treads, handrails, and shaft protection at stair locations.

1.14 TEMPORARY HOISTS AND CHUTES

- A. Each trade shall provide its own hoists, including associated rigging, conveyance apparatus and chutes, where the maximum elevation of such hoists does not exceed a height of eight feet. Where hoists with elevations over eight feet are required, the Contractor shall provide the entire installation, including the first eight feet, and also including associated rigging, conveyance apparatus and chutes.
- B. Construction, maintenance and operation of material hoists shall conform to applicable requirements of the "Standard Safety Code for Building Construction", ANSI; to AGC "Manual" requirements and to State and local regulations.
- C. Temporary ladders, ramps, runways, chutes, derricks, stairs, and similar items required for proper execution of Contractor's work and that of his Subcontractors shall be properly maintained. Use of such facilities by other contractors, subcontractors and trades shall be permitted as required by construction schedule. Hoists and chutes shall be so constructed as to prevent damage, staining and marring of permanent work.

- D. No materials, rubbish or debris, shall be permitted to drop free, but shall be removed by the use of material hoist and/or fully enclosed rubbish chute.
- E. Provide openings in slabs, roofs, walls and partitions, where required, for moving in large pieces of equipment. Close and restore openings and finish them after equipment is in place. Structural modification, if required, shall be subject to prior written approval by the Architect.

1.15 STAGING AND SCAFFOLDING

- A. Responsibility for Staging:
 - 1. Staging eight feet or less in height: Each trade shall provide staging and scaffolding required for its work, where such staging and scaffolding does not exceed a height of eight feet.
 - 2. Staging greater than eight feet in height: Where staging or scaffolding over eight feet high is required, the General Contractor shall provide the entire installation, including the first eight feet.
 - 3. The General Contractor shall coordinate the use of staging and scaffolding as required to permit trades to perform the Work in a timely manner.
- B. Construction Requirements for Staging: The General Contractor is responsible for safety of staging and scaffolding, including but not limited to the following requirements:
 - 1. Staging shall be of approved design, erected and removed by experienced stage builders, and shall comply with all applicable OSHA standards.
 - 2. Provide accident prevention devices required by State and local laws.

1.16 TEMPORARY USE OF ELEVATORS

- A. Make arrangements with Elevator Subcontractor for temporary use of elevators, if required, during construction period, and for normal use by all trades and Subcontractors.
- B. Make arrangements for provision of temporary cab enclosures, cars, car switches, gate contacts, power, signaling devices, temporary hoistway openings, protection of permanent hoistway entrances and other installed finished work, and all such other items as are necessary to permit temporary operation in accordance with local, State and national codes.
- C. Arrange with Elevator Subcontractor for all necessary maintenance of elevators during period of temporary operation and for restoration of elevators to their original, perfect condition with guarantees as specified. All costs in connection with temporary operation of elevators shall be paid by the Contractor.
- D. Do not abuse, overload or otherwise damage elevators in temporary use for construction purposes.

1.17 TEMPORARY ENCLOSURES

- A. Provide temporary weather tight enclosure of exterior walls as necessary to provide acceptable working conditions, provide weather protection for interior materials, allow for effective temporary heating, and to prevent entry of unauthorized persons.

- B. Provide temporary exterior doors with self-closing hardware and padlocks. Permanent door enclosures shall not be used as temporary enclosures. Other enclosures shall be removable as necessary for work and for handling of materials.
- C. Refer to Section INDOOR AIR QUALITY CONTROL, for requirements for temporary interior partitions to enclose portions of the work where required for protection of indoor air quality.
- D. Relocate temporary enclosures as required by progress of construction, by operations of the building, or work requirements, and to accommodate legitimate requirements of Owner and Subcontractors employed at the site.
- E. Completely remove temporary materials, equipment and services when enclosure needs can be met by use of permanent construction and at completion of the Project.

1.18 PROTECTION OF WORK, PROPERTY AND THE PUBLIC

- A. Furnish, erect, and maintain, until such time as removal is approved by the Architect, temporary fencing and barricades to extent recommended by OSHA and as otherwise required for the protection of life and property during operations under the Contract.
- B. Construct barricades and protective facilities in accordance with local and State regulations. Furnish and install all signs, lights, reflectors, and all such protection facilities as may be required.
- C. Contractor shall save the Owner harmless from all claims arising from the use of public streets, sidewalks, and adjoining premises for construction purposes.
- D. Keep all access roads and walks clear of debris, materials, construction plant and equipment during building operation. Repair streets, drives, curbs, sidewalks, fences, poles and the like where disturbed in building operation and leave them in as good condition after completion of the Work as before operations started.
- E. Protect all planting, landscaping, trees and site improvements to remain.
- F. The Contractor shall be responsible for the maintenance of construction barriers and traffic barriers in order to maintain traffic around the Work with the maximum of safety and practical convenience to such traffic during the life of the Contract, and whether or not work has been suspended temporarily. He shall take all precautions for preventing injuries to persons or damage to property on or about the Work.
- G. Work shall be carried on and barriers erected in such a manner as to provide safe passage at all times for public travel and with least obstruction to traffic. The Contractor shall provide and maintain at his own expense in a safe and passable condition such temporary bypasses created by the barriers as may be necessary to accommodate both pedestrian and vehicular traffic.
- H. Whenever gale or high winds are forecast, take proper measurements to secure all loose material, equipment or other items that could blow about and be damaged or cause damage to other work. No such loose items shall be left unsecured at end of working day. Particular attention shall be taken with scaffolding and items placed or stored on roofs or within the structure prior to being enclosed.

- I. Remove all snow and ice which may impede work, damage the finishes or materials, be detrimental to workers, or impede trucking, delivery, or moving of materials at the job site, or prevent adequate drainage of the site or adjoining areas.
- J. Be responsible for all breakage of glass from the time construction operations commence in each portion of the Project until each portion of the Project is occupied by the Owner. Unless glass has been broken by the Owner or his representatives, or by other separate prime contractors, the cost of glass replacement shall be borne by Contractor.

1.19 SECURITY OF THE WORK

- A. The Contractor shall be responsible for providing any and all security precautions necessary to insure adequate protection of his and the Owner's interests.
- B. Take all required measures to protect the Work at all times against fire, storm, theft, vandalism and other losses.
- C. The Contractor shall be wholly responsible for patrolling and protecting the work under construction and the materials stored on the site; and shall reimburse the Owner for any losses, damage or injury not compensated by insurance, except those directly caused by the Owner, his agents or his employees.
- D. The Contractor shall rebuild, repair, restore and make good all damage to any portion of the Work occasioned by any of the above causes before completion and written acceptance of the completed Work, and shall bear the expense thereof. No extension of time will be allowed in such cases.
- E. Should the Contractor fail to take prompt action whenever conditions make it necessary, the Owner may make emergency repairs or cause the same to be made, with the stipulation that the costs for such repairs shall be charged against the Contractor and deducted from monies due to him.

1.20 RODENT CONTROL

- A. Pest Control: Engage pest-control service to recommend practices to minimize attraction and harboring of rodents and to perform extermination and control procedures at regular intervals so Project will be free of rodents and their residues at Substantial Completion.
 - 1. Obtain extended warranty for Owner.
 - 2. Perform control operations lawfully, using environmentally safe materials.
 - 3. The Contractor's attention is brought to the fact that the building will be occupied by children. Every effort shall be made to avoid applications of materials that will in any way compromise their health.

1.21 WATER CONTROL

- A. Take over responsibility for site drainage in work areas upon entering the premises and maintain such drainage during the life of this Contract in a manner approved by the Architect and so as not to adversely affect adjacent areas or abutting property.
- B. During the progress of the Work, provide and maintain all required pumps, suction and discharge lines, and power in sufficient number and capacity to keep all excavations, pits,

trenches, foundations, and the entire property area free from accumulation of water from any source whatsoever, at all times, and under any and all circumstances and contingencies that may arise.

1.22 SNOW AND ICE CONTROL

- A. De-icing Materials:
 - 1. General: Comply with state and local regulations.
- B. Snow Storage:
 - 1. General: Comply with state and local regulations.

PART 2 - PRODUCTS

2.1 CONSTRUCTION FENCE

- A. Furnish, install, maintain, and pay for temporary fencing and other protection required for the safety of the Work and of stored materials and equipment. Provide temporary construction fence as required for public safety and protection around entire construction area at the Limit of Work line, at each site as shown on Drawings. Fence shall be installed in a manner that will not impact wetlands.
- B. Construction fence shall be eight (8) feet high and of chain link construction with 6 gauge wire at the top and the bottom of the fencing material, erected in a substantial manner, straight, plumb and true.
- C. Gates shall be built into fence at such approved locations as are necessary, well cross-braced and hung on heavy strap hinges with proper post and hook for double gates. Provide heavy hasps and padlocks for each gate. Provide keys to Owner to facilitate emergency access by Owner's Security Forces and local Police and Fire Department.
- D. All fencing shall be in accordance with local ordinances and shall be removed at such time before Final Acceptance as the Architect directs. Restore site to acceptable condition after removing fence.
- E. Vehicular access to the site, and parking for Contractor's employees' vehicles shall be restricted to the specific areas designated by the Owner.

2.2 PROJECT SIGNS

- A. Provide in a location designated by the Architect one (1) sign, 4 feet by 8 feet in size, with three 4-inch by 4-inch post supports. Sign shall be fabricated from 3/4 inch thick medium density overlaid exterior plywood, edged continuously with 3/4 inch square pine banding. Apply one coat of exterior primer and two coats of exterior gloss enamel to all surfaces of sign and supports.
- B. Sign shall be professionally produced and shall indicate: (1) the name of the Project, (2) the name of the Owner, (3) the name of the Contractor, (4) names and addresses of the Architect and Consulting Engineers, and (5) MSBA information. Graphic images and lettering, including

type size, style and colors, will be provided by the Architect prior to beginning of construction. Architect will provide layout in electronic disc format or printed copy for sign production.

- C. Provide directional signs as required to properly control construction traffic at each site.
- D. No other signs or advertisements will be allowed on building or premises.
- E. Erect where required for DEP File No. in accordance with Wetland Regulations and the Order of Conditions where applicable.

2.3 TEMPORARY OFFICES

- A. Provide, maintain, and pay all costs in connection with temporary offices; including but not limited to office furniture, office equipment, and exhaustible office supplies.
- B. In addition to his own requirements, the Contractor shall provide and bear all costs for completely enclosed weathertight structure equal to Williams Scotsman Model MO6012; not less than 60'-0" x 12'-0" in area for use of the Owner, the Architect, and their representatives. The trailer shall have two offices and a conference room, a reasonable amount of natural light, adjustable natural ventilation, and two exterior doors with dead bolt locks accessible and keyed from the outside. In addition include the following equipment:
 - 1. One private toilet facility with running water within the structure.
 - 2. Heat during cold weather below 55 degrees F.
 - 3. One layout table, approximately 36" x 84" with one drafting stool and two drafting lamps with bulbs.
 - 4. Two desks (30x60 standard double pedestal) and two desk chairs (swivel type with arms) in separate offices. One desk and one desk chair in the main area.
 - 5. Twelve straight back folding chairs.
 - 6. Four metal file cabinets (4 drawers each) with locks.
 - 7. One plan rack to accommodate at least 6 sets of drawings.
 - 8. Two desk-type telephones.
 - 9. One electronic telephone answering machine.
 - 10. One coat rack, two wastepaper baskets, and one 30"x40" wall-mounted tackboard.
 - 11. One exterior high quality mercury thermometer.
 - 12. Air conditioning during weather above 75 degrees F.
 - 13. Two conference tables, 36" x 72" and 8'-0" of 12" deep shelving.
 - 14. Sufficient number of electric lights (50 fc at desk level over entire area) and outlets.
 - 15. One electrostatic copying machine, capable of copying, sorting, stapling, and collating equal to Xerox model XC830 or Sharp Z-820 with toner and drum cartridges. The copier shall have a 100-sheet paper drawer, able to reduce 30%, enlarge 40% and produce letter and legal size copies. Provide letter and legal size paper supply for the duration of the work.
 - 16. One facsimile transmitting and receiving machine with dedicated telephone line.
 - 17. Once digital camera equal to USA PowerShot S45 and direct interface data cable.
 - 18. Supplies: Office supplies, including toners for all equipment, four (4) pairs of boots, four hard hats, and raincoats, one water-cooler with refrigerator, paper cups, and weekly bottle replacement for the duration of the project.
 - 19. One industrial quality wall-mounted first aid kit sized and supplied for 10 people.
 - 20. One automatic coffee machine.
 - 21. One new computer equal to or better than a Dell Dimension 4550 Series Pentium 4 processor at 2.66 GHz w/ 533 MHz front side bus/512K L2 Cache, 333MHz DDR

SDRAM, 512mb RAM. Include a Dell quitekey keyboard, a new 17 in E171 FPb Flat Panel Display, a Video Card equal to or better than 64mb DDR NVIDIA GeForce MX Graphics Card with TV-Out, a Hard Drive with a minimum of 60 GB Ultra ATA/100 7200 RPM, a 3.5 floppy disk drive, an operating system equal to MS Windows XP Professional, a Logitech Optical USB or equal mouse, a Network to include Integrated Intel Pro 10/100 Ethernet or equal and related cord, a 56K PCI Data/Fax Modem and related cord, a CD/DVD Drive equal to 48x/24x/40x Max CD-RW/DVD Combo Drive, a Sound Card equal to Sound Blaster Live 5.1 Digital Sound Card, a Speaker equal to Harmon Kardon HK-206, a zip drive equal to 250 mb lomega ZIP Built-in Drive, and Software equal to MS Office XP Small Business. All items, including related power cords, adapters, surge suppressors, and other misc items necessary to operate the equipment are to be installed and made operational for use by the Owner.

22. One printer equal to the HP Officejet all-in-one printer/scanner/fax; include all related cables and driver software.
- C. Heat and Air Conditioning shall be maintained to provide an indoor air temperature of 76 degrees F at 72 inches above the floor and throughout the space during the cooling season and 70 degrees F at 30 inches above the floor during the heating season.
- D. Electrical Convenience Power: Provide convenience outlets for at least 2400 watts and at least 2 convenience circuits independent of the lighting, equipment power, and heating needs.
- E. Offices shall be located in location approved by the Architect, shall be maintained by the Contractor in a clean and orderly condition, and shall be removed at Substantial Completion. The Contractor shall provide a cleaning service in each office at regular intervals (at least weekly).
- F. Provide routine emergency service for office equipment specified and reasonable quantities of expendable supplies as required for job related use. When the sitework and building has been completed to the extent that removal of the temporary structures is required, the Contractor shall provide a fully organized and connected temporary office spaces within the building located in and area approved by the Architect.
- G. All office equipment provided under this Section shall be the property of the Contractor and shall be removed at Substantial Completion; except the computer, camera, printer, and associated hardware and software for which the titles and licenses shall be transferred to the Awarding Authority before final acceptance of the Project.

PART 3 - EXECUTION (NOT USED)]

END OF SECTION

SECTION 015639

TEMPORARY TREE AND PLANT PROTECTION

1.1 SUMMARY

- A. Section includes general protection and pruning of existing trees and plants that are affected by execution of the Work, whether temporary or permanent construction.

1.2 QUALITY ASSURANCE

- A. Arborist Qualifications: Licensed arborist in jurisdiction where Project is located.

1.3 MATERIALS

- A. Topsoil: Natural or cultivated top layer of the soil profile or manufactured topsoil; containing organic matter and sand, silt, and clay particles; friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more than 1 inch (25 mm) in diameter; and free of weeds, roots, and toxic and other nonsoil materials.
- B. Organic Mulch: Shredded hardwood. Free from deleterious materials and suitable as a top dressing for trees and shrubs, consisting of one of the following:
- C. Protection-Zone Fencing: Fencing fixed in position and meeting one of the following requirements. Previously used materials may be used when approved by Owner's Representative.
- D. Protection-Zone Signage: Shop-fabricated, rigid plastic or metal sheet with attachment holes prepunched and reinforced; legibly printed with nonfading lettering and as follows:

1.4 EXECUTION

- A. Protection-Zone Fencing: Install protection-zone fencing along edges of protection zones before materials or equipment are brought on the site and construction operations begin in a manner that will prevent people and animals from easily entering protected area except by entrance gates.
- B. Protection-Zone Signage: Install protection-zone signage in visibly prominent locations in a manner approved by Owner's Representative.
- C. Trenching near Trees: Where utility trenches are required within protection zones, hand excavate under or around tree roots or tunnel under the roots by drilling, auger boring, or pipe jacking. Do not cut main lateral tree roots or taproots; cut only smaller roots that interfere with installation of utilities. Cut roots as required for root pruning.
- D. Crown Pruning: prune branches that are affected by temporary and permanent construction. Prune branches as follows:

TEMPORARY TREE AND PLANT PROTECTION

1. Prune trees to remain to compensate for root loss caused by damaging or cutting root system. Provide subsequent maintenance during Contract period as recommended by arborist.
- E. Regrading: Lowering Grade: Where new finish grade is indicated below existing grade around trees, slope grade beyond the protection zone. Maintain existing grades within the protection zone.
- F. Regrading: Raising Grade: Where new finish grade is indicated above existing grade around trees, slope grade beyond the protection zone. Maintain existing grades within the protection zone.
- G. Minor Fill within Protection Zone: Where existing grade is 2 inches (50 mm) or less below elevation of finish grade, fill with topsoil. Place topsoil in a single uncompacted layer and hand grade to required finish elevations.
- H. Trees Replacement: Remove and replace trees indicated to remain that are more than 25-percent dead or in an unhealthy condition or are damaged during construction operations that Owner's Representative determines are incapable of restoring to normal growth pattern.
 1. Provide new trees of same size and species as those being replaced for each tree that measures 4 inches (100 mm) or smaller in caliper size.
- I. Soil Aeration: Where directed by Owner's Representative, aerate surface soil compacted during construction. Aerate 10 feet (3 m) beyond drip line and no closer than 36 inches (900 mm) to tree trunk. Drill 2-inch- (50-mm-) diameter holes a minimum of 12 inches (300 mm) deep at 24 inches (600 mm) o.c. Backfill holes with an equal mix of augered soil and sand.

END OF SECTION

SECTION 017329

CUTTING AND PATCHING

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. This Section covers procedural requirements for cutting and patching, including but not limited to the following:
 - 1. Standard requirements for all cutting and patching to be done on the Project, whether by the General Contractor, Filed Sub-Contractors or other subcontractors.
- B. Refer to the following Sections for related work:
 - 1. Section 015000 – TEMPORARY FACILITIES AND CONTROLS, for temporary protection, shoring and construction aids.
 - 2. Section 017400 – CONSTRUCTION WASTE MANAGEMENT, for disposal of demolished materials.
 - 3. Division 2 through Division 14 Sections, for specific requirements and limitations applicable to cutting and patching individual parts of the Work.
 - 4. Section 033000 – CAST-IN-PLACE CONCRETE, for cutting, patching and repair of concrete.
 - 5. Section 042000 – UNIT MASONRY, for cutting and patching of existing masonry for the work of all trades, unless otherwise provided herein.
 - 6. Section 042000 – UNIT MASONRY, for installation of lintels where required for all penetrations through new and existing masonry.
 - 7. Section 055000 – METAL FABRICATIONS, for furnishing of lintels where required for all penetrations through new and existing masonry.
 - 8. Section 078400 – FIRESTOPPING, for patching fire-rated construction.
 - 9. Division 9 – FINISHES, for all patching of new and existing construction, except for masonry and concrete.
 - 10. Section 092900 – GYPSUM BOARD, for cutting and patching gypsum wallboard construction.
 - 11. Section 099000 – PAINTING AND COATING, for final preparation of existing, new and patched surfaces as required for application of paint, and for paints and coatings applied to patched surfaces.
 - 12. Division 21, 22, 23 – MECHANICAL and Division 26 – ELECTRICAL, for coring and drilling for all items to be installed by mechanical and electrical trades, except as otherwise indicated.
 - 13. Division 21, 22, 23 – MECHANICAL and Division 26 – ELECTRICAL, for items to be installed by mechanical and electrical trades, except as otherwise indicated.

1.3 DEFINITIONS

- A. Cutting: Removal of in-place construction necessary to permit installation or performance of other Work.
- B. Patching: Fitting and repair work required to restore surfaces to original conditions after installation of other Work.
- C. Coring: Any new penetration cut through existing or new construction using core drill and measuring no more than 6 inches in diameter, or 6 inches by 6 inches. Larger cores are considered under cutting.

1.4 RESPONSIBILITY FOR CUTTING AND PATCHING

- A. General: All cutting and patching shall conform to the requirements of this Section, whether or not the work is to be done by the Contractor, a Filed Subcontractor or other Subcontractor.
 - 1. Patching shall be performed so as to maintain the integrity of acoustical rating of adjacent construction.
 - 2. Refer to Section 078400 – FIRESTOPPING, for requirements for maintaining the integrity of fire-rated construction at penetrations.
- B. Coordination: The General Contractor shall be responsible for the following:
 - 1. Obtain locations and dimensions of penetrations required through walls and floors from trades requiring penetrations.
 - 2. Coordinate those penetrations with the requirements of other trades.
 - 3. Forward locations and dimensions of requested penetrations to the trades responsible for performing the cutting and patching work.
- C. Modifications with Structural Implications:
 - 1. Non-masonry construction: Provide new penetrations and other work where modification to existing structural elements is shown on the Drawings.
 - 2. Masonry construction: Coordinate the work of Subcontractors as required where modification to existing load-bearing masonry is shown on the Drawings.
 - 3. Do not perform any work that will alter existing structural elements unless it is shown on the Drawings or proposed alterations have been approved in writing by the Architect.
 - 4. Structural elements include, but are not limited to, the following: Steel beams and columns, structural masonry walls, reinforced concrete slabs.
- D. Coring: All coring shall be performed by the trade requiring the new penetration.
- E. New Penetrations in Masonry Construction:
 - 1. Exposed masonry and all masonry bearing walls: All cutting and patching shall be performed under Section 042000 – UNIT MASONRY, with lintels furnished under Section 055000 – METAL FABRICATIONS where required.
 - 2. Concealed portions of non-bearing masonry walls:
 - a. Small penetrations where no lintel will be required shall be provided under Section 042000 – UNIT MASONRY.

- b. Larger penetrations requiring a lintel shall be provided under Section 042000 – UNIT MASONRY, with lintels furnished under Section 055000 – METAL FABRICATIONS.
- 3. Structural criteria for new openings in masonry walls: Bring the following conditions to the attention of the Structural Engineer for determination of whether a lintel or other reinforcement will be required.
 - a. Non-load-bearing masonry walls: Any opening wider than one block or 16 inches.
 - b. Load-bearing masonry walls: Any opening wider than 6 inches.

F. New Penetrations in Non-Masonry Construction:

- 1. Exposed locations: Cutting and patching shall be provided by the trade(s) responsible for surrounding construction.
- 2. Concealed locations: Cutting and patching shall be provided by the trade(s) responsible for surrounding construction.
- 3. Locations at roof: Cutting and patching of roof deck and substrate shall be coordinated with the work of Section 075300 – ELASTOMERIC MEMBRANE ROOFING and Section 075400 – THERMOPLASTIC MEMBRANE ROOFING.

1.5 QUALITY ASSURANCE

- A. Structural Elements: Do not cut and patch structural elements in a manner that could change their load-carrying capacity or load-deflection ratio. Structural elements include but are not limited to the following:
 - 1. Reinforced concrete columns and beams. Coring of concrete foundation walls and slabs will be permitted where shown on drawings or required for mechanical and electrical work.
 - 2. Reinforced masonry bearing walls.
 - 3. Steel columns, beams, joists and connections.
- B. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety. Operating elements include but are not limited to the following:
 - 1. Primary operational systems and equipment.
 - 2. Air or smoke barriers.
 - 3. Partitions and other construction required to provide acoustical separation.
 - 4. Fire-suppression systems.
 - 5. Mechanical systems piping and ducts.
 - 6. Control systems.
 - 7. Communication systems.
 - 8. Conveying systems.
 - 9. Electrical wiring systems.
- C. Miscellaneous Elements: Do not cut and patch miscellaneous elements or related components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety. Miscellaneous elements include but are not limited to the following:

1. Water, moisture, or vapor barriers.
2. Membranes and flashings.
3. Exterior curtain-wall construction.
4. Equipment supports.
5. Piping, ductwork, vessels, and equipment.
6. Noise- and vibration-control elements and systems.

- D. Visual Requirements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch construction exposed on the exterior or in occupied spaces in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

1.6 WARRANTY

- A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during cutting and patching operations, by methods and with materials so as not to void existing warranties.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. General: Comply with requirements specified in other Sections.
- B. In-Place Materials: Use materials identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.
1. If identical materials are unavailable or cannot be used, use materials that, when installed, will match the visual and functional performance of in-place materials.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine surfaces to be cut and patched and conditions under which cutting and patching are to be performed.
1. Compatibility: Before patching, verify compatibility with and suitability of substrates, including compatibility with in-place finishes or primers.
 2. Proceed with installation only after unsafe or unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Temporary Support: Provide temporary support of Work to be cut.
- B. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be

exposed during cutting and patching operations. Refer to Section 015000 – Temporary Facilities and Controls for additional requirements.

- C. Adjoining Areas: Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.

3.3 PERFORMANCE

- A. General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.
 - 1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.
 - 2. Cutting of openings in roofs shall be delayed as long as feasible, and preferably until the Roofing Subcontractor is at the site and can provide permanent roof covering immediately. Otherwise, protect roof openings so made in a weather tight manner until permanent roof is installed. Protect existing roofing to remain. Do not damage or alter existing roofing and flashing to remain when doing work under this Section. Refer to Section 015000 – TEMPORARY FACILITIES AND CONTROLS, for additional requirements for protection from the weather.
- B. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.
 - 1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots as small as possible, neatly to size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
 - 2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces, in such a manner as to ensure a minimal difference between the cut area and new materials when patched..
 - 3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
 - 4. Excavating and Backfilling: Comply with requirements in applicable Sections where required by cutting and patching operations.
 - 5. Mechanical and Electrical Services: Use extreme care when cutting through construction containing concealed mechanical and electrical lines. Coordinate cutting and patching work with the following work to be performed under Division 21, 22, 23 and 26 Sections.
 - a. Cut off pipe or conduit in walls or partitions to be removed.
 - b. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
 - 6. Hazardous Materials: If unanticipated hazardous materials which would be disturbed by cutting and patching are discovered at any time during the course of work, cease work in the affected area only and continue work in other areas, and notify Architect and the Owner of such discovery. Do not proceed with work in such affected areas until written instructions are received.
 - 7. Proceed with patching after construction operations requiring cutting are complete.

- C. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other Work. Patch with durable seams that are as invisible as possible. Provide materials and comply with installation requirements specified in other Sections.
1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate integrity of installation.
 2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.
 - a. Clean piping, conduit, and similar features before applying paint or other finishing materials.
 3. Restore damaged pipe covering to its original condition.
 4. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
 - a. Where patching occurs in a painted surface, apply primer and intermediate paint coats over the patch and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.
 5. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
 6. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weather tight condition.

3.4 DEBRIS REMOVAL AND CLEANING

- A. Dispose of all materials under Section 017400 – CONSTRUCTION WASTE MANAGEMENT.
- B. Cleaning: Clean areas and spaces where cutting and patching are performed. Completely remove paint, mortar, oils, putty, and similar materials.

END OF SECTION

SECTION 017400

CONSTRUCTION WASTE MANAGEMENT

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS, which are hereby made a part of this Section of the Specifications.

1.2 SUMMARY

- A. This Section includes requirements for the Contractor's implementation of waste management controls and systems for the duration of the Work.
- B. Sustainable Design Intent: Refer to Section 018110 - SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.

- 1. Construction and Demolition Waste Management Planning: Develop a waste management plan, quantifying material diversion by either weight or volume to recycle and/or salvage non-hazardous construction and demolition debris.

- a. Exclude excavated soil and land-clearing debris from calculations.
- b. Diverted waste includes recycled, salvaged, reused, and donated materials.
- c. Include materials destined for alternative daily cover (ADC) in the calculations as waste (not diversion).
- d. Include wood waste converted to fuel (bio-fuel) in the calculations as diversion. Other types of waste-to-energy are not considered diversion for this credit.

- 2. Construction and Demolition Waste Management: Comply with one of the following paths, as directed by the LEED Checklist:

- a. Option 1, Diversion: For non-hazardous construction and demolition debris.
 - 1) Path 1: Divert at least 50 percent and three material streams.
 - 2) Path 2: Divert at least 75 percent and four material streams.
 - 3) Path 3: Divert at least 75 percent and three material streams.
 - 4) Path 4: Divert at least 75 percent using certified commingled recycling facility and two additional material streams.
- b. Option 2, Reduction of Total Waste Material: Do not generate more than 7.5 pounds of construction waste per square foot (36.6 kilograms of waste per square meter) of the building's floor area.

- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:

- 1. Section 011000 - GENERAL REQUIREMENTS for general submittal requirements.
- 2. Section 024100 - DEMOLITION for demolition, salvage, and reuse requirements.
- 3. Section 028200 - ASBESTOS REMOVAL AND RELATED WORK for hazardous materials abatement and remediation.

4. **Section 028300 - LEAD-BASED PAINT REMOVAL AND RELATED WORK for hazardous materials abatement and remediation.**

1.3 INTENT

- A. The Owner and Architect have established that this Project shall generate the least amount of waste practical and that processes that ensure the generation of as little waste as possible due to error, poor planning, breakage, mishandling, contamination, or other factors shall be employed.
1. With regard to these goals the Contractor shall develop, for the Architect's review, a Waste Management Plan (WMP) for this Project.
 - a. Final Waste Management Plan shall be submitted for LEED certification.
 - b. Include both demolition and construction waste management.
 2. Each Subcontractor shall be responsible for segregating their own waste into different dumpsters as directed by the Contractor.
 3. Source Separation, Definition: Source separated construction or demolition waste materials that are sorted into separate bins on the project site (aka on-site).
 - a. This waste strategy often isolates waste materials targeted for reuse, donation, or recycling programs.
 - b. Typically, sorted materials on-site include metals, wood, ceiling tiles, furniture, and concrete.
- B. Contractor shall be responsible for ensuring that debris will be disposed of at appropriately designated licensed solid waste disposal facilities, as defined by local authorities having jurisdiction.
- C. Hazardous Wastes: Any unforeseen hazardous wastes shall be separated, stored, and disposed of according to local regulations and as directed by the Owner. Hazardous wastes shall not be included in diversion calculations.

1.4 SUBMITTALS

- A. Construction and Demolition Waste Management Plan (WMP): Submit within 21 calendar days after receipt of Notice to Proceed, in a format acceptable to the Owner and in compliance with USGBC requirements. Demolition shall not begin until WMP has been approved.
1. Establish waste diversion goals for the project by **identifying at least seven materials** (both structural and nonstructural) targeted for diversion. Approximate a percentage of the overall project waste that each material represents.
 2. Construction and Demolition Handling Facilities:
 - a. Indicate the name(s) of the facilities where construction and demolition waste will be delivered and the applicable tipping fees.
 - b. Furnish Contractor's statement of verification that facilities proposed for use are licensed for types of waste to be delivered and have sufficient capacity to receive waste from this project.
 - c. Landfill Options: The name of the landfills where the non-recyclable Construction and Demolition waste will be taken to be disposed of, applicable tipping fees and the projected cost of disposing of the Project waste in landfills.

- d. Off-Site Sorting: The name of off-site sorting facilities to receive commingled demolition and construction debris collected in mixed materials containers on site.
 - 1) If sorted off-site identify the sorting facilities and how the materials will be processed
 - e. Alternative daily cover (ADC) does not qualify as material diverted from disposal. Land-clearing debris is not considered construction, demolition, or renovation waste that can contribute to waste diversion.
3. Material Handling Procedures, at Construction and Demolition Handling Facilities:
- a. Indicate annual recycling rates and material streams, as defined by local authorities having jurisdiction.
 - b. Specify which materials shall be source separated or commingled and describe the diversion strategies planned for the project. Describe where the materials will be taken and how the recycling facilities will process the materials.
4. Landfill Certification: Provide a statement of verification that the landfills proposed for use are licensed for types of waste to be deposited and have sufficient capacity to receive the estimated waste from this project
5. Co-Mingled Materials: Co-mingled waste may be considered only one material stream unless the facility can provide project specific diversion rates for specific materials. Provide one or both of the following for co-mingled materials collected in mixed containers on site and sorted off-site:
- a. For Each Container: A detailed breakdown of the weight of each material after sorting, including materials diverted to landfills
 - b. For Each Sorting Facility: A detailed annual average recycling rate for EACH facility where off-site sorting takes place.
 - 1) Additionally, provide documentation that the facility is State regulated.
6. Alternatives to Landfilling: A list of each material proposed to be salvaged or recycled during the course of the Project. Include the following and any additional items proposed:
- a. Cardboard and paper products.
 - b. Clean dimensional wood. If means of diversion is Wood Derived Fuel (WDF) refer to submittal requirements below.
 - c. Beverage containers and employee food containers.
 - d. Concrete.
 - e. Slurry wall materials.
 - f. Bricks and masonry.
 - g. Asphalt.
 - h. Metals from framing, banding, stud trim, ductwork, piping, rebar, roofing, other trim, steel, iron, galvanized sheet steel, stainless steel, aluminum, copper, zinc, lead, brass, and bronze.
 - i. Mechanical and electrical equipment.
 - j. Building components which can be removed relatively intact from existing construction.
 - k. Packaging materials, including cardboard, boxes, plastic sheet and film, polystyrene packaging, wood crates, and plastic pails.
 - l. Glass.
 - m. Scraps from new gypsum wall board (drywall).
 - n. Carpet and pad.
 - o. Acoustical ceiling panels.
 - p. Plastics, including plastic pails, polyethylene sheet, and bubble wrap.

- q. Rigid foam.
- 7. Meetings: A description of the regular meetings to be held to address waste management.
- 8. Materials Handling Procedures, at Project Site: A description of the means by which any waste materials identified above will be protected from contamination, and a description of the means to be employed in recycling the above materials consistent with requirements for acceptance by designated facilities.
 - a. Indicate which material streams shall be source separated and which shall be commingled.
- 9. Transportation: A description of the means of transportation of the recyclable materials (whether materials will be site-separated and self-hauled to designated centers, or whether mixed materials will be collected by a waste hauler and removed from the site for offsite sorting) and destination of materials.
- B. Waste Management Progress Reports: Concurrent with each Application for Payment, submit a written Waste Management Progress Report in the same format as required for Final Report.
 - 1. Provide updated LEED v4 Construction and Demolition Waste Calculator with each progress report.
- C. Waste Management Final Report: Prior to Substantial Completion, submit a written Waste Management Final Report summarizing the types and quantities of materials recycled and disposed of under the Waste Management Plan. Include the name and location of disposal facilities. Quantity may be measured by either weight or volume; be consistent in calculations. Include the following:
 - 1. Material category, including source separated material streams.
 - 2. Generation point of waste.
 - 3. Total quantity of waste, by weight.
 - 4. Quantity of waste salvaged, both estimated and actual.
 - 5. Quantity of waste recycled, both estimated and actual.
 - 6. Total quantity of waste diverted (salvaged plus recycled).
 - 7. Total quantity of waste diverted (salvaged plus recycled) as a percentage of total waste.
- D. Other Submittals:
 - 1. Records of Donations: Indicate receipt and acceptance of salvageable waste donated to individuals and organizations. Indicate whether organization is tax exempt.
 - 2. Records of Sales: Indicate receipt and acceptance of salvageable waste sold to individuals and organizations. Indicate whether organization is tax exempt.
 - 3. Recycling and Processing Facility Records: Indicate receipt and acceptance of recyclable waste by recycling and processing facilities licensed to accept them. Include manifests, weight tickets, and/or receipts.
 - 4. Landfill and Incinerator Disposal Records: Indicate receipt and acceptance of waste by landfills and incinerator facilities licensed to accept them. Include manifests, weight tickets, and/or receipts.
 - 5. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that all refrigerant that was present was recovered and that recovery was performed according to EPA regulations. Include name and address of technician and date refrigerant was recovered.
 - 6. Specific LEED v4 Submittals:

- a. Provide completed LEED v4 Construction and Demolition Waste Calculator.
 - b. Provide final report detailing waste streams generated, including tipping slips, disposal rates, and diversion rates.
- E. Commingling Waste Vendor Submittals: Provide annual report from local or state government authority and summary attachment of diverted materials with the average annual recycling rate. Figures in the summary must be derived from the annual reports in concise clear language.
 1. Commingling waste shall be considered one material stream.
 2. Provide tipping invoices for commingled waste and the following:
 - a. Vendor's most recent annual report from local or state government authority.
 - b. Vendor's annual report summary attachment of diverted materials in tonnage, with the average annual recycling rate and percent ADC.
 3. If Wood Derived Fuel (WDF) was listed as a diverted material in the above, vendors shall furnish a letter from the biomass plant stating their DOE operating permit number and that WDF was received from vendor, for the same year as the annual report.

1.5 CONTRACTORS

- A. Contractor may subcontract work of this Section to a sub-contractor specializing in recycling and salvaging of construction waste.
- B. Gypsum Wallboard Recycling: New, paper-faced gypsum wallboard scrap (cuts from construction - not demolition waste) generated at project may be recycled by Cambridge Gypsum Recycling, Grafton, MA (508-868-9664).
- C. Acoustical Ceiling Panel Recycling: Demolition and construction waste pulpable mineral fiber ceiling panels may be recycled by Armstrong World Industries and US Gypsum. Contact Armstrong at 1-877-ARMSTRONG (1-877-276-7876) or www.armstrongceilings.com/recycling or contact USG at 1-800-USG-4YOU (1-800-874-4968 x2) or www.usgdesignstudio.com, to coordinate recycling efforts, apply for product approvals, and receive reclamation procedure requirements.
- D. Carpet Recycling: Demolition and construction waste carpet and carpet padding may be recycled by Carpet America Recovery Effort (CARE). Visit www.carpetrecovery.org to locate carpet reclaimers in local project area and reclamation procedure requirements.

PART 2 - PRODUCTS [Not Used]

PART 3 - EXECUTION

3.1 PLAN IMPLEMENTATION

- A. General: Implement Waste Management Plan as approved by the Architect. Provide containers, storage, signage, transportation, and other items as required to implement WMP for the entire duration of the Contract.
 1. Deliver waste directly to construction and demolition handling facilities. Do not deliver to transfer stations.

- B. Commingling Waste: Commingling waste at the job site may be allowed, provided that the following conditions are met:
 - 1. Comminglers shall be included in the Waste Management Plan (WMP).
 - 2. Additional comminglers must be pre-approved by the Architect via WMP addenda, prior to tipping on the job site.

3.2 WASTE MANAGEMENT PLAN IMPLEMENTATION

- A. Manager: The Contractor shall designate an on-site person responsible for instructing workers and overseeing and documenting results of the Waste Management Plan for the Project.
- B. Distribution: The Contractor shall distribute copies of the Waste Management Plan to the Job Site Foreman, each Subcontractor, the Owner and the Architect.
- C. Instruction: The Contractor shall provide on-site instruction of appropriate separation, handling, and recycling, salvage, reuse, and return methods to be used by all parties at the appropriate stages of the Project.
- D. Separation Facilities: The Contractor shall lay out and label a specific area to facilitate separation of materials for recycling, salvage, reuse, and return. Recycling and waste bin areas are to be kept neat and clean and clearly marked in order to avoid contamination of materials. Location shall be acceptable to the Architect.
 - 1. Commingling: Waste commingling shall be approved prior to jobsite tipping, per requirements of this Section.

END OF SECTION

SECTION 017700
CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. The Work of this Section includes, but is not limited to, requirements for the following procedures:
 - 1. Final cleaning
 - 2. Temporary and trial usage
 - 3. Warranties and bonds
 - 4. Closeout requirements
 - 5. Inspection and Submittals for Substantial Completion
 - 6. Monetized Punch List Inspections
 - 7. Final Inspection and Submittals
 - 8. Final application and certificate for payment
 - 9. Post-construction inspection
- B. Related Work includes, but is not limited to, the following Work under other Sections:
 - 1. Dates for Substantial Completion and Final Completion: Section 002100 – INSTRUCTIONS TO BIDDERS.
 - 2. Procedures related to Architect's additional services if required to complete closeout of Project: Section 011400 – WORK RESTRICTIONS
 - 3. Construction schedule requirements: Section 013200 – CONSTRUCTION PROGRESS DOCUMENTATION.
 - 4. Temporary facilities to be removed at the end of the Project: Section 015000 – TEMPORARY FACILITIES AND CONTROLS.
 - 5. Documents to be submitted as part of Closeout Requirements: Section 017839 – PROJECT RECORD DOCUMENTS
 - 6. Verification of performance of mechanical and electrical systems: Section 018100 – COMMISSIONING.

1.3 SUBMITTALS

- A. Warranties and Bonds: As specified herein.
- B. Punch Lists: As specified herein.

- C. Submittals for Substantial Completion: As specified herein.
- D. Final Submittals: As specified herein.

PART 2 - PRODUCTS

2.1 Cleaning materials

- A. Refer to Section 011400 WORK RESTRICTIONS for cleaning materials.

PART 3 - EXECUTION

3.1 FINAL CLEANING

- A. Before final inspection, thoroughly clean the entire exterior and interior areas of the building where construction work has been performed, the immediate surrounding areas, and corridors, stairs, halls, storage areas, temporary offices, and toilets.
 - 1. Allow adequate time in Construction Schedule to perform thorough final cleaning of entire Project.
- B. Refer to Section 011400 WORK RESTRICTIONS for general requirements for cleaning and for cleaning products, and refer to individual specification sections for cleaning requirements for particular products.
- C. Employ experienced workmen or professional cleaners for final cleaning operations.
- D. Remove all construction facilities, debris, and rubbish from the Owner's property and legally dispose of same beyond site limits.
- E. Broom clean exterior paved surfaces, and rake clean other surfaces of the grounds.
- F. Sweep, dust, wash, and polish all finished surfaces. This includes cleaning of the Work of all finished trades where needed, whether or not cleaning for such trades is included in their respective Sections.
- G. Remove grease, mastic, adhesives, dust, dirt, stains, fingerprints, labels, and other foreign materials from exposed interior and exterior surfaces.
- H. Leave pipe and duct spaces, chases, and furred spaces thoroughly clean.
- I. Wash and polish all new glass on both sides, such Work shall be performed by a contractor specializing in a window cleaning work.
- J. Clean all ceilings, wall surfaces, floors, window and door frames, hardware, metal work, glass, glazing, enameled metals, and the like.
- K. Repair, patch and touchup marred surfaces to specified finish, to match adjacent surfaces.

- L. Each Subcontractor for mechanical and electrical work, including Plumbing, HVAC, Fire Protection, and Electrical Work shall clean materials and equipment for which they are responsible, leaving the Work in a finished and clean state.
- M. For each mechanical unit that has been in operation during construction, Contractor shall clean permanent filters and replace disposable filters with new filters as specified for that mechanical unit, and shall also clean ducts, blowers and coils associated with that unit.
- N. Prior to final completion, Contractor shall conduct an inspection of sight-exposed interior and exterior surfaces and all work areas, to verify that the entire Work is clean.
- O. Owner will assume responsibility for cleaning as of time designated on Certificate of Substantial Completion for Owner's acceptance of Work or portion thereof.

3.2 TEMPORARY AND TRIAL USAGE

- A. Temporary or trial usage by Owner of any mechanical device, machinery, apparatus, equipment, or any Work or materials supplied under the Contract before final completion and written acceptance by the Architect shall not be construed as evidence of acceptance as same.
- B. The Owner reserves the privilege of such temporary or trial usage for such reasonable time as required to properly test such item. Claims for damages due to injury to or breaking of any parts of such Work, when the determined cause is weakness or inaccuracy of structural parts, defective material or workmanship, will not be allowed.
- C. If the Owner so requests, place an approved person or persons to instruct and assist in such trial usage and bear the costs therefore. Trials shall be made under the Architect's supervision.

3.3 WARRANTIES AND BONDS

- A. Compile specified warranties and bonds, review to verify compliance with Contract Documents, and submit to Architect for review and subsequent transmittal, if approved, to the Owner.
- B. Assemble two original signed copies of warranties, bonds and service and maintenance contracts executed by Officers of each of the respective manufacturers, suppliers and subcontractors.
- C. Neatly type Table of Contents in orderly sequence. Provide complete information for each item:
 - 1. Product or work item identification.
 - 2. Manufacturing or supplying firm, with name of principal, address and telephone number.
 - 3. Scope of work and of warranty provided.
 - 4. Date of beginning of warranty, bond or service and maintenance contract. Commence upon date of Substantial Completion.
 - 5. Duration of warranty, bond or service maintenance contract. (In no case less than one (1) year).
 - 6. Information for Owner's personnel:
 - a. Proper procedure in case of failure.
 - b. Instances which might affect validity of warranty or bond.

7. Contractor, name of responsible principal, address and telephone number.
- D. Form of Submittals: Prepare in duplicate packets and in the following format:
1. Size: 8-1/2" x 11". Punch sheets for 3-ring binder. Z-Fold larger sheets to fit into binders.
 2. Cover: Identify each packet with types or printed title "WARRANTIES AND BONDS". List Title of Project, Date and Name of Contractor.
 3. Binders: Commercial quality, three-"D"-ring, with durable and cleanable plastic covers.
- E. Time of Submittals:
1. For equipment or component parts of equipment put into service during progress of construction, submit documents within ten (10) days after inspection and acceptance. Otherwise, make submittals before Date of Substantial Completion.
 2. For items of Work where acceptance is delayed materially beyond the Date of Substantial Completion, provide updated submittal within ten days after acceptance, listing the date of acceptance as the start of the warranty period.
- F. Submittals Required: Submit warranties, bond, service and maintenance contracts as specified in the respective Sections of the Specifications.

3.4 CLOSEOUT REQUIREMENTS

- A. Punch List: When the Contractor submits a complete list of items to be completed or corrected in accordance with subparagraph 9.8.2 of the GENERAL CONDITIONS and the Architect receives the list, the Architect will make an inspection to determine whether the Work or designated portion is substantially complete. The Contractor shall submit a schedule indicating when each item will be completed.
- B. If the Architect determines that the Contractor's list is not complete, the Architect will notify the Contractor. The Contractor shall provide a complete list before the Architect will complete his inspection.
- C. If the Architect's inspection discloses any item whether or not included on the Contractor's list, which is not in accordance with the requirements of the Contract Documents, the Architect will add the item to the list and will issue a punch list of items to be completed or corrected before final payment will be made. Such punch list shall not be construed as all-inclusive of the work which the Contractor will be required to perform before final payment.
- D. Substantial Completion: Architect will prepare and issue a Certificate of Substantial Completion, AIA G704, complete with signatures of Owner and Contractor, accompanied by list of items to be completed or corrected, as verified and amended by the Architect. Architect will not issue certificates of Substantial Completion until the items listed below in Articles 3.05 and 3.06 have been completed and submitted.

3.5 INSPECTION for substantial completion

- A. In preparation for Substantial Completion, the Contractor shall submit written certification that:
1. Contract Documents have been reviewed.

2. Work has been inspected for compliance with Contract Documents.
 3. Work has been completed in accordance with Contract Documents.
 4. Equipment and systems have been tested in presence of Owner's Representative and are operational.
 5. Work is completed, and ready for inspection.
- B. Architect will begin inspection within seven (7) days after receipt of above referenced Contractor's Certification.
- C. Should the Architect consider the Work is substantially complete in accordance with requirements of Contract Documents, the Architect will request Contractor to make Project Closeout submittals.
- D. Should the Architect consider that the Work is not substantially complete:
1. The Architect will notify Contractor, in writing, stating reasons.
 2. Contractor shall take immediate steps to remedy the stated deficiencies, and send second written notice to the Architect certifying that the Work is complete.

3.6 SUBMITTALS FOR SUBSTANTIAL COMPLETION

- A. Contractor shall submit the following items at Substantial Completion:
1. Operating and Maintenance Data.
 2. Schedule for training and instruction on new mechanical and electrical systems.
 3. Guarantees and Warranties.
 4. Keys and keying schedule.
 5. Spare Parts and Maintenance Materials.
 6. Roofing Guarantee and Flashing Endorsement.
 7. Evidence of Compliance with requirements of governing authorities.
 8. Punch list with schedule.
 9. Final Record Documents
- B. Evidence of compliance with authorities' requirements shall include:
1. Certificates of compliance for flame and smoke, and fire rating.
 2. Certificates of Inspection:
 - a. Mechanical
 - b. Electrical
 3. Certificate of Occupancy
- C. Submit Certificate of Insurance for products and completed operations.
- D. Instructions: Instruct Owner's personnel in the operation of all systems, mechanical, electrical and other equipment.

3.7 monetized punchlist inspections

- A. Within 30 days of Substantial Completion, the Architect will produce a Monetized Punch List that assigns a monetary value to each item remaining incomplete or incorrect.
- B. The Contractor may request two inspections by the Architect after receipt of the Monetized Punch List, for the purpose of documenting progress toward completion of items on the List.
 - 1. If the Architect is required to inspect the Work more than twice prior to establishment of Final Completion, the Contractor shall be responsible to the Owner for costs for Additional Services of the Architect to perform additional inspections, until the Work is considered Finally Complete.
 - 2. Refer to Section 011400 WORK RESTRICTIONS, for procedures required in cases where Contractor is responsible for costs for Additional Services of the Architect.

3.8 FINAL INSPECTION

- A. The Contractor shall complete or correct all remaining items on the Monetized Punch List in accordance with the time limits stated in the General Conditions.
- B. Certification of Final Completion: When the Contractor considers that all of the items on the Monetized Punch List have been completed or corrected, the Contractor shall submit written certification that the items on the Monetized Punch List have been completed and corrected. This certification shall include a copy of the Monetized Punch List with the following information added:
 - 1. Indicate beside each item the date when the item was completed or corrected and,
 - 2. In the case of items completed by subcontractors or sub-subcontractors, the name of the Subcontractor or Sub-subcontractor.
- C. The Architect will begin inspection within seven (7) days after receipt of such certification, to determine whether items on the Punch List have been completed.
 - 1. Should the Architect determine that the Work is not complete after receipt of the certification of Final Completion, the Contractor shall be responsible to the Owner for costs for Additional Services of the Architect to perform additional inspections, until all items on the Punch List are completed.
 - 2. Refer to Section 011400 WORK RESTRICTIONS, for procedures required in cases where Contractor is responsible for costs for Additional Services of the Architect.

3.9 FINAL SUBMITTALS

- A. Contractor's Affidavit of Payment of Debts and Claims, AIA G706.
- B. Contractor's Affidavit of Release of Liens, AIA G706A, with:
 - 1. Consent of Surety to Final Payment: AIA G707.
 - 2. Contractor's release or waiver of liens.
 - 3. Separate releases or waivers of liens for subcontractors, suppliers and others with lien rights against property of Owner, together with list of those parties.

- C. All submittals shall be duly executed before delivery to the Architect.

3.10 FINAL APPLICATION AND CERTIFICATE FOR PAYMENT

- A. Contractor shall submit final application for payment in accordance with requirements of the GENERAL CONDITIONS.
- B. Architect will issue final certificate in accordance with provisions of Conditions of the Contract.
- C. Prior to issuance of the Certificate for Final Payment by the Architect, all requirements contained in this Paragraph entitled "Closeout Requirements" and other requirements of the Conditions of the Contract shall be executed, received and approved by the Architect.

3.11 POST-CONSTRUCTION INSPECTION

- A. Prior to expiration of one year from Date of Substantial Completion, the Owner's Project Manager will make visual inspection of Work in company with Owner and Contractor to determine whether correction of Work is required, in accordance with provisions of GENERAL CONDITIONS.
- B. For guarantees beyond one year, the Owner's Project Manager will make inspection at request of Owner after notification to Contractor.
- C. Owner's Project Manager will promptly notify Contractor in writing of any observed deficiencies.

END OF SECTION

SECTION 017839

PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. The Work of this Section includes, but is not limited to, requirements for the following procedures:
 - 1. Record prints
 - 2. Final record drawings
 - 3. Operations and maintenance submittals and instructions.
- B. Related work includes, but is not limited to, the following work under other Sections:
 - 1. Availability and restriction for use of project electronic files: Section 011400 Work Restrictions.
 - 2. Availability of electronic files for preparation of record documents: Section 011400 Work Restrictions.
 - 3. Surveying and field engineering: Section 013100 Project Management and Coordination.
 - 4. Photographic documentation of construction: Section 013200 Construction Progress Documentation.
 - 5. General requirements for submittals: Section 013300 Submittal Procedures.
 - 6. Other submittals required at the completion of the Work: Section 017700 Closeout Procedures.
 - 7. Documentation required for commissioning: Section 018100 Commissioning.

1.3 DEFINITIONS

- A. Record Prints are full sets of black-line or blue-line prints of Contract Drawings, kept at the Project Site and marked regularly to record as-built conditions as specified herein.
- B. Final Record Drawings: Reproducible drawings or electronic files prepared from completed and approved Record Prints.
- C. Final Record Coordination Drawings: Reproducible drawings or electronic files prepared from updated prints of approved coordination drawings, to record as-built conditions.

1.4 SUBMITTALS

- A. Record Prints: Periodic submittal of prints of Drawings marked to indicate Work completed and changes in the Work, as specified in this Section:

PROJECT RECORD DOCUMENTS

1. Record Prints
 2. Coordination Drawing Record Prints
- B. Final Record Drawings: Reproducible drawings, as specified in this Section:
1. Final Record Drawings
 2. Final Record Coordination Drawings
- C. Operations and Maintenance Submittals:
1. Maintenance Manuals
 2. Schedule of Training and Instruction for mechanical and electrical systems.

PART 2 - PRODUCTS

2.1 RECORD DOCUMENTS, GENERAL

- A. The General Contractor shall maintain Record Prints of site plans, landscape drawings, architectural drawings, and structural drawings.
- B. Filed Sub-Contractors shall maintain Record Prints of the Work of the following Sections:
1. Section 210000 - Fire Protection.
 2. Section 220000 – Plumbing.
 3. Section 230000 – Heating, Ventilating, and Air Conditioning.
 4. Section 260000 – Electrical Work.

2.2 RECORD PRINTS

- A. During the progress of the Work, the General Contractor shall keep on file at all times two (2) complete and separate sets of black line prints of the entire set of Contract Drawings. Each set shall be updated daily to record the following information:
1. Status of Work: One set shall be used to indicate the progress of the Work installed by coloring in the various pipelines, ducts, and apparatus as erected.
 2. Revisions: The second set shall be accurately and promptly updated with colored inks, daily as the Work progresses, to accurately record all revisions to the Work, including, but not limited to, the following:
 - a. Fire Protection, Plumbing, Heating and Ventilating, and Electrical Work, wherever Work was installed other than as shown on the Contract Drawings or described in the Specifications
 - b. Locations, elevations, sizes, etc. of all concealed and buried utilities, ducts, and services, including exterior utility and storm drainage lines.
 - c. The General Contractor shall be responsible for assuring that the various revisions are delineated by the specific trades involved.
 3. Both sets shall be kept available at all times for use and inspection by the Architect and the Owner.

- B. Refer to Section 011400 Work Restrictions for Project Electronic Files to be made available for use by the Contractor in the preparation of Final Record Drawings.
- C. Transfer all information from the updated Record Prints to the electronic files at least once every three months.
 - 1. Submit three prints of each updated drawing to the Architect at least three times during construction: when the work is approximately 1/4, 1/2, and 3/4 complete.
 - 2. When roughing in for any particular area is completed, it shall be shown on the Record Prints and a copy submitted for Architect's review.

2.3 FINAL RECORD DRAWINGS

- A. Before completion of the Work, and when directed by the Architect, the General Contractor and all indicated subcontractors shall perform the following:
 - 1. Transcribe all previously recorded information from Record Prints onto the electronic files.
 - 2. Make all final changes and corrections to the electronic files for the Final Record Drawings.
 - 3. Signatures Required: The General Contractor or Filed Sub-Contractor shall sign each drawing for which they are responsible, as certification that the work was installed as shown.
 - 4. Deliver signed, completed Final Record Drawings to Architect.
- B. Acceptance by the Architect of the completed Final Record Drawings shall be a prerequisite for Substantial Completion.
- C. Shop Drawings will not be acceptable as Final Record Drawings for the Project.
- D. The Architect shall be the sole judge of the acceptability of Final Record Drawings.
- E. Special Requirements for Final Record Drawings of Site Work:
 - 1. Record Drawings for exterior utilities and other items below grade shall include accurate locations of the following:
 - a. The points where such items enter the building and property lines.
 - b. All turns, offsets, and other changes in direction below grade.
 - c. All valves and other appurtenances.
 - 2. Indicate locations of these items using dimensions to adjacent permanent benchmarks or structures as approved by the Architect. Reliance on scale only to locate any temporary or concealed construction will not be acceptable.
 - 3. Final Record Drawings for work below grade shall be submitted immediately upon completion of utility line installation and prior to concealment of the work
 - 4. Refer to Division 2 Sections for additional requirements for Final Record Drawings of site work.

2.4 RECORD COORDINATION DRAWINGS

- A. Record progress of the Work and modifications and corrections on a set of prints of approved coordination drawings. Follow procedures as for Record Prints.

- B. Final Record Coordination Drawings shall be prepared using information from approved record copies of coordination drawings as for Final Record Drawings.

2.5 MAINTENANCE MANUALS

- A. Upon Substantial Completion of the Work, submit maintenance schedules, maintenance manuals, and all approved Shop Drawings, presenting full details for care and maintenance of visible surfaces and all equipment furnished and installed under the Contract.
- B. Maintenance manuals shall consist of manufacturer's catalog cuts with descriptive information, lubricating and maintenance instructions, parts lists, usage instructions, names, addresses and telephone numbers where replacement parts and service can be quickly obtained, and all other information required for the Owner to use, maintain, and service the items properly.
- C. Upon Architect's approval of drafts, submit two (2) corrected copies properly bound in a logical and well arranged order, with index, to the Architect for transmittal to the Owner.

PART 3 - EXECUTION

3.1 TRAINING AND INSTRUCTIONS

- A. The Contractor shall arrange for instruction for the Owner's employees, to insure proper operation of the equipment furnished.
 - 1. It is the intent of this paragraph to require the Contractor and the applicable Subcontractors to furnish as much detailed instruction as is necessary to educate the Owner's on-site personnel in the proper use of the equipment.
 - 2. This instruction shall be provided by a qualified trainer who is also a manufacturer's certified technician with expertise with the specific system or equipment for which training is required. In some cases, this may require more than one visit to the Project by those responsible for the instruction.
 - 3. The Contractor and, in particular, the Plumbing, Heating and Ventilating, and Electrical Subcontractors shall not assume that the Owner's employees possess special expertise or have had any previous experience whatsoever in the operation and maintenance of sophisticated mechanical and electrical equipment.
 - 4. Submit the schedule for instructional sessions to the Owner. Do not proceed with instruction until Owner has approved schedule.
 - 5. Refer to specific technical sections for additional requirements specific to particular equipment and systems.
- B. For major items of mechanical and electrical equipment, instructions and demonstrations shall be performed during the initial start-up period and, if necessary, during one or more return visits as may be required.
- C. Videotape: Instruction sessions and demonstrations shall be video-recorded by professional videographers in DVD format, using tripods, broadcast-quality video cameras and proper lighting. Close-ups of items being demonstrated shall be included. Sound recording shall be clear and perfectly intelligible. Video shall be edited as required to provide a permanent reference. Each session and demonstration shall be included, except where waived by the Architect, and all DVDs shall be properly labeled as to date, subject, and presenter. Provide two (2) copies of each DVD.

END OF SECTION

SECTION 018110

SUSTAINABLE DESIGN REQUIREMENTS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Section includes general requirements and procedures for compliance with certain prerequisites and credits needed for Project to obtain **USGBC "LEED Version 4 for Building Design and Construction" (LEED v4 BD+C) certification.**

- 1. Specific requirements for LEED are also included in other Sections.
- 2. Some LEED prerequisites and credits needed to obtain LEED certification depend on product selections and may not be specifically identified as LEED requirements. Compliance with requirements needed to obtain LEED prerequisites and credits may be used as one criterion to evaluate substitution requests and comparable product requests.
- 3. A copy of the LEED Project checklist, with certification level target, is attached at the end of this Section for information only.
 - a. Some LEED prerequisites and credits needed to obtain the indicated LEED certification depend on aspects of Project that are not part of the Work of the Contract.
- 4. A copy of the LEED Product Data Submittals Form is attached at the end of this Section.
- 5. Definitions included in the "LEED Version 4 for Building Design and Construction" (LEED v4 BD+C) Reference Guide and online amendments apply to this Section.

- B. Related Work: The following items are not included in this Section and are specified under the designated Sections:

- 1. Section 011000 - SUMMARY for general submittal procedures; for temporary heating and cooling requirements; construction photography; and for operations and maintenance data.
- 2. Section 017400 - CONSTRUCTION WASTE MANAGEMENT.
- 3. Section 018120 - CONSTRUCTION INDOOR AIR QUALITY (IAQ) MANAGEMENT.
- 4. Section 019100 - GENERAL COMMISSIONING REQUIREMENTS.
- 5. Divisions 01 through 49 Sections for LEED requirements specific to the work of each of these Sections. Requirements may or may not include reference to LEED.

1.3 DEFINITIONS

- A. Bio-Based Materials: Materials that meet the Sustainable Agriculture Network's Sustainable Agriculture Standard. Bio-based raw materials shall be tested using ASTM D 6866 and be legally harvested, as defined by the exporting and receiving country.

- B. CDPH Standard Method v1.2: California Department of Public Health (CDPH) Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers, v. 1.2–2017, for the emissions testing and requirements of products and materials.
- C. Chain-of-Custody (COC): A procedure that tracks a product from the point of harvest or extraction to its end use, including all successive stage of processing, transformation, manufacturing, a distribution.
- D. Chain-of-Custody Certificates: Certificates signed by manufacturers and fabricators certifying that wood used to make products was obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001.
- E. Composite Wood and Agrifiber: Products made of wood particles and/or plant material pressed and bonded with adhesive or resin such as particleboard, medium density fiberboard (MDF), plywood, wheatboard, strawboard, panel substrates, and door cores.
- F. Corporate Sustainability Report: A third-party verified report that outlines the environmental impacts of extraction operations and activities associated with the manufacturer's product and the product's supply chain.
- G. Environmental Product Declaration (EPD): An independently verified report based on life-cycle assessment studies that have been conducted according to a set of common rules for each product category and peer-reviewed.
 - 1. Product-Specific Declaration: A product with a publicly available, critically reviewed life-cycle assessment conforming to ISO 14044 that has at least a cradle to gate scope.
 - 2. Industry-Wide (Generic) EPD: Provide products with third-party certification (Type III), including external verification, in which the manufacturer is explicitly recognized as a participant by the program operator. EPD must conform to ISO 14025, 14040, 14044, and EN 15804 or ISO 21930 and have at least a cradle to gate scope.
 - 3. Product-Specific Type III EPD: A product with a third-party certification, including external verification, in which the manufacturer is explicitly recognized by the program operator. EPD must conform to ISO 14025, 14040, 14044, and EN 15804 or ISO 21930 and have at least a cradle to gate scope.
- H. Extended Producer Responsibility (EPR): Measures undertaken by the maker of a product to accept its own and sometimes other manufacturers' products as postconsumer waste at the end of the products' useful life.
- I. Health Product Declaration Open Standard (HPD): A standard format for reporting product content and associated health information for building products and materials.
- J. Indoor Air Quality (IAQ) Management Plan: Plan developed by the Contractor to provide a healthy indoor environment for workers and building occupants during construction. Plan must meet or exceed the recommendations of the Sheet Metal and Air Conditioning Contractors National Association (SMACNA) "IAQ Guidelines for Occupied Buildings Under Construction."
- K. Leadership Extraction Practices: Products that meet at least one of the responsible extraction criteria, which include: extended producer responsibility; bio-based materials; FSC wood products; materials reuse; recycled content; and other USGBC approved programs.

- L. **Material Cost:** The dollar value of materials being provided to the site, after Contractor mark-ups, including transportation costs, taxes, fees, and shop labor, but excluding field equipment and field labor costs.
- M. **Materials Reuse:** Reuse includes salvaged, refurbished, or reused products.
- N. **Multi-Attribute Optimization:** Third party certified products that demonstrate impact reduction below industry average in at least three of the following six categories: global warming potential; stratospheric ozone depletion; acidification; eutrophication; tropospheric ozone creation; nonrenewable resource depletion.
- O. **Passive (As Related to MEP):** Not part of the active portions of the Mechanical, Electrical, and Plumbing systems, for example piping, pipe insulation, ducts, duct insulation, conduit, plumbing fixtures, faucets, showerheads, and lamp housings.
- P. **Recycled Content:** Recycled content is the sum of postconsumer recycled content plus one-half the preconsumer recycled content, based on cost.
 - 1. "Postconsumer" material is defined as waste material generated by households or by commercial, industrial, and institutional facilities in their role as end users of the product, which can no longer be used for its intended purpose.
 - 2. "Preconsumer" material is defined as material diverted from the waste stream during the manufacturing process. Excluded is reutilization of materials, such as rework, regrind, or scrap, generated in a process and capable of being reclaimed within the same process that generated it.
- Q. **Regional Materials:** Materials that are extracted, harvested, recovered, and manufactured within a radius of 100 miles from the Project site.
- R. **Volatile Organic Compounds (VOC) Emissions Test:** Refer to CDPH Standard Method definition.

1.4 ADMINISTRATIVE REQUIREMENTS

- A. Work of this project includes completed building and application for LEED certification. Work is not complete until Owner has accepted USGBC's final review of LEED certification.
 - 1. Provide documentation required by LEED and LEED review.
- B. Provide materials and procedures necessary to obtain LEED prerequisites and credits required in this Section. Other Sections may specify requirements that contribute to LEED prerequisites and credits. Refer to other sections for additional materials and procedures necessary to obtain LEED prerequisites and credits.
- C. Respond to questions and requests for additional information from Architect and the USGBC regarding LEED credits until the USGBC has made its determination on the project's LEED certification application.
- D. **LEED Online Submittals:** Upload LEED documentation submittal data directly to USGBC project "LEED Online" website. Complete online forms at least bi-weekly and as necessary to document LEED credits for submittals required in this Section.

- E. LEED Conference: Schedule and conduct a conference at a time convenient to Owner and Architect within 21 days prior to commencement of the work. Advise Architect, Owner's Commissioning Authority, and Owner's Project Manager of scheduled meeting dates.
1. Attendees: Authorized representatives of Owner, Owner's Commissioning Authority, Owner's Project Manager, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. Participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
 2. Agenda: LEED goals for the project, Contractor's action plans, and discussion of targeted LEED Prerequisites and Credits.
 3. Minutes: Record and distribute minutes to attendees and other entities with responsibilities for obtaining LEED Credits.

1.5 ACTION SUBMITTALS

- A. General: Submit additional LEED submittals required by other Specification Sections.
1. Submit each LEED submittal simultaneously with applicable product submittal.
- B. LEED Documentation Submittals:
1. General, LEED v4 Product Data Submittal Reporting Form: Project submittals must be accompanied by a completed LEED v4 Product Data Submittal Reporting Form, which follows this Section. Submittal packages must also include highlighted documentation supporting the sustainability claims made on the LEED v4 Product Data Submittal Reporting Form.
 - a. Provide location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material.
 2. Heat Island Reduction: Product data for roof and non-roof hardscape products indicating compliance with solar reflectance index (SRI) and solar reflectance (SR) requirements.
 3. Optimize Energy Performance: Product data for appliances and equipment that are the responsibility of the contractor. Eligible appliances and equipment must be Energy Star rated. Include rated power in submittal documentation.
 4. Building-Level Energy Metering: Product data for meters, sensors, and data collection system used to provide continuous metering of building energy-consumption performance.
 5. Advanced Energy Metering: Meter Product cut sheets that include the following information: recording interval, ability to record consumption and demand, data transmission capability, data collection system description, storage capacity, and remote data retrieval capability.
 6. Construction and Demolition Waste Management: Comply with submittal requirements of Section 017400 - CONSTRUCTION WASTE MANAGEMENT.
 7. Building Product Disclosure and Optimization: Environmental Product Declarations complying with LEED requirements.
 8. Building Product Disclosure and Optimization, Sourcing of Raw Materials: Option 1, Raw Material Source and Extraction Reporting.
 - a. Corporate sustainability reports for products that comply with LEED requirements for raw material and source extraction reporting.

9. Building Product Disclosure and Optimization, Sourcing of Raw Materials: Option 2, Leadership Extraction Practices.
 - a. Extended Producer Responsibility: Product data and certification letter from product manufacturers, indicating participation in an extended producer responsibility program and statement of costs.
 - b. Bio-Based Materials: Product data and certification for bio-based materials, indicating that they comply with requirements. Include statement of costs.
 - c. Certified Wood: Product data and chain-of-custody certificates for products containing certified wood. Include statement indicating cost for each certified wood product.
 - d. Materials Reuse: Receipts for salvaged and refurbished materials used for Project, indicating sources and costs.
 - e. Recycled Content: Product data and certification letter from product manufacturers, indicating percentages by weight of postconsumer and preconsumer recycled content for products having recycled content. Include statement of costs.
10. Building Product Disclosure and Optimization, Material Ingredients: Option 1, Material Ingredient Reporting.
 - a. Material ingredient reports for products that comply with LEED requirements for material ingredient reporting, including but not limited to the following:
 - 1) Manufacturer Inventory.
 - 2) Health Product Declaration.
 - 3) Cradle to Cradle certifications.
 - 4) Declare product labels.
 - 5) UL Product Lens certifications.
 - 6) ANSI/BIFMA e3 Furniture Sustainability Standard.
11. Building Product Disclosure and Optimization, Material Ingredients: Option 2, Material Ingredient Optimization.
 - a. Documentation for products that comply with LEED requirements for material ingredient optimization, including but not limited to the following:
 - 1) GreenScreen Benchmarks.
 - 2) Cradle to Cradle certifications.
 - 3) REACH optimizations.
12. Indoor Air Quality: Comply with submittal requirements of Section 018120 - CONSTRUCTION INDOOR AIR QUALITY (IAQ) MANAGEMENT.
13. Low-Emitting Materials: Product data, indicating VOC content and emissions testing documents showing compliance with requirements for low-emitting materials, for the following materials:
 - a. Paints and coatings.
 - b. Adhesives and sealants.
 - c. Flooring.
 - d. Products containing composite wood or agrifiber products or wood glues.
 - e. Ceiling products.
 - f. Thermal and acoustic insulation.
 - a. Exterior applied materials.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For LEED coordinator.
- B. Project Materials Cost Data: Provide statement indicating total cost and shop labor for materials used for Project. Costs exclude site labor, overhead, and profit. Include breakout of costs for the following categories of items:
 - 1. Wood construction materials.
 - 2. Furniture.
 - 3. Passive plumbing materials.
 - 4. Passive mechanical (HVAC) materials.
 - 5. Passive electrical materials.
 - 6. Earthwork and exterior improvements, hard costs.
- C. LEED Action Plan Components: Provide preliminary submittals within 21 days of date established for commencement of the Work indicating how the following requirements will be met:
 - 1. Waste management plan, complying with Section 017400 - CONSTRUCTION WASTE MANAGEMENT.
 - 2. Indoor air quality plan, complying with Section 018120 - CONSTRUCTION INDOOR AIR QUALITY (IAQ) MANAGEMENT.
- D. LEED Progress Reports: Concurrent with each Application for Payment, submit reports comparing actual construction and purchasing activities with LEED action plans for the following:
 - 1. Waste reduction progress reports complying with Section 017400 - CONSTRUCTION WASTE MANAGEMENT.
 - 2. Building Product Disclosure and Optimization, Environmental Product Declarations (EPD).
 - 3. Building Product Disclosure and Optimization, Sourcing of Raw Materials.
 - a. General: Manufacturing locations.
 - b. Option 1: Corporate sustainability reports.
 - c. Option 2:
 - 1) Extended producer responsibility.
 - 2) Bio-based materials.
 - 3) Certified wood products.
 - 4) Materials reuse.
 - 5) Recycled content.
 - 4. Building Product Disclosure and Optimization, Material Ingredients.
 - 5. Low Emitting Materials.
 - a. Low Emitting Materials Tracking Sheet monitoring the project's progress towards targeted LEED Indoor Environmental Quality Credits. Tracking Sheet to be presented at construction meetings.
 - 6. Indoor air quality, during construction, complying with Section 018120 - CONSTRUCTION INDOOR AIR QUALITY (IAQ) MANAGEMENT.

7. Indoor air quality assessment, complying with Section 018120 - CONSTRUCTION INDOOR AIR QUALITY (IAQ) MANAGEMENT.

1.7 QUALITY ASSURANCE

- A. LEED Coordinator: Engage an experienced LEED-Accredited Professional to coordinate LEED requirements. LEED coordinator may also serve as waste management coordinator.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

- A. Provide products and procedures necessary to obtain LEED credits required in this Section. Although other Sections may specify some requirements that contribute to LEED credits, the Contractor shall determine additional materials and procedures necessary to obtain LEED credits indicated. Contractor to determine a combination of credit options best suited for achieving credits required.
 1. Exclusions: Special equipment, such as elevators, escalators, process equipment, and fire suppression systems, is excluded from the credit calculations. Also excluded are products purchased for temporary use on the project, like formwork for concrete.
- B. Unauthorized Products: Materials and products required for work of this section shall not contain asbestos, lead, mercury, polychlorinated biphenyls (PCBs), or other hazardous materials identified by the Owner.

2.2 BUILDING PRODUCT DISCLOSURE AND OPTIMIZATION

- A. Building Product Disclosure and Optimization, Environmental Product Declarations (EPD): Option 1. Provide at least 20 permanently installed products (sourced from at least 5 different manufacturers) which meet one of the disclosure criteria:
 1. Product-Specific Declaration: Valued as one quarter (1/4) of a product.
 2. Industry-Wide (Generic) EPD: Valued as one half (1/2) of a product.
 3. Product-Specific Type III EPD: Valued as one whole product.
- B. Building Product Disclosure and Optimization, Environmental Product Declarations (EPD): Option 1. Provide at least 10 permanently installed products (sourced from at least 5 different manufacturers) which meet one of the disclosure criteria:
 1. ISO 14044 Conforming LCA: Valued as one whole product.
 2. Industry-Wide Type III EPD: Valued as one whole product.
 3. Product-Specific Type III EPD (Internally Reviewed): Valued as one whole product.
 4. Product-Specific Type III EPD (Externally Reviewed and Verified): Valued as 1-1/2 products.
- C. Building Product Disclosure and Optimization, Sourcing of Raw Materials: Option 1, Raw Material Source and Extraction Reporting. Provide at least 20 permanently installed products (sourced from at least 5 different manufacturers) which meet one of the disclosure criteria:
 1. Corporate sustainability reports.
- D. Building Product Disclosure and Optimization, Sourcing of Raw Materials: Option 2, Leadership Extraction Practices. Provide products that meet at least one of the responsible extraction

criteria below for at least 25%, by cost, of the total value of permanently installed building products in the project:

E. **Building Product Disclosure and Optimization, Sourcing of Raw Materials: Option 2, Leadership Extraction Practices.** Provide products that meet at least one of the responsible extraction criteria below for at least 15%, by cost, of the total value of permanently installed building products in the project:

1. Extended producer responsibility program.
2. Bio-based materials.
3. Certified Wood: Wood-based materials include, but are not limited to, the following materials when made from wood, engineered wood products, or wood-based panel products:
 - a. Rough carpentry.
 - b. Miscellaneous carpentry.
 - c. Heavy timber construction.
 - d. Wood decking.
 - e. Metal-plate-connected wood trusses.
 - f. Structural glued-laminated timber.
 - g. Finish carpentry.
 - h. Architectural woodwork.
 - i. Wood paneling.
 - j. Wood veneer wall covering.
 - k. Wood flooring.
 - l. Wood lockers.
 - m. Wood cabinets.
 - n. Furniture.
4. Materials Reuse: The following materials may be salvaged, refurbished, or reused materials:
 - a. As directed by Architect.
5. Recycled content.
 - a. Exceptions: Do not include fire protection, operational plumbing, operational mechanical, and operational electrical components, and specialty items, such as elevators and equipment, in the calculation.

F. **Building Product Disclosure and Optimization, Material Ingredients: Option 1, Material Ingredient Reporting.**

1. Use at least 20 different permanently installed products from at least five different manufacturers that use any of the following programs to demonstrate the chemical inventory of the product to at least 0.1% (1000 ppm), which meet one of the following disclosure criteria:
2. **Use at least 10 different permanently installed products from at least three different manufacturers that use any of the following programs to demonstrate the chemical inventory of the product to at least 0.1% (1000 ppm), which meet one of the following disclosure criteria:**
 - a. **Manufacturer Inventory.**

- b. Health Product Declarations (HPDs).
- c. Cradle to Cradle (C2C) certifications.
- d. Declare product labels.
- e. UL Product Lens certifications.
- f. ANSI/BIFMA e3 Furniture Sustainability Standard.

G. Building Product Disclosure and Optimization, Material Ingredients: Option 2, Material Ingredient Optimization.

1. Use products that document their material ingredient optimization using the paths below for at least 25%, by cost, of the total value of permanently installed products in the project, which meet one of the following disclosure criteria:
 - a. GreenScreen benchmarks.
 - b. Cradle to Cradle certifications.
 - c. REACH optimizations.

2.3 LOW-EMITTING MATERIALS

A. Low-Emitting Materials, General Emissions Requirements: Products must demonstrate they have been tested and determined compliant in accordance with California Department of Public Health, (CDHP), Standard Method v1.2-2017, using the applicable exposure scenario. Manufacturer's documentation demonstrating compliance must state the range of total VOCs (tVOC) after 14 days measured as specified in the CDPH Standard Method v1.2 as follows:

1. 0.5mg/m³ or less,
2. between 0.5 and 5.0 mg/m³ or,
3. 0.50 mg/m³ or more.

B. Low-Emitting Materials, Paints and Coatings: For field applications that are inside the weatherproofing system, use paints and coatings that comply with the limits for VOC content when calculated according to the California Air Resources Board (CARB) 2007, Suggested Control Measure (SCM) for Architectural Coatings, or the South Coast Air Quality Management District (SCAQMD) Rule 1113, effective June 3, 2011.

Product Type:	Allowable VOC Content (g/L):
Bond Breaker	350
Clear wood finishes - Varnish	275
Clear wood finishes – Sanding Sealer	275
Clear wood finishes - Lacquer	275
Colorant – Architectural Coatings, excluding IM coatings	50
Colorant – Solvent Based IM	600
Colorant - Waterborne IM	50
Concrete – Curing compounds	100
Concrete – Curing compounds for roadways & bridges	350
Concrete surface retarder	50
Driveway Sealer	50
Dry-fog coatings	50
Faux finishing coatings - Clear topcoat	100
Faux finishing coatings – Decorative Coatings	350
Faux finishing coatings - Glazes	350

Faux finishing coatings - Japan	350
Faux finishing coatings – Trowel applied coatings	50
Fire-proof coatings	150
Flats	50
Floor coatings	50
Form release compounds	100
Graphic arts (sign) coatings	150
Industrial maintenance coatings	100
Industrial maintenance coatings – High temperature IM coatings	420
Industrial maintenance coatings – Non-sacrificial anti-graffiti coatings	100
Industrial maintenance coatings – Zinc rich IM primers	100
Magnesite cement coatings	450
Mastic coatings	100
Metallic pigmented coatings	150
Multi-color coatings	250
Non-flat coatings	50
Pre-treatment wash primers	420
Primers, sealers and undercoaters	100
Reactive penetrating sealers	350
Recycled coatings	250
Roof coatings	50
Roof coatings, aluminum	100
Roof primers, bituminous	350
Rust preventative coatings	100
Stone consolidant	450
Sacrificial anti-graffiti coatings	50
Shellac- Clear	730
Shellac – Pigmented	550
Specialty primers	100
Stains	100
Stains, interior	250
Swimming pool coatings – repair	340
Swimming pool coatings – other	340
Traffic Coatings	100
Waterproofing sealers	100
Waterproofing concrete/masonry sealers	100
Wood preservatives	350
Low solids coatings	120

- C. Low-Emitting Materials, Paints and Coatings: For field applications that are inside the weatherproofing system, paints and coatings shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- D. Low-Emitting Materials, Adhesives and Sealants: For field applications that are inside the weatherproofing system, use adhesives and sealants that comply with the limits for VOC content when calculated according to South Coast Air Quality Management District (SCAQMD) Rule #1168, requirements in effect on July 1, 2005, and rule amendment date January 7, 2005:

Architectural Applications:	Allowable VOC Content (g/L):
Indoor carpet adhesives	50
Carpet pad adhesives	50
Outdoor carpet adhesives	150
Wood flooring adhesives	100
Rubber floor adhesives	60
Subfloor adhesives	50
Ceramic tile adhesives	65
VCT and asphalt tile adhesives	50
Dry wall and panel adhesives	50
Cove base adhesives	50
Multipurpose construction adhesives	70
Structural glazing adhesives	100
Single ply roof membrane adhesives	250
Specialty Applications:	
PVC welding	510
CPVC welding	490
ABS welding	325
Plastic cement welding	250
Adhesive primer for plastic	550
Computer diskette manufacturing	350
Contact adhesive	80
Special purpose contact adhesive	250
Tire retread	100
Adhesive primer for traffic marking tape	150
Structural wood member adhesive	140
Sheet applied rubber lining operations specialty	850
Top and Trim adhesive	250
Substrate Specific Applications:	
Metal to metal substrate specific adhesives	30
Plastic foam substrate specific adhesives	50
Porous material (except wood) substrate specific adhesives	50
Wood substrate specific adhesives	30
Fiberglass substrate specific adhesives	80
Sealants:	
Architectural sealant	250
Marine deck sealant	760
Nonmember roof sealant	300
Roadway sealant	250
Single-ply roof membrane sealant	450
Other sealant	420
Sealant Primers:	
Architectural non-porous sealant primer	250
Architectural porous sealant primer	775
Modified bituminous sealant primer	500
Marine deck sealant primer	760
Other sealant primer	750
Other	

Other adhesives, adhesive bonding primers, adhesive primers or any other primers	250
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1. Exception: The provisions of SCAQMD Rule 1168 do not apply to adhesives and sealants subject to state or federal consumer product VOC regulations.
- E. Low-Emitting Materials, Adhesives and Sealants: For field applications that are inside the weatherproofing system, adhesives and sealants shall comply with the 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."
- F. Low-Emitting Materials, Flooring: Flooring shall comply with the 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."
- G. EQc2, Low-Emitting Materials, Flooring, General Emissions Requirement: 90 percent of flooring measured by cost or surface area, shall be tested according to California Department of Public Health (CDPH) Standard Test Method v1.2-2017, using the applicable exposure scenario.
 1. To comply with the General Emissions Requirement, products may comply with one of the following:
 - a. FloorScore Certified (resilient, hard surface, textile flooring, and flooring adhesives).
 - b. UL Greenguard Gold Certified.
 - c. CRI Green Label Plus certified (carpet, adhesive, and cushion).
 - d. SCS Indoor Advantage Gold Certified.
 - e. NSF/ANSI 332 certified (resilient flooring).
- H. Low-Emitting Materials, Composite Wood: Composite wood, agrifiber products, and adhesives shall be made using ultra-low-emitting formaldehyde (ULEF) resins as defined in the California Air Resources Board's "Airborne Toxic Control Measure to Reduce Formaldehyde Emissions from Composite Wood Products" or shall be made with no added formaldehyde (NAF).
- I. Low-Emitting Materials, Ceilings, Walls, Thermal, and Acoustic Insulation: Ceilings, walls, and thermal insulation shall comply with the 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."
 1. To comply with the General Emissions Requirement, products may comply with one of the following:
 - a. UL Greenguard Gold Certified.
 - b. SCS Indoor Advantage Gold Certified.
 - c. MAS Certified Green.
- J. Low-Emitting Materials, Exterior Applied Materials: Exterior applied materials, measured by volume, shall comply with the 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."
 1. The following materials are prohibited and do not count toward total percentage compliance:

- a. Hot-mopped asphalt for roofing.
 - b. Coal tar sealants for parking lots and other paved surfaces.
 - K. Low-Emitting Materials, Furniture: Furniture, measured by cost, shall be tested in accordance with ANSI/BIFMA Standard Method M7.1-2011; comply with ANSI/BIFMA e3-2011 Furniture Sustainability Standard, Sections 7.6.1 and 7.6.2, using either the concentration modeling approach or the emissions factor approach; and model the test results using the open plan, private office, or seating scenario in ANSI/BIFMA M7.1, as appropriate.
 - L. Additional Low-Emitting Requirements:
 - 1. If the applicable regulation requires subtraction of exempt compounds, any content of intentionally added exempt compounds larger than 1% weight by mass (total exempt compounds) must be disclosed.
 - 2. If a product cannot reasonably be tested as specified above, testing of VOC content must comply with ASTM D2369-10; ISO 11890, part 1; ASTM D6886-03; or ISO 11890-2.
 - 3. Methylene chloride and perchloroethylene may not be intentionally added in paints, coatings, adhesives, or sealants.
- 2.4 INDOOR WATER USE REDUCTION
- A. Indoor Water Use Reduction:
 - 1. Building Water Use: Provide WaterSense labeled products for plumbing fixtures located within Tenant spaces. Do not exceed water flow requirements indicated in Division 22 - PLUMBING.
 - 2. Appliance and Process Water Use: Provide US EPA ENERGY STAR or performance equivalent appliances. Comply with other LEED requirements for process water use, indicated in Division 22 - PLUMBING and Division 23 - HEATING, VENTILATING, AND AIR CONDITIONING.
 - B. Indoor Water Use Reduction, Plumbing Fixtures: Do not exceed water flow requirements indicated in Division 22 - PLUMBING.
 - 1. Provide US EPA WaterSense labeled plumbing fixtures, where applicable.

PART 3 - EXECUTION

3.1 NONSMOKING BUILDING

- A. Environmental Tobacco Smoke Control: Smoking is not permitted within the building or within 25 feet of entrances, operable windows, or outdoor-air intakes.
 - 1. Refer to Section 018120 - CONSTRUCTION INDOOR AIR QUALITY (IAQ) MANAGEMENT.

3.2 CONSTRUCTION WASTE MANAGEMENT

- A. Construction and Demolition Waste Management: Comply with Section 017400 - CONSTRUCTION WASTE MANAGEMENT.

3.3 CONSTRUCTION INDOOR-AIR-QUALITY MANAGEMENT

- A. Construction Indoor Air Quality Management Plan: Comply with Section 018120 - CONSTRUCTION INDOOR AIR QUALITY (IAQ) MANAGEMENT.

END OF SECTION

SECTION 018120

CONSTRUCTION INDOOR AIR QUALITY (IAQ) MANAGEMENT

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. This Section includes requirements for the Contractor's implementation of indoor air quality management controls and systems for the duration of the Work.
- B. Sustainable Design Intent: Refer to Section 018110 - SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.
 - 1. Environmental Tobacco Smoke Control: Prevent exposure of building systems to environmental tobacco smoke during construction.
 - 2. Construction Indoor Air Quality Management Plan: Requirements for minimum indoor air quality (IAQ) performance standards during the construction period.
 - 3. Indoor Air Quality Assessment: Requirements for assessment of minimum indoor air quality (IAQ) performance standards through either building flush-out or air testing before occupancy
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 011000 - GENERAL REQUIREMENTS for photographic documentation requirements, submittal requirements, temporary construction facilities, protection, and controls.
 - 2. Section 017420 - CONSTRUCTION WASTE MANAGEMENT for demolition and construction waste management.
 - 3. Division 23 - HVAC for coordination with HVAC requirements.
 - 4. Divisions 02 through 49 Specification Section for specific requirements relating to indoor air quality.

1.3 PERFORMANCE REQUIREMENTS

- A. Environmental Tobacco Smoke Control: At a minimum, take the following measures:
 - 1. **Comply with Owner's Non-Smoking Campus Policy.**
 - 2. Do not allow smoking in enclosed portions of the project site, on the rooftop, or in construction trailers.
 - a. **This prohibition includes tobacco smoke, as well as smoke produced from the combustion of cannabis and controlled substances and the emissions produced by electronic smoking devices.**

CONSTRUCTION INDOOR AIR QUALITY (IAQ) MANAGEMENT

3. Locate exterior designated smoking areas at least 25 feet away from entries, outdoor air intakes, and operable windows. Provide signage for designated smoking areas, located within 10 feet of each entry. Provide ash receptacles and clean areas daily.
- B. Construction Indoor Air Quality Management Plan: During construction, comply with the following requirements:
1. **Coordinate with Owner's current IAQ management plans and procedures.**
 2. Meet or exceed the minimum requirements of the recommended Control Measures of the Sheet Metal and Air Conditioning National Contractors Association (SMACNA) IAQ Guidelines for Occupied Buildings Under Construction, Second Edition, November 2007, Chapter 3.
 3. If permanently installed air handlers are used during construction, filtration media with a Minimum Efficiency Reporting Value (MERV) of 13 shall be used at each return air grille, as determined by ASHRAE 52.2-2007. Replace filtration media immediately prior to occupancy, according to Division 23 - HVAC.
- C. Indoor Air Quality Assessment: Comply with one of the following requirements:
1. **Option 1: Perform a building flush-out with outside air, either before occupancy or during occupancy.**
 2. **Option 2: Conduct IAQ testing for air contaminant levels in the building, after construction ends and before occupancy.**

1.4 SUBMITTALS

- A. Construction Indoor Air Quality Management Plan: Within 21 calendar days after receipt of Notice to Proceed, the Contractor shall submit Construction IAQ Management Plan.
1. Construction IAQ Management Plan: Include, but do not limit to, the following:
 - a. HVAC Protection.
 - b. Source Control.
 - c. Pathway Interruption.
 - d. Housekeeping.
 - e. Scheduling.
 2. Product Data: Submit for each type of filtration media used during construction and installed immediately prior to occupancy, with MERV values clearly identified.
- B. Indoor Air Quality Assessment:
1. **Option 1, Flushout: Signed statement describing the building air flush-out procedures, including the dates when flush-out was begun and completed and statement that filtration media was replaced after flush-out.**
 - a. **Product Data: Submit for filtration media used during flush-out and occupancy, with MERV values clearly identified.**
 2. **Option 2, IAQ Testing: Report from testing and inspecting agency indicating results of IAQ testing and documentation showing compliance with IAQ testing procedures and requirements, with testing laboratory name and date clearly identified.**

PART 2 - PRODUCTS

2.1 FILTRATION MEDIA

- A. Filtration Media: Comply with ASHRAE 52.2-2007 and provide MERV as required.

PART 3 - EXECUTION

3.1 CONSTRUCTION IAQ MANAGEMENT PLAN IMPLEMENTATION

- A. IAQ Manager: The Contractor shall designate an on-site person responsible for instructing workers and overseeing and documenting results of the Construction IAQ Management Plan for the Project.
 - 1. Distribution: The Contractor shall distribute copies of the Construction IAQ Management Plan to the Job Site Foreman, each subcontractor, the Owner, and the Architect.
 - 2. Instruction: The Contractor shall provide on-site instruction of appropriate procedures and methods to be used by all parties at the appropriate stages of the Project.
- B. Preconditioning: Allow products, which have odors and significant VOC emissions, to off-gas in a dry, well-ventilated space for sufficient period to dissipate odors and emissions prior to delivery to Project.
 - 1. Remove containers and packaging from materials prior to conditioning to maximize off-gassing of VOCs.
 - 2. Condition products in ventilated warehouse or other building.
- C. Ventilation: Ventilate interior spaces directly to the exterior to minimize accumulation of odors and VOC emissions during construction.
- D. Coordinate Construction IAQ Management Plan with construction cleaning and final cleaning as indicated in Section 011000 -GENERAL REQUIREMENTS.

3.2 INDOOR AIR QUALITY (IAQ) ASSESSMENT

- A. Indoor Air Quality Assessment: Option 1, Flush-Out:
 - 1. After construction ends, prior to occupancy and with all interior finishes installed, perform a building flush-out by supplying a total volume of 14,000 cu. ft. of outdoor air per sq. ft. of floor area while maintaining an internal temperature of at least 60 deg F and a relative humidity no higher than 60 percent.
 - a. Operating Requirements: Refer to Division 23 - HVAC.
 - 2. If occupancy is desired prior to flush-out completion, the space may be occupied following delivery of a minimum of 3500 cu. ft. of outdoor air per sq. ft. of floor area to the space. Once a space is occupied, it shall be ventilated at a minimum rate of 0.30 cfm per sq. ft. of outside air or the design minimum outside-air rate, whichever is greater. During each day of the flush-out period, ventilation shall begin a minimum of three hours prior to occupancy and continue during occupancy. These conditions shall be maintained until a total of 14,000 cu. ft./sq. ft. of outside air has been delivered to the space.

- a. Operating Requirements: Refer to Division 23 - HVAC.
- B. Indoor Air Quality Assessment: Option 2, Indoor Air Quality Testing: Engage testing agency to perform the following:
1. Conduct baseline IAQ testing, after construction ends and prior to occupancy, using testing protocols consistent with the EPA's "Compendium of Methods for the Determination of Air Pollutants in Indoor Air," and as additionally detailed in the USGBC's "LEED Reference Guide for Building Design and Construction."
 2. Demonstrate that contaminants do not exceed the concentrations listed below:
 - a. Formaldehyde: 27 ppb.
 - b. Particulates (PM10): 50 micrograms/cu. m.
 - c. Ozone: 0.075 ppm.
 - d. Total Volatile Organic Compounds (TVOCs): 500 micrograms/cu. m.
 - e. Carbon Monoxide (CO): 9 ppm and no greater than 2 ppm above outdoor levels.
 - f. Target Volatile Organic Compounds: California Department of Public Health (CDPH) Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers, v1.2–2017, Table 4-1.
 3. For each sampling point where the concentration exceeds the limit, take corrective action and retest for the noncompliant contaminants at the same sampling points. Repeat until all requirements are met.
 4. Air-sample testing shall be conducted as follows:
 - a. All measurements shall be conducted prior to occupancy but during normal occupied hours, and with building ventilation system starting at the normal daily start time and operated at the minimum outside-air flow rate for the occupied mode throughout the duration of the air testing.
 - b. Building shall have all interior finishes installed, including, but not limited to, millwork, doors, paint, carpet, and acoustic tiles. Nonfixed furnishings, such as workstations and partitions, are encouraged, but not required, to be in place for the testing.
 - c. Number of sampling locations varies depending on the size of building and number of ventilation systems. For each portion of building served by a separate ventilation system, the number of sampling points shall not be less than one per 5000 sq. ft.
 - 1) For large open spaces, one sampling point per 50,000 sq. ft. may be used.
 - d. Air samples shall be collected between 3 and 6 feet from the floor to represent the breathing zone of occupants, and over a minimum four-hour period.

END OF SECTION

SECTION 023000

SUBSURFACE INVESTIGATION

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS, which are hereby made a part of this Section of the Specifications.

1.2 SUBSURFACE INVESTIGATION

- A. Information Not Guaranteed: Information on the Drawings and in the Project Manual relating to subsurface conditions, natural phenomena, and existing utilities and structures is from the best sources presently available. Such information is furnished only for the information and convenience of the Contractor, and the accuracy or completeness of this information is not guaranteed.
- B. Foundation Engineering Report: Refer to the Geotechnical Report in the Appendices.

1.3 CONFIRMATION OF GRADES AND UTILITIES

- A. Prior to commencement of site excavating operations, the Contractor shall compare existing site grading and proposed new site grading. Where existing utilities are indicated but their inverts or depths are not, exploratory excavating shall be performed to assure that sufficient earth coverage will be attained during the course of new site grading.
 - 1. Utilities existing on the site shall be carefully protected from damage and relocated or removed as required by the work. When an active utility line is exposed during construction, its location and elevation shall be plotted on the record drawings and the Architect, Owner and the utility owner notified in writing.
- B. If exploratory excavating confirms that the depth of existing utilities will be negatively impacted by proposed new grades (i.e., will be too shallow or become exposed), immediately notify the Architect and the Owner. Do not proceed with work in such areas until instructions are issued by the Architect. Continue work in other areas.

1.4 CONFIRMATION OF INTEGRITY OF ADJACENT STRUCTURES

- A. Prior to commencement of site excavating operations, the Contractor shall compare foundation depths of existing structures and proposed depths of new utilities. Where existing structures are indicated but their foundation depths are not, exploratory excavating shall be performed to assure that proposed new excavations adjacent to them, or in near proximity of them, will not undermine the structural integrity of the existing structures.
- B. If exploratory excavating confirms that the footing depths of existing structures may be negatively impacted or undermined by proposed new excavations, immediately notify the

Architect and the Owner. Do not proceed with work in such areas until instructions are issued by the Architect. Continue work in other areas.

PART 2 - PRODUCTS [Not Used]

PART 3 - EXECUTION [Not Used]

END OF SECTION

SECTION 024100

DEMOLITION

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS, which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included:
1. Demolition and removal of selected portions of buildings and structures and as required for new work. Refer to the Drawings for additional requirements.
 2. Demolition and removal of selected site elements and as required for new work. Refer to the Drawings for additional requirements.
 3. Salvage of existing items to be reused or turned over to the facility.
 4. Removal and legal disposal of demolished materials off site. Except those items specifically designated to be relocated, reused, or turned over to the facility, all existing removed materials, items, trash and debris shall become property of the Contractor and shall be completely removed from the site and legally disposed of at their expense. Salvage value belongs to the Contractor. On-site sale of materials is not permitted.
 5. Maintenance, watering and care of trees designated to remain by a certified arborist during the construction period.
 6. Demolition and removal work shall properly prepare for alteration work and new construction to be provided under the Contract.
 7. Scheduling and sequencing operations without interruption to utilities serving occupied areas. If interruption is required, obtain written permission from the utility company and the Owner.
- B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council. Refer to Section 018110, SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
1. Section 011000 - GENERAL REQUIREMENTS for temporary facilities and controls, for maintenance of access, for cleaning during construction, and for dust and noise control.
 2. Section 017400 - CONSTRUCTION WASTE MANAGEMENT for waste management and recycling.
 3. Section 018120 - CONSTRUCTION INDOOR AIR QUALITY (IAQ) MANAGEMENT for indoor air quality control procedures.
 4. Section 017419 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL:

- a. Waste management and recycling.
- 5. Division 21 - FIRE PROTECTION:
 - a. Disconnecting, capping and otherwise making inactive existing fire protection services in areas where demolition and removal work is required.
 - b. Disconnect and reinstallation of fire protection equipment temporarily interrupted during construction.
- 6. Division 22 - PLUMBING:
 - a. Disconnecting, capping and otherwise making inactive existing plumbing services in areas where demolition and removal work is required.
 - b. Disconnection and reinstallation of plumbing equipment temporarily interrupted during construction.
- 7. Division 23 - HEATING, VENTILATING AND AIR CONDITIONING:
 - a. Disconnecting, capping and otherwise making inactive existing HVAC services in areas where demolition and removal work is required.
 - b. Disconnect and reinstallation of HVAC equipment temporarily interrupted during construction.
- 8. Division 26 - ELECTRICAL WORK:
 - a. Disconnecting, capping and otherwise making inactive existing electrical services in areas where demolition and removal work is required.
 - b. Disconnect and reinstallation of electrical equipment temporarily interrupted during construction.
- 9. Section 311000 – SITE CLEARING:
 - a. Excavating and removal of existing pavement, sub-surface building and utility structures and lines, appurtenances, and other elements indicated on the Drawings.

1.3 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 Salvage: Detach items from existing construction and deliver them to the Owner ready for reuse, at a location designated by the Owner. Protect from weather until accepted by Owner.
- C. Remove and Reinstall: Detach items from existing construction, prepare them for reuse, and reinstall them where indicated. Protect from weather until reinstallation.
- D. 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 MATERIALS OWNERSHIP

- A. Historic items, relics, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques, antiques, and other items of interest or value to Owner that may be encountered during selective demolition remain property of the Owner as applicable. Carefully remove each item or object in a manner to prevent damage and deliver promptly to a location acceptable to the Owner.

1.5 SUBMITTALS

- A. Schedule of Selective Demolition Activities: Indicate the following:
 - 1. Detailed sequence of selective demolition and removal work, with early and late starting and finishing dates for each activity. Ensure Owner's on-site operations are uninterrupted if applicable.
 - 2. Interruption of utility services. Indicate how long utility services will be interrupted.
 - 3. Coordination for shutoff, capping, and continuation of utility services.
 - 4. Use of elevator and stairs.
 - 5. Locations of proposed dust- and noise-control temporary partitions and means of egress, including for other occupants affected by selective demolition operations.
 - 6. Coordination of Owner's continuing occupancy of portions of existing building and of Owner's partial occupancy of completed Work.
 - 7. Means of protection for items to remain and items in path of waste removal from building.
- B. Inventory: After selective demolition is complete, submit a list of items that have been removed and salvaged, and turned over the Owner.
- C. Predemolition Video and Pictures: Show existing conditions of adjoining construction and site improvements, including finish surfaces, that might be misconstrued as damage caused by selective demolition operations. Comply with Division 01 requirements. Submit before Work begins.

1.6 QUALITY ASSURANCE

- A. Examination of Existing Conditions: The Contractor shall examine the Contract Drawings for demolition and removal requirements and provisions for new work. Verify all existing conditions and dimensions before commencing work. The Contractor shall visit the site and examine the existing conditions as he finds them and shall inform herself/himself of the character, extent and type of demolition and removal work to be performed. Submit any questions regarding the extent and character of the demolition and removal work in the manner and within the time period established for receipt of such questions during the bidding period.
- B. Demolition Firm Qualifications: An experienced firm that has specialized in demolition work similar in material and extent to that indicated for this Project.
- C. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.
- D. Standards: Comply with ANSI A10.6 and NFPA 241.

- E. Predemolition Conference: Conduct conference at Project site to comply with requirements in Section 011000 - GENERAL REQUIREMENTS, Project Meetings. Review methods and procedures related to selective demolition including, but not limited to, the following:
 - 1. Inspect and discuss condition of construction to be selectively demolished.
 - 2. Review structural load limitations of existing structure.
 - 3. Review and finalize selective demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.
 - 4. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.
 - 5. Review areas where existing construction is to remain and requires protection.

1.7 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.

PART 2 - PRODUCTS

2.1 SALVAGING

- A. Salvaged for Reinstallation: Materials indicated on the Drawings to be salvaged and reinstalled shall be carefully removed and stored at a location acceptable to the Architect and Owner.
- B. Salvaged for Storage: Materials indicated on the Drawings or designated in the field by the Owner to be salvaged and stored shall be carefully removed and delivered to the Owner at locations determined by Owner.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that utilities have been disconnected and capped.
- B. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.
- C. Inventory and record the condition of items to be removed and reinstalled and items to be removed and salvaged.
- D. 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.
- E. Engage a professional engineer registered in the state that the project is located to survey 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 demolition operations.

- F. Survey of Existing Conditions: Record existing conditions by use of 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.
- G. Perform surveys as the Work progresses to detect hazards resulting from selective demolition activities.

3.2 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

- A. Service/System Requirements: Locate, identify, disconnect, and seal or cap off indicated utility services and mechanical/electrical systems serving areas to be selectively demolished.
 - 1. Arrange to shut off indicated utilities with utility companies and Owner.
 - 2. If services/systems are required to be removed, relocated, or abandoned, before proceeding with selective demolition provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.
 - 3. Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit after bypassing. Where entire wall is to be removed, existing services/systems may be removed with removal of the wall.
 - 4. Prior to commencing cutting work in existing surfaces, take all precautionary measures to assure that mechanical and electrical services to the particular area have been made inactive. Coordinate with Fire Suppression, Plumbing, HVAC, and Electrical subcontractors. Only licensed tradesmen of that particular trade shall disconnect and cap existing mechanical and electrical items that are to be removed, abandoned and/or relocated.
 - 5. If, during the process of cutting work, existing utility lines are encountered which are not indicated on the Drawings, regardless of their condition, immediately report such items to the Architect. Do not proceed with work in such areas until instructions are issued by the Architect. Continue work in other areas.

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.
 - 1. Comply with requirements for access and protection specified in Section 011000 - GENERAL REQUIREMENTS, Temporary Facilities and Controls.
 - 2. Maintain adequate passage to and from all exits at all times. Before any work is done which significantly alters access or egress patterns, consult with the Architect and obtain approval of code required egress. Under no condition block or interfere with the free flow of people at legally required exits, or in any way alter the required condition of such exits.
- B. 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.

2. Remove temporary shoring, bracing and structural supports when no longer required.
3. Post warning signs and place barricades as applicable during placement and removal of temporary shoring.

C. Conduct demolition operations to prevent injury to people and damage to adjacent buildings and facilities to remain. Ensure safe passage of people around demolition area(s).

1. Erect temporary protection, such as walks, fences, railings, canopies, and covered passageways, where required by authorities having jurisdiction. Provide temporary barricades as required to limit access to demolition areas.
2. Protect existing site improvements, appurtenances, and landscaping to remain.

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. Maintain clear unimpeded passage through the work area for safety and emergency egress.
10. Saw cut overruns in concrete and masonry for new door, window and other finish openings is not permitted. Core drill corners and finish square to match required opening.
11. Dispose of demolished items and materials promptly.
 - a. Comply with requirements in Section 017400 - CONSTRUCTION WASTE MANAGEMENT.

B. Removed and Salvaged Items:

1. Clean salvaged items.

2. Pack or crate items after cleaning. Identify contents of containers.
3. Store items in a secure area until delivery to Owner.
4. Transport items to storage area designated by the Owner.
5. Protect items from damage during transport and storage.

C. Removed Items for Reinstallation by the Respective Trade.

1. Clean salvaged items.
2. Pack or crate items after cleaning. Identify contents of containers.
3. Store items in a secure area until delivery to Owner.
4. Transport items to storage area designated by the Owner.
5. Protect items from damage during transport and storage.

D. 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.

E. Items for Re-use and Preservation of Existing Surfaces to Remain:

1. The Contractor shall inspect closely each item specifically designated to be relocated, re-used, or turned over to the Owner prior to its removal, and immediately report damages and defects to the Architect and the Owner. The Contractor shall be responsible for any subsequent damage to the same other than latent defects not readily apparent from close inspection, and shall bear responsibility for its repair or same replacement as directed by the Architect, to the satisfaction of the Owner.
2. Unless special surface preparation is specified under other Specification Sections, leave existing surfaces that are to remain in a condition suitable to receive new materials and/or finishes.

3.5 PROTECTION OF PUBLIC AND PROPERTY

- A. Provide all measures required by federal, state and municipal laws, regulations, and ordinances for the protection of surrounding property, the public, workmen, and Owner's employees during all demolition and removal operations. Measures are to be taken, but not limited to installation of sidewalks, sheds, barricades, fences, warning lights and signs, trash chutes and temporary lighting.
- B. Protect all walks, roads, streets, curbs, pavements, trees and plantings, on and off premises, and bear all costs for correcting such damage as directed by the Architect, and to the satisfaction of the Owner.
- C. Demolition shall be performed in such a manner that will insure the safety of adjacent property. Protect adjacent property from damage and protect persons occupying adjacent property from injuries which might occur from falling debris or other cause and so as not to cause interference with the use of other portions of the building, of adjacent buildings or the free access and safe passage to and from the same.
- D. Every precaution shall be taken to protect against movement or settlement of the building, of adjacent buildings, sidewalks, roads, streets, curbs and pavements. Provide and place at the Contractor's own expense, all necessary bracing and shoring in connection with demolition and removal work.

- E. Remove portions of structures with care by using tools and methods that will not transfer heavy shocks to existing and adjacent building structures, both internal and external of the particular work area.
- F. Provide and maintain in proper condition, suitable fire resistive dust barriers around areas where interior demolition and removal work is in progress. Dust barriers shall prevent the dust migration to adjacent areas. Remove dust barriers upon completion of major demolition and removal in the particular work area.

3.6 DISCOVERY OF HAZARDOUS MATERIALS

- A. If hazardous materials, such as chemicals, asbestos-containing materials, or other hazardous materials are discovered during the course of the work, cease work in affected area only and immediately notify the Architect and the Owner of such discovery. Do not proceed with work in such areas until instructions are issued by the Architect. Continue work in other areas.
- B. If unmarked containers are discovered during the course of the work, cease work in the affected area only and immediately notify the Architect and the Owner of such discovery. Do not proceed with work in such areas until instructions are issued by the Architect. Take immediate precautions to prohibit endangering the containers integrity. Continue work in other areas.

3.7 CUTTING

- A. Perform all cutting of existing surfaces in a manner which will ensure a minimal difference between the cut area and new materials when patched. Use extreme care when cutting existing surfaces containing concealed utility lines which are indicated to remain and bear full responsibility for repairing or replacement of all such utilities that are accidentally damaged.
- B. Provide a flush saw cut edge where pavement, curb and concrete removals abut new construction work or existing surfaces to remain undisturbed.
- C. All slurry and water shall be contained and managed to avoid damage to existing conditions when using a wet saw or wet core driller.
- D. Obtain and pay for a hot work permit and arrange to have on-site a Fire Watch when using a cutting torch or similar item.

3.8 DISPOSAL OF DEMOLISHED MATERIALS

- A. General: Comply with requirements of Section 017400 - CONSTRUCTION WASTE MANAGEMENT and the following:
 - 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.

3.9 CLEANING

- A. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Premises shall be left in a clean condition and ready to accept alteration work and new construction.

END OF SECTION

SECTION 033000

CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.
- B. Examine all other Sections of the Specifications for requirements that affect work of this Section whether or not such work is specifically mentioned in this section.
- C. Coordinate work with that of all other trades affecting or affected by work of this Section. Coordinate with such trades to assure the steady progress of all work under the Contract.

1.2 DESCRIPTION OF WORK

- A. The work of this Section consists of all plain and reinforced concrete work as shown on the Drawings and as specified herein, and includes, but is not limited to the following:
 - 1. Furnishing, placing, curing, and finishing of all plain and reinforced concrete work for the building and site.
 - 2. Furnishing, erection and removal of formwork and shoring.
 - 3. Furnishing and placing of reinforcing steel and related accessories.
 - 4. Furnishing and installation of bentonite strip waterstops.
 - 5. Setting of anchor bolts and grouting of leveling plates and bearing plates.
 - 6. Grouting anchor rod oversize holes at column base plates.
 - 7. Furnishing and installation of mastic coating on embedded structural steel.
 - 8. Coordination with all other trades for location of all pipe sleeves, roof drains, floor drains, duct openings, keys, chases, electrical boxes and conduits, anchors, inserts, fastenings, and other devices required by other trades.
 - 9. Mockups of Architecturally Exposed Concrete.
 - 10. Coordination of floor slab finish requirements with flooring manufacturers and contractors.
 - 11. As-built surveys of concrete floor slab elevations.
 - 12. Leveling of concrete slabs with a self-leveling concrete underlayment, if required to meet the specified tolerances.
- B. Items To Be Furnished Only: Furnish the following items for installation by the designated Sections:
 - 1. Section 051200 STRUCTURAL STEEL FRAMING: Threaded reinforcing bar couplers to be shop welded to structural steel shapes and plates.

- C. Items to be installed only: Install the following items furnished by the designated Sections:

1. Section 051200 - STRUCTURAL STEEL FRAMING: Anchor bolts, embedded plates with bolts or anchors, as indicated on the Drawings.

1.3 RELATED WORK

- A. Related work shall be performed under the following Sections:

1. Section 033300 - ARCHITECTURAL CONCRETE.
2. Section 033650 - CONCRETE FINISHES.
3. Section 034500 - PRECAST ARCHITECTURAL CONCRETE.
4. Section 042000 - UNIT MASONRY.
5. Section 051200 - STRUCTURAL STEEL FRAMING.
6. Section 051226 - SHEAR CONNECTORS.
7. Section 052100 - STEEL JOIST FRAMING.
8. Section 053100 - STEEL DECKING.
9. Section 071100 - BITUMINOUS DAMPPROOFING.
10. Section 071400 - SELF-ADHERING SHEET WATERPROOFING.
11. Section 072100 - THERMAL INSULATION.
12. Section 072500 - AIR AND VAPOR BARRIERS.
13. Section 079200 - JOINT SEALANTS.
14. Section 312000 - EARTHWORK.

1.4 REFERENCES (LATEST EDITIONS)

- A. ASTM listed standards by the American Society for Testing and Materials.
- B. ACI listed standards by the American Concrete Institute.
- C. CRSI listed standards by the Concrete Reinforcing Steel Institute.
- D. In case of conflict between the References and the Project Specification, the Project Specification shall govern. In the case of conflict between References, the more stringent shall govern.
- E. When compliance with any such References is specified herein for materials or a manufactured or fabricated product, the Contractor, if requested, shall furnish an affidavit from the manufacturer or fabricator certifying that the materials or product delivered to the job meets the requirements specified. However, such certification shall not relieve the Contractor from the responsibility of complying with any added requirements specified herein.

1.5 SUBMITTALS

- A. LEED Submittal requirements: For each product specified, complete and submit the Materials Submittal Cover Sheet - See Section 018110 - SUSTAINABLE DESIGN REQUIREMENTS.

1. Show percentage of product that is post-consumer and/or post-industrial recycled content. Provide backup documentation as described in Section 018110.
 2. Show installed costs of all items listed.
- B. Submit complete Shop Drawings, Samples, and other Data in accordance with the provisions of Section 013300 - SUBMITTAL PROCEDURES.
1. Shop Drawings:
 - a. Construction joint layout: Submit drawings showing proposed construction joint locations for all walls, slabs on grade, slabs on metal deck, structural slabs, beams, and other concrete elements. Drawings shall be submitted prior to preparation of reinforcement drawings.
 - b. Control joint layout: Submit drawings showing proposed control joint layout locations for all slabs on grade. Control joints are not required in slabs on metal deck or structural slabs.
 - c. Reinforcement Drawings: Prepare in accordance with ACI 315, "Manual of Standard Practice for Detailing Reinforced Concrete Structures" and show the following: elevations; dimensions of concrete work with specified reinforcement clearances; ledges, brackets, openings, sleeves or other items furnished by other Sections, where interference with reinforcement may occur; bending diagrams; assembly diagrams; splices and laps of reinforcement; temperature and shrinkage reinforcement; construction joint locations and reinforcement; shapes, dimensions, grade designations and details of reinforcement and accessories. Show dowels with concrete work to be placed first. Indicate suitable marks for placing bars.
 - d. Formwork Drawings: Schedules of placement; beam and haunch detailing, expansion joint details, construction joints and contraction or control joints with methods of forming; general arrangement, sizes and grades of lumber, panel and tie layouts and alignment. Formwork drawings will be reviewed for general compliance with Contract Documents only. Dimensions, strength of formwork, shoring, bracing, and all related work are the sole responsibility of the Contractor. At exposed concrete areas, show layout of joint patterns and exposed cone recesses at wall ties.
 - e. Except as otherwise noted, approval of Shop Drawings will be for size and arrangement of components. Errors in dimensions shown on Shop Drawings shall be responsibility of Contractor.
 - f. Check and coordinate cast-in-place concrete work with work of other trades before submitting Shop Drawings.
 - g. Submit plans for all levels with MEP/FP penetration sizes and locations for approval prior to submitting reinforcing shop drawings.

- h. Reproduction of structural plans, sections and details, and any like information by reprographic or electronic methods for use as Shop and Coordination Drawings is subject to the requirements of Section 011401 - ELECTRONIC RELEASE FORM and the following conditions:
 - (1) The entity producing the Shop and Coordination Drawings (The "User") agrees to accept the reproduced information from Foley Buhl Roberts & Associates, Inc. without any warranties, guarantees and/or representations of any nature whatsoever regarding the correctness, dimensional and/or quantitative accuracy and/or completeness of any such information contained therein.
 - (2) The User further agrees that such information shall be used as reference material only for the production of Shop and Coordination Drawings for the referenced project to which this Specification applies and only for that project.
 - (3) The User further agrees to release, indemnify, hold harmless and defend Foley Buhl Roberts & Associates, Inc. with respect to any claims, costs (including the cost of litigation), losses, damages and/or liabilities which arise from (or related to) the use, misuse, modification, interpretation, misinterpretation and/or misrepresentation of the reproduced information.
- 2. Concrete Constituents: Submit a detailed list of concrete materials and corresponding sources, proposed for use in concrete for this project. If conveying concrete by pump is requested by Contractor, related data regarding concrete materials, pumping devices and methods shall be submitted to Architect for approval three weeks before such method is proposed for use. Provide concrete mix data as specified in Paragraph 2.2B.
- 3. Methods of Construction: Prior to starting work, submit summary of methods, sequence of construction, and type of equipment proposed for use for performing cast-in-place concrete work. This submission shall not relieve Contractor of his responsibility for providing proper methods, equipment, workmanship, and safety precautions.
- 4. Samples: Submit samples and/or descriptive literature of materials, products, and methods as noted herein, and as otherwise requested by the Architect: concrete constituents including admixtures; form ties and spreaders; accessories for reinforcement; reglets; non-shrink cement grout; inserts; form release agents and waterstops.
- 5. Mill Test Certification: Prior to delivery of steel or concrete to job site, submit certified mill test reports of reinforcing steel and cement, (including names and locations of mills and shops and analyses of chemical and physical properties) properly correlated to concrete to be used in this project. Test reports for reinforcing to be welded shall show that the steel meets AWS weldability requirements.

6. Concrete Curing and Protection: Submit summary of methods proposed for curing and protection of concrete. When applicable, submittal shall include methods of cold weather protection following the requirements of ACI 306 – Cold Weather Concreting and/or hot weather protection following the requirements of ACI 305 – Hot Weather Concreting.
 7. Corrective Work: Submit drawings showing details of any proposed corrective work.
 8. Affidavit: Submit, upon request by Architect, manufacturer's and/or supplier's and/or installer's affidavit stating that material or product provided complies with Contract Documents.
- C. Provide concrete Mix Data as specified in Paragraph 2.2B.
- D. Provide manufacturer's data for other products.
- E. Fabrication of any material or performing of any work prior to the final approval of the Submittals will be entirely at the risk of the Contractor.
- F. The Contractor is responsible for furnishing and installing materials called for in Contract Documents, even though these materials may have been omitted from approved Submittals.
- 1.6 QUALITY ASSURANCE
- A. All materials, measuring, mixing, transportation, placing and curing shall be subject to inspection by the Architect or by the testing agency. However, such inspection, wherever conducted, shall not relieve the Contractor of his responsibility to furnish materials and workmanship in accordance with Contract requirements, nor shall inspector's acceptance of material or workmanship prevent later rejection of same by the Owner or Architect if defects are discovered.
- B. A qualified testing agency for testing and inspection will be selected by the Owner and will be paid directly by the Owner.
- C. Advise the testing agency of intent to place concrete by notification at least 24 hours prior to the time of placement. Make all necessary accommodations and provide access as required for the testing agency to conduct the testing and inspection work required by the Statement of Special Inspections.
- D. Concrete will be sampled and tested for quality control as follows:
1. ASTM C 172: Sampling fresh concrete.
 2. ASTM C 31: Making and curing concrete test specimens.
 3. ASTM C 143: Slump
 4. ASTM C 231: Air content
 5. ASTM C 39: Testing compressive strength.

6. ASTM C 618: Standard Specification for Fly Ash and Raw or Calcined Natural Pozzolan for Uses as a Mineral Admixture in Portland Cement Concrete.
 7. ASTM C 311: Standard Methods of Sampling and Testing Fly Ash and Natural Pozzolans for Use as a Mineral Admixture in Portland Cement Concrete.
- E. Water held back at the plant must be indicated on all delivery tickets. Water added at the site shall not exceed the amount held back at the plant. The testing agency shall monitor water added at the site to ensure that excess water is not added to the concrete.
- F. All reinforcing shall be inspected by the testing agency for grade, size, spacing, position, cleanliness, cover and support.
- G. Cooperate with the testing agency's work and provide help for taking and storing samples. Provide storage facilities for concrete cylinders at the site. Facilities must protect cylinders from affects of low or high temperatures in cold or hot weather, respectively.
- H. Compression tests shall consist of four - six inch diameter by 12 inch long cylinders (or six - four inch diameter by eight inch long cylinders) for each test made, cured and tested by the laboratory during the progress of the job. At least one test shall be made for each strength of concrete up to 50 cubic yards pour, and at least one test per strength for each 50 cubic yards thereafter, unless otherwise directed by the Architect. For each test made, one cylinder shall be tested at seven days test sample age and two - six inch diameter cylinders (three for four inch diameter cylinders) shall be tested at 28-day test sample age. One six inch diameter cylinder (or two - four inch diameter cylinders) for each test shall be kept in the event that a 56-day sample age test is required due to low 28-day results. Concrete for each set of cylinders shall be from one sample representative of the entire batch.
- I. In addition to the above, the Architect or the Contractor may direct additional control cylinders to be made, cured, and tested to verify strengths for removal of forms, shoring or adequacy for curing or cold weather protection. In such instances, the cylinders shall be cured in the same environment as the area which the cylinders represent. All such additional work requested by the Contractor shall be at his own expense.
- J. Evaluation of Compression Tests:
1. Architect has authority to order, for any strength of concrete, increase in cement content and mix redesign for remaining work of either:
 - a. Average seven-day strength of any two consecutive tests representing a particular design strength of a class of concrete is less than 55 percent of specified strength; OR
 - b. Average 28-day strength of any two consecutive tests representing particular design strength of a class of concrete is less than 90 percent of specified strength.
 2. The strength level of a class of concrete shall be considered satisfactory, if the following requirements are met:

- a. Averages of any three consecutive 28-day strength tests representing each class of concrete equal or exceed the specified strength (f'_c).
 - b. Not more than 10 percent of 28-day strength tests have values less than the specified strength (f'_c).
 - c. No individual 28-day test shows an average strength less than 90 percent of specified strength (f'_c).
3. When tests of control specimens fall below the strength level requirements, the Architect may require core specimens taken from concrete in question and tested in accordance with ASTM C 42. If these specimens do not meet the strength requirements, the Architect will have the right to require additional curing, load tests, strengthening or removal and replacement of those parts of the structure which are unacceptable, and in addition, removal of such sound portions of structure as necessary to ensure safety, appearance, and durability of the structure. Additional testing, load tests, strengthening or removal and replacement of parts of the structure and any costs associated with redesign or delay of the project shall be at the Contractor's expense.
- L. Upon completion of concrete testing for the project the testing agency will compile all results and perform a statistical strength analysis for each class of concrete in accordance with ACI 214.
- M. Accept as final, results of tests made by the qualified professional testing organization engaged by the Owner.
- N. Testing required because of changes requested by the Contractor in materials, sources of materials or mix proportions, and extra testing of concrete or materials because of failure to meet the Specification requirements is to be paid by the Contractor.
- O. A final report shall be issued by the testing agency following the completion of work in this Section stating that all deficiencies have been corrected.
- P. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1.
 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: (1) Architect, (2) Construction Manager, (3) Concrete Subcontractor, (4) Independent testing agency, (5) Ready-mix concrete manufacturer, (6) Under slab vapor mitigation/ventilation system subcontractor, (7) Mechanical Contractor and radiant heating system manufacturer's representative, (8) Waterproofing and dampproofing subcontractor and manufacturer's representative.
 2. Review items such as: special inspection, testing and inspection agency procedures for field quality control, concrete finishes and finishing, cold and hot weather concreting procedures, curing procedures, construction, contraction, construction, control and isolation joints, joint filler strips, semi-rigid joint fillers, forms and form removal limitations, vapor mitigation system installation, anchor rod and anchorage device installation tolerances, steel reinforcement installation, floor

and slab flatness and levelness measurements, floor elevation survey, concrete repair procedures, and concrete protection.

3. Before concrete slabs on grade are placed, and after approval of all flooring materials, a pre-flooring conference shall be held at the job site. In attendance shall be (1) Architect, (2) General Contractor, (3) Concrete Subcontractor, (4) Flooring Subcontractors, and (5) Flooring manufacturer's technical representatives. The parties shall review drawings, specifications and approved materials and coordinate surface, methods of curing, protection, moisture, and PH requirements of the concrete in preparation for the application of the finish flooring materials.

1.7 NOTIFICATION OF RELATED TRADES

- A. Notify all other trades responsible for installing chases, inserts, sleeves, anchors, louvers, and at similar locations when ready for such installation, and for final checking immediately before concrete is placed. Cooperate with such trades to obtain proper installation.
- B. Leave openings in walls for pipes, ducts, and similar penetrations for mechanical and electrical work, as shown on Drawings or required by layout of mechanical systems.

1.8 SUBSTITUTIONS

- A. Substitutions or any modifications of details proposed by Contractor will be considered by Architect only under the requirements of SECTION 013301 - SUBSTITUTION/OR EQUAL REQUEST FORM and the following conditions:
 1. That request has been made and accepted prior to submission of Shop Drawings.
 2. That there is a substantial cost advantage or time advantage to the Owner.
 3. That sufficient sketches, engineering calculations, and other data have been submitted to facilitate checking by the Architect, including cost reductions or savings in time to complete work.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Cement
 1. Portland Cement - ASTM C 150, Type I or II.
 2. Fly Ash - ASTM C 618 Class F.
 3. Ground Granulated Blast-Furnace Slag - ASTM C 989 - Grade 100 or 120.
 4. Blended Cements - ASTM C595, Types IP and IS
- B. Natural Aggregate
 1. Coarse Aggregate: Shall be hard, durable, uncoated crushed stone or gravel conforming to ASTM C 33. Typical coarse aggregate shall pass through a 3/4" sieve and meet the grading requirements of ASTM C 33 size number 67. Coarse aggregate for toppings less than three inch thick or areas with congested, closely

spaced rebar shall pass through a 3/8" sieve and meet the grading requirements of ASTM C 33 size number 8. Coarse aggregate for exposed concrete shall be specially selected for light color approved by the Architect and shall come from a single source. Stockpile sufficient quantities to assure continuous supply. Coarse aggregate shall meet the following additional requirements:

Fineness Modulus: (+/- 0.20) 6.70 and 5.5 respectively
Silt: 1.0 % maximum

2. Fine Aggregate: Shall be sand, clean, hard, durable, uncoated grains, free from silt, loam, and clay, to meet ASTM C 33. Fine aggregate for exposed concrete shall be specially selected for light color approved by the Architect and shall come from a single source. Stockpile adequate amounts of fine aggregate to assure continuous supply. Fine aggregate shall meet the following additional requirements:

<u>Sieve</u>	<u>Retained Percent</u>
#4	0-5
#16	25-40
#50	70-87
#100	93-97

Fineness Modulus: 2.8 (+/- 0.20)
Organic: Plate 2 maximum
Soundness: 5% - 10% maximum loss, magnesium sulfate, five cycles.

C. Water

1. Water shall be from the local municipal supply.

D. Admixtures

1. Water-reducing Agent shall conform to ASTM C 494, Type A. Water-reducing agent shall be compatible with air-entraining agent.
2. Superplasticizer shall conform to ASTM C494, Type F or Type G. Superplasticizer shall be compatible with the other admixtures.
3. Air-entraining agent shall conform to ASTM C 260.
4. Calcium Chloride or admixtures containing more than 0.1% Chloride ions are not permitted.
5. Additional admixtures will be considered by the Architect provided they are submitted in accordance with Paragraph 1.6D

E. Concrete Reinforcement

1. Reinforcing steel shall conform to ASTM A 615 deformed bars, Grade 60. Reinforcing to be welded shall conform to ASTM A 706 deformed bars, Grade 60.
2. Welded wire fabric shall conform to ASTM A 1065 in flat sheets.
3. Reinforcing supports, metal accessories and other devices necessary for proper

assembly of concrete reinforcing shall be of standardized factory-made wire bar supports. Reinforcing that bears on vapor barriers shall have continuous, integral bearing plates. Wire for tying shall be ASTM A 1064 / A 1064M, 18 gauge black annealed wire. All accessories shall conform to Product Standard PS7-766, National Bureau of Standards, Department of Commerce, Class C.

4. Steel reinforcing shall be manufactured using minimum 95% recycled materials.
5. Accessories touching formed surfaces exposed to view shall have not less than 1/4 inch of high density polyethylene between metal and concrete surface. Plastic tips shall extend not less than 1/2 inch up on metal legs.

F. Formwork

1. Forms for concrete surfaces not exposed to view, shall be made of wood, metal, or other material subject to approval of Architect.
2. Forms for exposed concrete surfaces exposed to view in finished work shall be new Class 1 B-B High Density Overlay plyform, exterior grade not less than 5 ply nor less than 5/8 inch thick, conforming to U.S. Product Standard P-1-66.
3. Form release agent shall be of a non-staining type, specifically manufactured for concrete forms.
4. Form ties shall be factory-fabricated, removable or snap back of approved design. Wire shall be at least 1-1/2 inch back from exterior surfaces and one inch from interior surfaces. Furnish with removable wooden or plastic cones of approved sizes where called for, with waterproof stop at exposed concrete surfaces.
5. Chamfer strips shall be one-half inch, 45 degree wood strips, or as detailed, nailed six inches on center, and installed at inside corners of all forms, unless otherwise directed by the Architect.
6. Reglets shall be formed from 24 gauge galvanized steel and shall be of type shown on Drawings or appropriate for use intended. Metal reglets shall be used merely as form to obtain desired profile. After concrete has set, remove reglets.

G. Bonding Agent:

1. Bonding agent for bonding new concrete to existing concrete at construction joints shall be Sikadur 32, Hi-Mod by Sika Corporation; Duralcrete by Euclid Chemical Co.; Deck-O-Weld by W.R. Meadows or equal approved by the Architect.

H. Self-Leveling Concrete Underlayment (Non-conforming work areas):

1. For areas to be covered by a finish or flooring:
Concrete underlayment used for floor leveling shall be "Sika Level-315" by Sika Corporation, "Ardex K-15" by Ardex, Inc., "ProSpec Level Set 300" by Bonsal American Inc., or an equal approved by the Architect.
2. For areas to remain exposed (excluding polished concrete areas):
Concrete underlayment used for floor leveling shall be "Sika Level-315" by Sika Corporation, "Ardex SD-T" by Ardex, Inc., "ProSpec Level Set Wear Topping" by Bonsal American Inc., or an equal approved by the Architect.
3. For feather finish areas use Ardex SD-F or equal approved by the Architect.
4. Aggregate shall be well-graded, washed fine gravel (1/8 inch to 1/4 inch or larger) for use when underlayment is installed to a thickness where aggregate is recommended by the manufacturer.

5. Gypsum based underlayment products are not allowed.

I. Other Materials:

1. Joint filler, where used with caulking or sealants, shall be cork type, non-extruding, self-expanding filler strips conforming to ASTM D 1752, Type III. Where no sealant or caulking is required, strips shall be closed cell flexible polyethylene type conforming to ASTM D 4819, Type II. Joint fillers for exterior paving shall be non-extruding bituminous type in accordance with ASTM D 1751 with removable top snap-caps to allow room for sealants. Joint filler manufacturers include W.R. Meadows, or an approved equal.
2. Flexible epoxy joint sealant for slab on grade control joints shall be "SIKADUR 51 SL" by Sika Corporation, "Rezi-Weld Flex" by W.R. Meadows, "Dural 340" by Euclid Chemical Company, "Joint Tite 750" by L&M Construction Chemicals or equal approved by the Architect. Sealant shall be applied at exposed slab on grade locations only, except at polished concrete areas.
3. Threaded Inserts: Richmond Screw Anchor Co. or equal structural concrete inserts of type shown on Drawings. Galvanize all components in accordance with ASTM A 153.
4. Curing cover sheets shall be "Hydracure" by PNA Construction Technologies, "Transguard 4000" by Reef Industries, "UltraCure DOT" by McTech Group or equal approved by the Architect.
5. Waterstops shall be bentonite strip type Waterstop - RX, manufactured by Cetco; Swellstop by Greenstreak Inc.; Rockmax Swelling 101 by Rockmax Co. Ltd., or an equal as approved by the Architect.
6. Non-Shrink Grout: Grout at column and beam bearing shall be "MasterFlow 100" by BASF, "SonogROUT 10K" by Sonneborn ChemRex, "Five Star Grout" by Five Star Products, Inc. or equal approved by the Architect.
7. Anchor Rod Base Plate Hole Grout: Grout in oversize anchor rod holes at brace column steel base plates shall be "MasterFlow 816" by Master Builders, "Five Star Fluid Grout PT" by Five Star Products, Inc., "Quikrete Cable Duct Grout" by Quikrete, or equal approved by the Architect.
8. Mastic coating of structural steel below the top of slab on grade elevation shall be a high-build coal tar epoxy mastic as manufactured by Carbolite, Inc., Sumter Coatings, Inc., Rust-Oleum, Inc., Krylon Industrial Coatings, Inc., or equal approved by the Architect.
9. Underslab built up voids shall be rigid cellular polystyrene geofoam blocks with a minimum compressive strength of 40 psi (value at yield or 10% compression); as manufactured by Universal Foam Products, ACH Foam Technologies, Atlas EPS, or approved equal.

2.2 CONCRETE MIXES

- A. Provide concrete with the following design compressive strengths (f'_c) as noted on the drawings and specified below:

- | | |
|---|--------------------|
| 1. Electrical Ductbanks: | $f'_c = 2,500$ psi |
| 2. Footings: | $f'_c = 4,000$ psi |
| 3. Foundation walls, piers, slabs on grade, and slabs on deck | $f'_c = 4,000$ psi |
| 4. Structural concrete beams, columns, and slabs: | $f'_c = 4,000$ psi |

5. Exterior concrete subject to de-icing salts: $f'_c = 5,000$ psi

- B. **BASE BID:** Fly ash or slag shall be used as a partial replacement for Portland Cement in all concrete mixes for the building and site. Concrete mix designs shall be based on a fly ash content equal to 30% replacement or a slag content equal to 40% replacement.

ALTERNATE: Fly ash or slag may be used as a partial replacement for Portland Cement in all concrete mixes except for interior slabs on metal deck, interior slabs on grade, exterior slabs, and site walls. Where permissible, concrete mix designs shall be based on a maximum fly ash content equal to 20% replacement or a maximum slag content equal to 25% replacement. Do not use fly ash or slag in concrete for any element during winter-concrete conditions. Identify cost and schedule impacts associated with the use of the alternate concrete mixes.

- C. The maximum water/cement ratios for the ACI Concrete Exposure Classes are listed below:

1. Exposure Class F1 (Footings and Foundation Walls): Maximum W/C Ratio = 0.55
2. Exposure Class F2 (Exterior, Exposed Walls): Maximum W/C Ratio = 0.45
3. Exposure Class F3 (Site Paving): Maximum W/C Ratio = 0.40

- D. Slabs on grade and slabs on metal deck (Exposure Class F0) shall have a maximum water/cement (W/C) ratio of 0.45.

- E. All concrete shall be proportioned in accordance with ACI Standard 211.1, "Standard Practice for Selecting Proportions for Normal, Heavyweight and Mass Concrete" and comply with the requirements of ACI 301 "Specifications for Structural Concrete" Section 4, Method 1 (trial mixtures) or 2 (field test data).

- F. All concrete with a strength of 4,000 psi or higher shall have a minimum coarse aggregate content of 1,600 lbs/cu.yd.

- G. Air-entraining and water-reducing agents shall be used in strict accordance with the manufacturer's printed instructions. All exterior concrete frequently subjected to freezing and thawing (Exposure Classes F2 and F3) shall have a total air content of 6% plus or minus 1%. All interior concrete slabs (Exposure Class F0) shall be non-air entrained. All other concrete (Exposure Class F1) shall have a total air content of 4% plus or minus 1%.

- H. All concrete shall contain a water-reducing agent. Use a high range water-reducing agent (superplasticizer) in concrete for slabs on grade and slabs on steel deck. The slump of concrete shall be 4" (+/-1"). If a superplasticizer is used, the slump shall be 3" (+/-1") prior to adding the superplasticizer and 8" (+/-1") after adding the superplasticizer.

- I. Premix admixtures in solution form and dispense as recommended by the manufacturer. Include the water in the solution in the design water content of the mixtures.

PART 3 - EXECUTION

3.1 STORAGE

- A. All materials shall be stored to prevent damage from the elements and other causes.
- B. Cement and aggregates shall be stored in such a manner as to prevent deterioration or intrusion of foreign matter. Any materials which have deteriorated, or which have been damaged, shall not be used for concrete.
- C. Store reinforcing steel on wood skids to protect it from earth and damage from trucking or other construction operations. Reinforcement shall be free from loose mill scale, rust, release agent, concrete splatter, and other extraneous coatings at the time it is embedded in the concrete.
- D. All forms shall be stored in neat manner and orderly fashion, protected from the weather and abuse.
- E. Materials which are judged not acceptable for this project shall not be stored on the site and shall be immediately removed from the site.

3.2 FORMING

- A. Formwork construction shall be as specified in ACI 347 "Guide to Formwork for Concrete".
 - 1. Provide Class A tolerances for all visually exposed concrete surfaces.
 - 2. Provide Class C tolerances for other concrete surfaces.
- B. Acceptable tolerances shall be as specified in ACI 117 "Standard Specifications for Tolerances for Concrete Construction and Materials".
- C. Forms shall be constructed to conform to shapes, lines, and dimensions shown, plumb and straight, and shall be maintained sufficiently rigid to prevent deformation under load. Forms shall be sufficiently tight to prevent the leakage of grout. Securely brace and shore forms to prevent displacement and to safely support the construction loads.
- D. Treat forms with a form release agent applied according to the manufacturer's instructions, by roller, brush, or spray to produce a uniform thin film without bubbles or streaks. Apply the release agent in two coats for the first use of the form and in one coat for each additional use.

3.3 MIXING PROCESS

- A. Ready-mixed concrete shall be mixed and transported in accordance with "Specification for Ready-Mixed Concrete" ASTM C 94, Alt. #3 and ACI 304, "Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete".

3.4 REINFORCING

- A. Reinforcing shall be securely tied and supported to maintain proper spacing and cover during placing operations. Take particular care to bend tie wire ends away from exposed faces of beams, slabs, and columns. In no case shall ends of tie wires project towards or touch formwork. Do not "wet-stick" reinforcing or anchor bolts into wet concrete. All reinforcing and accessories shall be placed in accordance with CRSI Standards 63 and 68. Reinforcing shall be free of excessive rust, scale or other coatings that will reduce bond.

3.5 EMBEDDED ITEMS

- A. Coordinate the installation of all embedded items required by other trades. Such items normally are to be in place prior to the placing of reinforcing steel.
- B. Place all anchor bolts, sleeves, inserts, and other embedded items, and secure properly.
- C. Conduits and Pipes by M.E.P. Contractors: Embed no pipes other than electrical conduit in structural concrete. Provide steel pipe sleeves for pipes passing through. Embed conduit in concrete only under the following conditions:
 - 1. No conduit coating, except galvanizing or equivalent shall be used. Do not embed aluminum conduit in concrete.
 - 2. Do not cut or displace any reinforcement.
 - 3. Place conduit within the middle half of any member. Do not place conduit between concrete surfaces and reinforcement.
 - 4. Place nearly parallel conduits apart at least 3 times O.D.
 - 5. Do not place conduit in concrete slabs on metal deck or slabs on grade.

3.6 JOINTS

- A. Provide construction joints as shown on the Drawings, but in any case, limit the maximum dimensions for placement of concrete in any one placement as follows:

1. Walls:	80 feet
2. Slabs-on-grade:	100 feet
3. Slabs on Metal Deck:	100 feet

The time period between adjacent concrete pours on either side of the construction joint shall not be less than two days to allow for drying shrinkage in the initial pour. If the above limits are exceeded, the Contractor shall be responsible for the repair of any cracks or defects which are judged to be unacceptable by the Architect and/or the flooring Subcontractor.

- B. Construction joints shall be formed with keyed bulkheads. At joint locations labeled on the drawings as roughened joints, the entire contact surface shall be mechanically roughened with a roughness of at least ¼ inch amplitude and an approved bonding agent shall be used in accordance with the manufacturer's recommendations. All construction joints shall be free of debris. Reinforcement shall continue through the joint, and additional reinforcement shall be placed as indicated on the Drawings.

- C. Provide control joints as shown on the Drawings (refer also to Architectural drawings for exposed areas with added joints), but in any case, joints shall be located as follows:
 - 1. Slabs on grade (non-exposed areas): On column lines in each direction and at 15 feet on center between column lines, maximum.
 - 2. Slabs-on-grade (exposed areas): On column lines in each direction and at 10 feet on center between column lines, maximum.
- D. Control joints shall be saw cut, as early as practical, the day after placement and finishing of concrete. Cut every other wire of welded wire fabric at control joints. Do not place control joints in slabs on metal deck or in structural slabs.
- E. Provide isolation joints around all columns in accordance with the details on the Drawings.

3.7 PLACING

- A. Notify the Architect and Structural Engineer at least 72 hours prior to each placement.
- B. Do not place concrete until soil bearing material, reinforcing steel, inserts, sleeves, and other work to be built into the concrete have been inspected and approved by the Architect and all trades concerned.
- C. In hot weather, all concreting shall be done in accordance with ACI 305, "Recommended Practice for Hot Weather Concreting".
 - 1. When temperature rises above 80 degrees F, all surfaces of concrete shall be protected against rapid drying.
 - 2. Concrete delivered to the forms shall have a temperature of not over 90 degrees F.
 - 3. The temperature of the forms shall not be over 90 degrees F.
- D. In cold weather, all concreting shall be done in accordance with ACI 306, "Recommended Practice for Cold Weather Concreting".
 - 1. When the average daily temperature falls below 40 degrees F, all surfaces of concrete shall be maintained at a temperature of at least 50 degrees F and not over 90 degrees F for seven days.
 - 2. Concrete delivered to the forms shall have a temperature of at least 60 degrees F and not over 90 degrees F.
 - 3. The temperature of the forms including gravel base, shall be at least 40 degrees F.
 - 4. The Contractor shall maintain a record of temperature of the concrete at the most exposed surfaces of each placement at the beginning and at the end of each day of the curing period, which shall be available to the Architect.
- E. Conveying - Concrete shall be handled from the mixer to the place of final deposit as rapidly as practicable by methods which will prevent separation or loss of ingredients and in a manner which will assure that the required quality of the concrete is retained.
- F. Depositing - Delivery and placement of concrete shall be programmed so that the time

lapse between batching and placement shall not exceed 1-1/2 hours. Concrete shall not be allowed a free fall of over four feet. Concrete shall be deposited as nearly as practicable in its final position, to avoid segregation due to rehandling or flowing.

- G. Concrete shall be deposited continuously, in horizontal layers of such thickness (not deeper than 18 inches) that no concrete will be deposited on concrete which has hardened sufficiently to cause the formation of seams or planes of weakness within the section. Placing shall be carried out at such a rate that the concrete which is being integrated with fresh concrete is still plastic. Concrete which has partially hardened or has been contaminated by foreign materials shall not be deposited.
- H. Concrete shall be consolidated with the aid of mechanical vibrators in conformance with ACI "Recommended Practice for Consolidation of Concrete" to produce a dense, homogeneous mass without voids or pockets. Vibrators should be placed in concrete rapidly so as to penetrate the entire previous lift, to blend the two layers. Vibrating techniques must assure that when the coarse aggregate reaches the form, it stops and the matrix fills the voids.
- I. Horizontal construction joints including those for toppings shall be mechanically roughened and cleaned thoroughly of all foreign materials and laitance, roughen with suitable tools such as chipping hammers or wire brushes, reclean by stream of water or compressed air and an approved bonding agent shall be used in accordance with the manufacturer's recommendations. New concrete shall be deposited before the bonding agent dries out.
- J. Concrete for floor slabs on metal deck shall be poured to the proper elevations by adding concrete to compensate for deck and structural member deflections. Slab thickness indicated on drawings is a minimum. Assume one and one quarter inch additional thickness concrete at mid-bay required (or ¾ inch average additional concrete slab thickness over the entire structural bay). Slabs on deck shall not be placed until the building frame has been plumbed and the installation of the permanent lateral force resisting system has been completed.

3.8 FINISHING OF CONCRETE SURFACES

- A. The intent of this Specification is to secure for the job, materials and workmanship of such quality that only nominal finishing will be required to produce concrete surfaces equal to the best obtainable with the concrete and forming materials specified. Surfaces which reveal, upon removal of forms, imperfections of such magnitude as to seriously impair the appearance of the structure, in the opinion of the Architect, shall be deemed cause for rejection, and concrete members containing such imperfections shall be entirely removed and replaced without damage to adjacent materials or extra expense to the Owner. Lesser imperfections of concrete surfaces shall be patched and finished in accordance with the following procedures.
- B. Patching - Areas to be patched shall not exceed 1.5 square feet for each 1000 square feet of surface area. Patches shall match in every respect, the color and texture of the surrounding surfaces. Mix formulation shall be determined by trial to obtain a color match when both the patch and the surrounding concrete are cured and dry. After initial set,

surfaces of patches shall be textured manually to obtain a match with the surrounding surfaces. All patches are subject to Architect's final acceptance as to appearance and quality.

- C. Exposed Vertical Surfaces - Immediately after removal of forms, chip off all fins, and other projections, and patch all voids, honeycombs, and air pockets exceeding $\frac{3}{4}$ inch in any dimension. In areas where concentrations of small voids occur, patch a sufficient number of voids to produce a uniform appearance across the entire panel. Smooth out projections and fins with wet carborundum stones or power grinders to extent directed by Architect. Pull tie rods and pack voids formed by tie-rod cones to a point $\frac{3}{4}$ inch from finish surface. Patch exposed irregular lines at edges of slab soffits to produce neat, uniform appearance.
- D. Surfaces to Receive Sandblast Finish: Upon completion of operations under the preceding paragraph, sandblast all exterior vertical surfaces and all other surfaces indicated as receiving sandblast finish. No interior surfaces shall be sandblasted. Use a #400 gradation abrasive that will not adversely affect the color of the finished surface, such as "Black Beauty" supplied by M. B. Reed and Company, Inc., Hammond, Indiana, "Garnet Sand" supplied by Davidson MacDonald, Boston, Massachusetts, or approved equal. Abrasive blasting shall be carried out to the same depth and produce the same texture as the accepted sample panel throughout. Sandblasting shall be done after all concrete to be blasted has attained a strength of 3,000 psi as determined by field control cylinders, or after a minimum of seven days, whichever is first. The Contractor shall be responsible for safety of the workers and for any damage or claims resulting from this operation and shall equip each person with an air-fed helmet. Provide suitable enclosures for collecting grit and dust from the blasting operation. During abrasive blasting, surfaces intended to be left smooth, such as rustications, chamfers, and tie cone holes, shall be protected from blasting by masking with wood, metal, rubber, or tape. Avoid rounding edges. All inserts shall be masked and protected from blasting. Sandblasting shall comply with all local and state anti-pollution laws.
- E. Finishing Concrete Vertical Surfaces Exposed to View and not scheduled to be sandblasted: Provide a smooth-formed surface obtained with selected form-facing material arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch defective areas with fins and other projections completely removed and smoothed.
- F. Smooth-Rubbed Finish: Provide smooth-rubbed finish on exposed concrete vertical surfaces that have received smooth-formed finish treatment not later than one day after form removal. Moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process. Thoroughly clean surfaces to remove stains, laitance, dust, form oil, and all other surface residue by use of water, stiff brushes, sandpaper, or other means approved by the Architect.
- G. Finishing of Concealed Concrete Surfaces - At surfaces to receive waterproofing membranes, chip off fins and other projections and trowel patch all voids, honeycombs and air pockets exceeding $\frac{1}{2}$ inch in any dimension. Pull tie-rods and patch voids formed by tie-rod cones flush with adjacent surfaces. At outside faces of foundation walls, except for surfaces to receive waterproofing membranes, trowel patch all voids, honeycombs, and air

pockets exceeding $\frac{3}{4}$ inch in depth. At other concealed surfaces, patching, if any, shall be as directed by the Architect and shall, in general, be only such as is required to assure or protect the structural integrity of concrete or reinforcing.

3.9 FLOOR AND OTHER FLATWORK FINISHES

- A. Concrete for finish floor slabs shall be poured as dry as practicable within allowable slump range. Except when otherwise indicated or specified, concrete floor slabs shall be monolithically finished at required elevation by screeding, floating, and troweling (if required) to provide a smooth, even, non-porous finish, free of finishing marks. Do not begin finish troweling until concrete has hardened sufficiently to prevent excess fines from working to the surface. Coordinate all work with the requirements of Section 033650 - CONCRETE FINISHES. Finish requirements for formed concrete slabs, concrete slabs on deck and concrete slabs on grade are as follows (but must be confirmed/coordinated with the requirements of the selected flooring manufacturers and contractors which shall govern):

Float Finish: Slabs to receive unbonded toppings, steel trowel finish, mortar setting beds, equipment pads, and other similar surfaces shall be floated to a smooth, dense, uniform, sandy textured finish. During floating, while surface is still soft, check surface flatness using a 10 foot highway straight edge. Correct high spots by cutting down and correct low spots by filling with material of the same composition as floor finish.

Light Steel Trowel Finish: At areas to receive resilient floor covering, carpeting, or other floor covering, perform a light steel troweling immediately after floating. These areas shall be prepared in accordance with ASTM F 710: Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring.

Steel Trowel Finish: At floors to remain exposed to view, steel trowel immediately after floating. After initial troweling is complete and slabs have set sufficiently to ring the trowel, the surfaces shall be given a second steel troweling to a burnished finish.

Scratch Finish: At areas to receive a bonded, applied cementitious application, finish base slab as indicated above, except bull floats or darbys may be used (no troweling). Thoroughly coarse wire broom within two hours after placing to roughen slab surface to ensure a permanent bond between base slab and applied cementitious materials.

Broom Finish: Provide edged and jointed broom finish for exposed concrete pavements, ramps, stairs, and other similar surfaces. Slab surfaces shall be float finished following the procedures listed below. Following the float finish, use a moistened, stiff bristled natural fiber broom with a long handle to obtain a heavy brush texture finish. Install brush marks perpendicular to the flow of traffic. Repeat edging and jointing operations to obtain a distinct edge. Match texture approved by Architect.

- B. Concrete floor slabs shall conform to the following flatness and levelness tolerances per ASTM E1155 for Specified Overall Values (SOV) and Minimum Local Values (MLV):

Carpeted areas:

Floor Flatness Number F_f : Specified Overall Value (SOV) = 25

Minimum Local Value (MLV) = 17

Floor Levelness Number F_L : Specified Overall Value (SOV) = 20
Minimum Local Value (MLV) = 15

Exposed areas or areas to receive resilient flooring or thin set tile:

Floor Flatness Number F_F : Specified Overall Value (SOV) = 35
Minimum Local Value (MLV) = 25

Floor Levelness Number F_L : Specified Overall Value (SOV) = 20
Minimum Local Value (MLV) = 15

Areas with wood flooring:

Floor Flatness Number F_F : Specified Overall Value (SOV) = 45
Minimum Local Value (MLV) = 30

Floor Levelness Number F_L : Specified Overall Value (SOV) = 30
Minimum Local Value (MLV) = 24

Measurements shall be taken by the Testing Agency in accordance with ASTM E1155, as directed by the Architect. Measurements shall be taken within 72 hours of concrete placement, to verify compliance with FF and FL requirements. Leveling of the slab by the Contractor to the specified tolerances, if not achieved by initial finishing, shall be by machine grinding or by special leveling compound, or both, as approved by the Architect.

Note: Only F_F numbers are applicable to slabs on metal deck. Both F_F and F_L numbers are applicable to slabs on grade.

- C. Elevation Tolerance: The top surface elevation of slabs on metal deck and slabs on grade must not vary from the specified design elevation by more than plus $\frac{1}{4}$ inch and minus $\frac{1}{2}$ (3/4 inch envelope).
- D. Concrete slab surfaces to be sloped shall be sloped uniformly to drains.
- E. Concrete slabs to receive Portland cement setting beds or concrete or fills shall be given a rough wood float or broom finish.
- F. Provide edged and jointed broom finish for exposed concrete pavements. Immediately following floating of surfaces to have broom finish, steel trowel the surface. Use a stiff bristled natural fiber broom with a long handle to obtain a heavy brush texture finish. Install brush marks perpendicular to the flow of traffic. Repeat edging and jointing operations to obtain a distinct edge.
- G. No dry cement or mixture of sand and cement shall be applied to surface of any concrete slab to absorb moisture.
- H. Protect floors from damage until completion of job.

- I. Protect floors from damage until completion of job. Floors to remain exposed or be polished shall be protected with masonite or plywood to prevent staining and mechanical damage to slabs. No permanent marks (such as paint, marker, and/or pencil) shall be applied to those concrete floors to be polished, before or after polishing work has been done. No marks shall be made that will be exposed to view in the finished work.

3.10 SURVEY

- A. The Contractor shall engage the services of a licensed Engineer or Surveyor to provide as-built surveys of concrete slab on grade and concrete slab on deck elevations at all levels. Surveys at each level shall include, but not be limited to elevation readings at the following locations:
 1. At each perimeter and interior column.
 2. Mid-way between each perimeter and interior column on the column centerlines.
 3. At mid-bay.
- B. Surveys shall be taken prior to removal of shoring, as applicable.
- C. Submit a summary of results at each level for review by the Architect. Additional readings may be requested, at the direction of the Architect. Floor leveling, if required, shall be as specified in Paragraph 2.1 H and Section 3.11.

3.11 FLOOR LEVELING

- A. If required to meet required elevation tolerances, place self-leveling concrete underlayment for floor leveling in accordance with manufacturer's recommendations:
 1. Remove all dirt, grease, sealers, and/or other debris from existing slab by sandblasting or power wash.
 2. Prime and seal entire surface to receive topping. Use bonding agent, applied in strict conformance with manufacturer's instructions.
 3. Pour or pump underlayment material onto primed area in accordance with manufacturer's instructions, filling areas to within 3/8 inch of the required finish elevation at mid-bay. The underlayment material shall be mixed with fine gravel aggregate (3/8 inch maximum size), as applicable and as specified by manufacturer.
 4. Protect newly applied underlayment from premature surface drying and moisture loss.

3.12 CURING AND PROTECTION

- A. Protect newly placed concrete against low and high temperature effects and against rapid loss of moisture. Cure all concrete for at least seven days at a temperature of at least 50 degrees F by curing methods approved by the Architect. Curing compounds shall not be used.

- B. Vertical or near vertical surfaces may be cured by maintaining wood forms continuously wet during curing period, by wrapping with continuous .006 inch polyethylene with taped joints or as approved by the Architect.
- C. Floor surfaces, after hardening sufficiently to prevent damage, and normally within several hours after final troweling, shall be covered with the approved curing cover sheets with taped, lapped seams.

3.13 FORM REMOVAL

- A. Forms shall be removed without damage to concrete. The Contractor shall be responsible for the safety of the construction during and after form removal. No act of the Architect shall relieve him of this responsibility.
- B. Protect corners from damage after form removal by boxing, corner boards or other means approved by the Architect.
- C. Formwork for pilasters, walls, and other parts not supporting the weight of concrete may be removed as soon as the concrete has reached 30% of its specified 28-day strength, but not before two days, provided it is properly cured and protected.
- D. Formwork for beam soffits, slabs and other parts supporting the weight of concrete shall remain in place until the concrete has reached 100% of its specified 28-day strength, except that after the concrete has reached 75% of its specified 28-day strength, but not before seven days, the form work may be removed and the elements securely reshored.
- E. Reshoring shall remain in place until concrete has reached its specified 28-day strength and until members can safely support their weight and load thereon. Until the 28-day strength has been achieved, all concrete shall be protected from shock, vibration, and heavy loads.
- F. Foundation walls retaining earth shall not be backfilled until the connecting slabs at the top and bottom of the wall have achieved their 28-day strength. Alternatively, the Contractor may provide an engineered wall bracing system to withstand wall earth pressures during construction prior to slab bracing.

3.14 WATERSTOP

- A. Install continuous Bentonite strip waterstop at vertical and horizontal below grade wall construction joints. Installation shall be in accordance with manufacturer's recommendations.

3.15 MASTIC COATING OF EMBEDDED STRUCTURAL STEEL

- A. Install mastic coating continuously over steel embedded in concrete or soil in accordance with the manufacturer's recommendations.

3.16 CUTTING OF HOLES

- A. Holes required by other trades in any cast-in-place concrete which did not receive sleeves

shall be cut by the respective trades. Use a core drilling process or sawing process which produces clean sharp edges and the minimum hole size which accommodates the piping, conduit, or equipment requiring the opening. Field locate all reinforcing bars prior to coring and do not cut bars.

- B. Obtain approval of Architect before cutting any holes for any trades.

3.17 NON-SHRINK GROUT

- A. Grout solid all column leveling plates and beam bearing plates in accordance with manufacturer's recommendations.

3.18 ANCHOR ROD BASE PLATE HOLE GROUT

- A. Grout solid all oversized braced frame or moment frame column steel base plate holes around anchor rods, in accordance with manufacturer's recommendations.

END OF SECTION

SECTION 033000

CAST-IN-PLACE CONCRETE (SITE)

1.1 SUMMARY

- A. Section includes:
 - 1. Concrete landscape walls; non-structural.
 - 2. Concrete stairs.
 - 3. Concrete ramps.
 - 4. Concrete curbs.
 - 5. Concrete fence mow strip.
 - 6. Concrete footings.

1.2 QUALITY ASSURANCE

- A. Conform to ACI 305R when concreting during hot weather.
- B. Conform to ACI 306.1 when concreting during cold weather.
- C. Conform to ACI 315 when detailing reinforcement and preparing Shop Drawings.
- D. Conform to ACI 318 when performing formwork, reinforcing and concreting.
- A. Mockups: Construct a sample panel of each cast-in-place concrete on the corresponding specified base and setting bed before start of any cast-in-place concrete. Cast concrete formed-surface panels to demonstrate typical joints, surface finish, texture, tolerances, and standard of workmanship.

1.3 PRODUCTS FORM-FACING MATERIALS

- A. Form facing materials
- B. Steel Reinforcement
 - 1. All bonding agents and non-shrink grouts shall comply with the Mass Highway Standard Specification for Highway and Bridges, as amended.
 - 2. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), deformed.
 - 3. Plain-Steel Welded Wire Reinforcement: ASTM A 185/A 185M, plain, fabricated from as-drawn steel wire into flat sheets.

1.4 CONCRETE MATERIALS

- A. The concrete strengths shall be specified on the plans and according to the following provisions. Mix and deliver in accordance with ASTM C94.
- B. Proportion mixtures to provide normal-weight concrete with the following properties:
 - 1. Compressive Strength (28-days): 4,000 psi (27.6 MPa).
 - 2. Water/Cement Ratio (maximum): 0.45-percent by weight (mass).
 - 3. Slump Limit: Maximum 3-inches (16.2 mm) to 5-inches (125 mm) a time of placement.

- C. Add air-entraining admixture at manufacturer's prescribed rate to result in normal-weight concrete at point of placement having an air content as follows:
 - 1. Air Content: 6 percent, plus or minus 1 percent at point of delivery for $\frac{3}{4}$ inch nominal maximum aggregates size (applies to footings and foundation walls and all other concrete exposed to freeze/thaw action).
- D. Limit water-soluble, chloride ion content in hardened concrete to 0.15-percent by weight of cement.

1.5 INSTALLATION

- 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, to be covered with a coating or covering material applied directly to concrete.
- C. Rubbed Finish: Apply the following to smooth-formed finished as-cast concrete where indicated:
 - 1. Smooth-Rubbed Finish: Not later than one day after form removal, moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.
- D. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

1.6 FIELD QUALITY CONTROL

- A. Testing and Inspecting: Engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.
- B. Field Inspection and testing will be performed in accordance with ACI 301.

END OF SECTION

SECTION 040001

MASONRY WORK

(Filed Sub-Bid Required)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 1 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

B. Time, Manner and Requirements for Submitting Sub-Bids:

1. Sub-bids for work under this Section shall be for the complete work and shall be filed in a sealed envelope with the _____ at a time and place as stipulated in the "NOTICE TO CONTRACTORS".

The following should appear on the upper left hand corner of the envelope:

NAME OF SUB-BIDDER: (Insert name of sub-bidder)

MASS. STATE PROJECT: ((Insert project number from top of page))

SUB-BID FOR SECTION: 040001 – MASONRY WORK

2. Each sub-bid submitted for work under this Section shall be on forms furnished by the _____ as required by Section 44F of Chapter 149 of the General Laws, as amended. Sub-bid forms may be obtained at the office of the _____, or may be obtained by written or telephone request; telephone _____.
3. Sub-bids filed with the _____ shall be accompanied by BID BOND or CASH or CERTIFIED CHECK or TREASURER'S CHECK or CASHIER'S CHECK issued by a responsible bank or trust company payable to the _____ in the amount of five percent of the sub-bid. A sub-bid accompanied by any other form of bid deposit than those specified will be rejected.

C. Sub Sub-Bid Requirements: (None required under this Section.)

D. Reference Drawings: The Work of this Filed Sub-Bid is shown on the following Contract Drawings: *To be inserted with final documents.*

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. All Work of Section 040120 – MASONRY RESTORATION AND CLEANING
2. All Work of Section 042000 – UNIT MASONRY
3. All Work of Section 044313 – CALCIUM SILICATE MASONRY VENEER

END OF SECTION

SECTION 040120

MASONRY RESTORATION AND CLEANING

(Part of Work of Section 040001 - MASONRY WORK, Filed Sub-Bid Required)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Repairing masonry, including replacing damaged units as indicated on Drawings.
 - 2. Reanchoring veneers.
 - 3. Repointing mortar joints, removing existing mortar and replacing with new color mortar.
 - 4. Cleaning exposed clay and stone masonry surfaces, including decorative stonework.
 - 5. Provide for repair or replacement of clay and stone masonry broken or damaged during disassembly and reconstruction. Contractor shall be responsible for damage resulting from work of this Section.
 - 6. Provide shoring and bracing required to maintain stability of masonry during work of this Section. Coordinate with requirements of Division 01 - GENERAL REQUIREMENTS.
- B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council. Refer to Section 018110, SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 024100 - DEMOLITION for demolition, removal and salvage requirements, to the extent not specified in this Section.
 - 2. Section 042000 - UNIT MASONRY for new clay masonry veneer.
 - 3. Section 076200 - SHEET METAL FLASHING AND TRIM for metal flashing installed in or on restored masonry.
 - 4. Section 079200 - JOINT SEALANTS for sealing joints in restored masonry.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated. Include recommendations for application and use. Include test data substantiating that products comply with requirements.
- B. Samples for Verification: Before erecting mockup, submit samples of the following:

1. Each type of exposed masonry unit to be used for replacing existing units.
 - a. For each brick type, provide straps or panels containing at least four bricks.
 - b. For each stone type, provide straps or panels containing at least four stones.
 2. Each type of sand used for pointing mortar.
 - a. For blended sands, provide samples of each component and blend.
 - b. Identify sources, both supplier and quarry, of each type of sand.
 3. Each type of pointing mortar in the form of sample mortar strips, 6 inches long by 1/2 inch wide, set in aluminum or plastic channels.
 - a. Include with each sample a list of ingredients with proportions of each. Identify sources, both supplier and quarry, of each type of sand and brand names of cementitious materials and pigments if any.
 4. Each type of anchor, insert, dowel, and attachment, full size.
 5. Each type of masonry patching compound in the form of briquettes, at least 3 inches long by 1-1/2 inches wide. Document each sample with manufacturer and stock number or other information necessary to order additional material.
- C. **Qualification Data: For restoration specialists including field supervisors and chemical manufacturer.**
- D. **Restoration Program:** For each phase of restoration process, provide detailed description of materials, methods, equipment, and sequence of operations to be used for each phase of restoration work including protection of surrounding materials on building and Project site.
1. Include methods for keeping pointing mortar damp during curing period.
 2. If materials and methods other than those indicated are proposed for any phase of restoration work, provide a written description, including evidence of successful use on comparable projects, and a testing program to demonstrate their effectiveness for this Project.
- E. **Cleaning Program:** Describe cleaning process in detail, including materials, methods, and equipment to be used and protection of surrounding materials on building and Project site, and control of runoff during operations.
1. If materials and methods other than those indicated are proposed for cleaning work, provide a written description, including evidence of successful use on comparable projects, and a testing program to demonstrate their effectiveness for this Project.
- 1.4 **QUALITY ASSURANCE**
- A. **Restoration Specialist Qualifications:** Engage an experienced, masonry restoration and cleaning firm to perform work of this Section. Firm shall have completed work similar in material, design, and extent to that indicated for this Project with a record of successful in-service performance.
1. At Contractor's option, work may be divided between two specialist firms: one for cleaning work and one for repair work.

2. **Field Supervision:** Restoration specialist firms shall maintain experienced full-time supervisors on Project site during times that masonry restoration and cleaning are in progress. Supervisors shall not be changed during Project except for causes beyond the control of restoration specialist firm.
 3. **Restoration Worker Qualifications:** Persons who are experienced and specialize in restoration work of types they will be performing.
- B. **Chemical Manufacturer Qualifications:** A firm regularly engaged in producing masonry cleaners that have been used for similar applications with successful results, and with factory-trained representatives who are available for consultation and Project-site inspection and assistance at no additional cost.
- C. **Source Limitations:** Obtain each type of material for masonry restoration (face brick, stone, cement, sand, etc.) from one source with resources to provide materials of consistent quality in appearance and physical properties.
- D. **Preconstruction Testing Service:** Owner will engage a qualified independent testing agency to test the following. Provide test specimens and assemblies as indicated.
1. **Replacement Brick:** For each proposed type of replacement brick, according to sampling and testing methods in ASTM C 67 for compressive strength, 24-hour cold-water absorption, 5-hour boil absorption, saturation coefficient, and initial rate of absorption (suction).
 2. **Existing Brick:** For each type of existing brick indicated for replacement, according to testing methods in ASTM C 67 for compressive strength, 24-hour cold-water absorption, 5-hour boil absorption, saturation coefficient, and initial rate of absorption (suction). Carefully remove existing bricks from locations designated by Architect.
- E. **Mockups:** Prepare mockups of restoration and cleaning as follows to demonstrate aesthetic effects and qualities of materials and execution. Prepare mockups on existing walls under same weather conditions to be expected during remainder of the Work.
1. Repair an area approximately 36 inches high by 48 inches wide for each type of masonry material indicated to be rebuilt or replaced.
 2. Patch three small areas at least 1 inch in diameter for each type of masonry material indicated to be patched.
 3. Clean an area approximately 25 sq. ft. in area for each type of masonry and surface condition.
 - a. Test cleaners and methods on samples of adjacent materials for possible adverse reactions unless cleaners and methods are known to have deleterious effect.
 - b. Allow a waiting period of not less than seven days after completion of sample cleaning to permit a study of sample panels for negative reactions.
 4. Rake out joints in two separate areas approximately 36 inches high by 72 inches wide for each type of repointing required and repoint one of the two areas.
- F. **Preinstallation Conference:** Conduct conference at Project site to comply with requirements in Division 01.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver masonry units to Project site strapped together in suitable packs or pallets or in heavy-duty cartons.
- B. Deliver other materials to Project site in manufacturer's original and unopened containers, labeled with manufacturer's name and type of products.
- C. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
- D. Store hydrated lime in manufacturer's original and unopened containers. Discard lime if containers have been damaged or have been opened for more than two days.
- E. Store lime putty covered with water in sealed containers.
- F. Store sand where grading and other required characteristics can be maintained and contamination avoided.

1.6 PROJECT CONDITIONS

- A. Repoint mortar joints and repair masonry only when air temperature is between and 40 and 90 deg F and is predicted to remain so for at least 7 days after completion of work.
- B. Cold-Weather Requirements: Comply with the following procedures for masonry repair and mortar-joint pointing:
 - 1. When air temperature is below 40 deg F, heat mortar ingredients, masonry repair materials, and existing masonry walls to produce temperatures between 40 and 120 deg F.
 - 2. When mean daily air temperature is below 40 deg F, provide enclosure and heat to maintain temperatures above 32 deg F within the enclosure for 7 days after repair and pointing.
- C. Hot-Weather Requirements: Protect masonry repair and mortar-joint pointing when temperature and humidity conditions produce excessive evaporation of water from mortar and repair materials. Provide artificial shade and wind breaks and use cooled materials as required. Do not apply mortar to substrates with temperatures of 90 deg F and above.
- D. Patch masonry only when air and surface temperatures are between and 55 and 100 deg F and are predicted to remain above 55 deg F for at least 7 days after completion of work. On days when air temperature is predicted to go above 90 deg F, schedule patching work to coincide with time that surface being patched will be in shade or during cooler morning hours.
- E. Clean masonry surfaces only when air temperature is 40 deg F and above and is predicted to remain so for at least 7 days after completion of cleaning.

1.7 SEQUENCING AND SCHEDULING

- A. Order replacement materials at earliest possible date, to avoid delaying completion of the Work.

- B. Order sand for repointing mortar immediately after approval of Samples or mockups. Take delivery of and store at Project site a sufficient quantity of sand to complete Project.
- C. Perform masonry restoration work in the following sequence:
 - 1. Remove plant growth.
 - 2. Repair existing masonry, including the following:
 - a. Reconstructing and resetting existing stone work.
 - b. Replacing existing masonry with new masonry materials.
 - 3. Rake out joints that are to be repointed.
 - 4. Point mortar joints.
 - 5. Inspect for open mortar joints and repair before cleaning to prevent the intrusion of water and other cleaning materials into the wall.
 - 6. Clean masonry surfaces.
- D. As scaffolding is removed, patch anchor holes used to attach scaffolding. Patch holes in masonry units to comply with Part 3 "Masonry Unit Patching and Repairs" Article. Patch holes in mortar joints to comply with Part 3 "Repointing Masonry" Article.

PART 2 - PRODUCTS

2.1 MASONRY MATERIALS

- A. Face Brick and Accessories: Provide face brick and accessories, including specially molded, ground, cut, or sawed shapes where required to complete masonry restoration work.
 - 1. Provide units with colors, surface texture, size, and shape to match existing brickwork and with physical properties not less than those determined from preconstruction testing of selected existing units.
 - a. For replacement brick at existing building provide brick to match existing as approved by Architect.
 - b. For existing brickwork that exhibits a range of colors, provide brick that matches that range rather than brick that matches an individual color within that range.
 - 2. Provide units with colors, surface texture, and physical properties to match Architect's sample. Match existing units in size and shape.
 - a. For sample that exhibits a range of colors, provide brick that matches that range rather than brick that matches an individual color within that range.
 - 3. Provide specially molded shapes for applications where shapes produced by sawing would result in sawed surfaces being exposed to view.
 - 4. Provide specially ground units, shaped to match patterns, for arches and where indicated.
- B. Building Brick: Provide building brick complying with ASTM C 62, of same vertical dimension as face brick, for masonry work concealed from view.
 - 1. Grade SW where in contact with earth.

2. Grade SW, MW, or NW for concealed backup.

- C. Stone: Reuse existing salvaged stones, where available, and as follows:

1. Varieties, Cut and Finish: To match existing stones, as approved by Architect.
2. For existing stone that exhibits a range of colors, finishes, sizes, or shapes, provide stone that matches that range rather than stone that matches an individual color, finish, size, or shape within that range.

2.2 MORTAR MATERIALS

- A. Portland Cement: ASTM C 150, Type I or Type II.

1. Provide white cement containing not more than 0.60 percent total alkali when tested according to ASTM C 114.

- B. Hydrated Lime: ASTM C 207, Type S.

- C. Quicklime: ASTM C 5, pulverized lime.

- D. Factory-Prepared Lime Putty: Screened, fully-slaked lime putty, prepared from pulverized lime complying with ASTM C 5.

- E. Mortar Sand: ASTM C 144, unless otherwise indicated.

1. Color: Provide natural sand or ground marble, granite, or other sound stone; of color necessary to produce required mortar color.
2. For pointing mortar, provide sand with rounded edges.
3. Match size, texture, and gradation of existing mortar sand as closely as possible. Blend several sands, if necessary, to achieve suitable match.

- F. Mortar Pigments: Natural and synthetic iron oxides, compounded for mortar mixes. Use only pigments with a record of satisfactory performance in masonry mortars.

1. Available Products: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. SGS Mortar Colors: Solomon Grind-Chem Services, Inc.
 - b. True Tone Mortar Colors: Davis Colors, a Subsidiary of Rockwood Industries, Inc.

- G. Water: Potable, clean and free from injurious amount of oil, alkali, organic matter or other deleterious material.

2.3 PAINT REMOVERS

- A. Alkaline Paste Paint Remover: Manufacturer's standard alkaline paste formulation for removing paint coatings from masonry.

1. Available Products:
 - a. American Building Restoration Products, Inc.; 800 Brush Grade.

- b. Diedrich Technologies Inc.; 606/606X Extra Thick Multi-Layer Paint Remover.
 - c. Hydrochemical Techniques, Inc.; Hydroclean Heavy Duty Paint Remover (HT-716).
 - d. Price Research, Ltd.; Price Heavy Duty Paint Stripper.
 - e. ProSoCo; Sure Klean Heavy-Duty Paint Stripper.
- B. Covered or Skin-Forming Alkaline Paint Remover: Manufacturer's standard covered or skin-forming alkaline formulation for removing paint coatings from masonry.
 - 1. Available Products:
 - a. American Building Restoration Products, Inc.; Grip 'N Strip 800 F.A.
 - b. Diedrich Technologies Inc.; 404 Rip-Strip.
 - c. Dumond Chemicals, Inc.; Peel Away 1 System.
 - d. ProSoCo; Enviro Strip #2.
- C. Solvent-Type Paint Remover: Manufacturer's standard water-rinsable, solvent-type gel formulation for removing paint coatings from masonry.
 - 1. Available Products:
 - a. American Building Restoration Products, Inc.; No. 3 Grip 'N Strip.
 - b. Diedrich Technologies Inc.; 505 Special Coatings Stripper.
 - c. Dominion Restoration, Inc.; Dominion Multi-Layer Paint & Graffiti Remover.
 - d. Dumond Chemicals, Inc.; Peel Away 2.
 - e. Hydrochemical Techniques, Inc.; Hydroclean Solvent Paint Remover (HT-300).
 - f. Price Research, Ltd.; Price Strip-All.
 - g. ProSoCo; Sure Klean Fast Acting Paint Stripper.
- D. Low-Odor, Solvent-Type Paint Remover: Manufacturer's standard low-odor, water-rinsable solvent-type gel formulation, containing no methanol or methylene chloride, for removing paint coatings from masonry.
 - 1. Available Products:
 - a. American Building Restoration Products, Inc.; 800 No Lye Grip 'N Strip.
 - b. Dumond Chemicals, Inc.; Peel Away 6.
 - c. ProSoCo; Enviro Klean NMC.

2.4 CLEANING MATERIALS

- A. Water: Potable, clean and free from injurious amount of oil, alkali, organic matter or other deleterious material.
- B. Hot Water: Heat water to a temperature of 140 to 160 deg F.
- C. Job-Mixed Detergent Solution: Solution prepared by mixing 2 cups of trisodium phosphate (TSP), 1/2 cup of laundry detergent, and 20 quarts of hot water for every 5 gal. of solution required.
- D. Job-Mixed Mold, Mildew, and Algae Remover: Solution prepared by mixing 2 cups of trisodium phosphate (TSP), 5 quarts of 5 percent sodium hypochlorite (bleach), and 15 quarts of hot water for every 5 gal. of solution required.

- E. Nonacidic Gel Cleaner: Manufacturer's standard gel formulation, with pH between 6 and 9, that contains detergents and chelating agents and is specifically formulated for cleaning masonry surfaces.
1. Available Products:
 - a. Price Research, Ltd.; Price Marble Cleaner-Gel.
 - b. ProSoCo; Sure Klean 942 Masonry Cleaner.
 - c. Dumond Chemicals, Inc.; Ultimate Stone and Masonry Cleaner.
- F. Nonacidic Liquid Cleaner: Manufacturer's standard mildly alkaline liquid cleaner formulated for removing mold, mildew, and other organic soiling from ordinary building materials, including polished stone, brick, aluminum, plastics, and wood.
1. Available Products:
 - a. Dominion Restoration, Inc.; Bio-Cleanse.
 - b. Dumond Chemicals, Inc.; Safe n' Easy Architectural Cleaner/Restorer.
 - c. Price Research, Ltd.; Price Non-Acid Masonry Cleaner.
 - d. ProSoCo; Enviro Klean Restoration Cleaner.
- G. Mild Acidic Cleaner: Manufacturer's standard mildly acidic cleaner containing no hydrochloric, hydrofluoric, or sulfuric acid; or chlorine bleaches.
1. Available Products:
 - a. Diedrich Technologies Inc.; Envirorestore 100.
 - b. Dominion Restoration, Inc.; DR-60 Stone and Masonry Cleaner.
 - c. Dumond Chemicals, Inc.; Safe n' Easy Heavy Duty Restoration Cleaner.
 - d. ProSoCo; Sure Klean Light-Duty Restoration Cleaner.
- H. Acidic Cleaner: Manufacturer's standard acidic masonry restoration cleaner composed of hydrofluoric acid blended with other acids, detergents, wetting agents, and inhibitors.
1. Available Products:
 - a. American Building Restoration Products, Inc.; 801 Heavy Duty Masonry Cleaner.
 - b. Diedrich Technologies Inc.; 101 Masonry Restorer.
 - c. Hydrochemical Techniques, Inc.; Hydroclean Brick, Granite, Sandstone and Terra Cotta Cleaner (HT-626).
 - d. ProSoCo; Sure Klean Heavy-Duty Restoration Cleaner, Sure Klean 1028 Restoration Cleaner or Sure Klean Restoration Cleaner.
- I. Two-Part Chemical Cleaner: Manufacturer's standard system consisting of potassium or sodium hydroxide based, alkaline prewash cleaner and acidic afterwash cleaner that does not contain hydrofluoric acid.
1. Available Products:
 - a. ProSoCo; Sure Klean 766 Limestone & Masonry Prewash and Afterwash.

2.5 MISCELLANEOUS MATERIALS

- A. Masonry Patching Compound: Factory-mixed cementitious product that is custom manufactured for patching masonry, is vapor- and water permeable, exhibits low shrinkage, and develops high bond strength to all types of masonry.
1. Formulate patching compound used for patching brick in colors and textures to match brick being patched. Provide number of colors needed to enable matching each brick.
 2. Available Products:
 - a. Cathedral Stone Products, Inc.; Jahn Restoration Mortar.
 - b. Edison Coatings, Inc.; Custom System 45.
 - c. Bonstone Materials Corp., Stone Repair.
- B. Liquid Strippable Masking Agent: Manufacturer's standard liquid, film-forming, strippable masking material for protecting glass, metal, and polished stone surfaces from damaging effects of acidic and alkaline masonry cleaners.
1. Available Products:
 - a. American Building Restoration Products, Inc.; LM 130 Acid Shield.
 - b. Diedrich Technologies Inc.; Diedrich Acid Guard.
 - c. Price Research, Ltd.; Price Mask.
 - d. ProSoCo; Sure Klean Strippable Masking.
- C. Masonry Repair Anchors, Expansion Type: Mechanical fasteners designed for masonry veneer stabilization consisting of 1/4-inch- diameter, Type 316 stainless-steel rod with brass expanding shells at each end and water-shedding washer in the middle. Expanding shells shall be designed to provide positive mechanical anchorage to veneer on one end and backup masonry on the other.
1. Available Products:
 - a. BLOK-LOK, a Hohmann & Barnard Company; Torq-Lok.
 - b. Dur-O-Wal, a Hohmann & Barnard Company; Dur-O-Wal Repair Anchor.
 - c. Hohmann & Barnard, Inc.; #521RA-B Restoration Anchor.
- D. Masonry Repair Anchors, Spiral Type: Type 304 stainless-steel spiral rods designed to anchor to backing and veneer. Anchors are flexible in plane of veneer but rigid perpendicular to it.
1. Provide adhesive-installed anchors complete with manufacturer's standard epoxy adhesive and injection tubes, screens, sleeves, or other devices required for installation.
 2. Provide driven-in anchors designed to be installed in drilled holes and relying on screw effect rather than adhesive to secure them to backup and veneer.
 3. Available Products:
 - a. Dur-O-Wal, a Hohmann & Barnard Company; Dur-O-Flex.
 - b. Heckmann Building Products, Inc.; #391 Spiro Remedial Tie.
 - c. Helifix Ltd.; Helifix HRT60 or Helifix HRT80.
 - d. Hohmann & Barnard, Inc.; Helix Spiro-Ties.

- E. Stone Anchors: Type and size indicated or, if not indicated, to match existing anchors in size and type. Fabricate anchors and dowels from ASTM A 167, Type 304 stainless steel.
1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Halfen USA.
 - b. Heckmann Building Products.
 - c. Hohmann & Barnard, Inc.
 2. Adhesives, for Stone Anchors and Pins: ASTM C 881, Types I, II, IV & V, Grade 1, high modulus, high strength, moisture-insensitive, high-viscosity epoxy adhesive.
 - a. Basis of Design: Sika; Sikadur 31, Hi-Mod Gel, or approved equal by anchor manufacturer.
- F. Stone-to-Stone Adhesive: 2-part polyester or epoxy-resin stone adhesive with a 15- to 45-minute cure at 70 deg F or 1-part cementitious stone adhesive, recommended by adhesive manufacturer for type of stone repair indicated, and matching stone color.
1. Available Products: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Two-Part Polyester or Epoxy:
 - 1) Akemi North America; Akepox.
 - 2) Bonstone Materials, Inc.; A-199-T/B-439-T.
 - 3) Edison Coatings, Inc.; Flexi-Weld 520T.
 - a) Aggregate for mixing with epoxy: Granite of the same color as the area to be patched, reduced to a fine aggregate with a mallet. Use particles that pass through a No. 50 sieve and are retained on a No. 200 sieve.
 - b. One-Part Cementitious Stone Adhesive:
 - 1) Cathedral Stone Products, Inc.; Jahn Restoration Adhesive.
- G. Joint Sealant and Backer Rods: Refer to Section 079200 - JOINT SEALANTS.

2.6 MORTAR MIXES

- A. Preparing Lime Putty: Slake quicklime and prepare lime putty according to appendix to ASTM C 5 and manufacturer's written instructions.
- B. Measurement and Mixing: Measure cementitious materials and sand in a dry condition by volume or equivalent weight. Do not measure by shovel; use known measure. Mix materials in a clean, mechanical batch mixer.
1. Mixing Pointing Mortar: Thoroughly mix cementitious materials and sand together before adding any water. Then mix again adding only enough water to produce a damp, unworkable mix that will retain its form when pressed into a ball. Maintain mortar in this dampened condition for 15 to 30 minutes. Add remaining water in small portions until

mortar reaches desired consistency. Use mortar within one hour of final mixing; do not retemper or use partially hardened material.

- C. Colored Mortar: Produce mortar of color required by using selected ingredients. Do not alter specified proportions without Architect's approval.
 - 1. Mortar Pigments: Where mortar pigments are indicated, do not exceed a pigment-to-cement ratio of 1:10 by weight.
 - 2. Color: Match existing, or as otherwise directed by Architect.
- D. Do not use admixtures of any kind in mortar, unless otherwise indicated.
- E. Mortar Proportions: Mix mortar materials in the following proportions:
 - 1. Pointing Mortar for Brick: 1 part portland cement, 2 parts lime, and 6 parts sand.
 - a. Add mortar pigments to produce mortar colors required.
 - 2. Rebuilding (Setting) and Pointing Mortar, for Stone: Comply with ASTM C 270, Proportion Specification, Type N, unless otherwise indicated, with cementitious material limited to portland cement and lime.
 - a. Mix: 1 part portland cement, 2 parts lime, and 6-7 parts sand.
 - b. Add mortar pigments to produce mortar colors required.

2.7 CHEMICAL CLEANING SOLUTIONS

- A. Dilute chemical cleaners with water to produce solutions not exceeding concentration recommended by chemical cleaner manufacturer.
- B. Acidic Cleaner Solution for Brick: Dilute with water to produce hydrofluoric acid content of 3 percent or less, but not greater than that recommended by chemical cleaner manufacturer.
- C. Acidic Cleaner Solution for Unpolished Stone: Dilute with water to produce hydrofluoric acid content of 3 percent or less, but not greater than that recommended by chemical cleaner manufacturer.
 - 1. Use only on unpolished granite, unpolished dolomite marbles, and siliceous sandstone.

PART 3 - EXECUTION

3.1 PROTECTION

- A. Protect persons, motor vehicles, surrounding surfaces of building being restored, building site, plants, and surrounding buildings from harm resulting from masonry restoration work.
 - 1. Erect temporary protective covers over walkways and at points of pedestrian and vehicular entrance and exit that must remain in service during course of restoration and cleaning work.

- B. Comply with chemical cleaner manufacturer's written instructions for protecting building and other surfaces against damage from exposure to its products. Prevent chemical cleaning solutions from coming into contact with pedestrians, motor vehicles, landscaping, buildings, and other surfaces that could be harmed by such contact.
 - 1. Cover adjacent surfaces with materials that are proven to resist chemical cleaners used unless chemical cleaners being used will not damage adjacent surfaces. Use materials that contain only waterproof, UV-resistant adhesives. Apply masking agents to comply with manufacturer's written instructions. Do not apply liquid masking agent to painted or porous surfaces. When no longer needed, promptly remove masking to prevent adhesive staining.
 - 2. Keep wall wet below area being cleaned to prevent streaking from runoff.
 - 3. Do not clean masonry during winds of sufficient force to spread cleaning solutions to unprotected surfaces.
 - 4. Neutralize and collect alkaline and acid wastes for disposal off Owner's property.
 - 5. Dispose of runoff from cleaning operations by legal means and in a manner that prevents soil erosion, undermining of paving and foundations, damage to landscaping, and water penetration into building interiors.
- C. Prevent mortar from staining face of surrounding masonry and other surfaces.
 - 1. Cover sills, ledges, and projections to protect from mortar droppings.
 - 2. Keep wall area wet below rebuilding and pointing work to discourage mortar from adhering.
 - 3. Immediately remove mortar in contact with exposed masonry and other surfaces.
 - 4. Clean mortar splatters from scaffolding at end of each day.

3.2 UNUSED ANCHOR OR EMBEDDED STEEL REMOVAL

- A. Remove embedded masonry anchors, brackets, wood nailers, and other extraneous items no longer in use unless identified as historically significant or indicated to remain.
 - 1. Remove items carefully to avoid spalling or cracking masonry.
 - 2. If item cannot be removed without damaging surrounding masonry, cut off item flush with surface and core drill surrounding masonry and item as close around item as practical.
 - 3. Patch holes where items were removed unless directed to remove and replace units.

3.3 MASONRY REMOVAL AND REPLACEMENT

- A. At locations indicated, remove masonry units that are damaged, spalled, or deteriorated. Carefully demolish or remove entire units from joint to joint, without damaging surrounding masonry, in a manner that permits replacement with full-size units.
 - 1. When removing single bricks, remove material from center of brick and work toward outside edges.
- B. Support and protect remaining masonry that surrounds removal area. Maintain flashing, reinforcement, lintels, and adjoining construction in an undamaged condition.
- C. Notify Architect of unforeseen detrimental conditions including voids, cracks, bulges, and loose masonry units in existing masonry backup, rotted wood, rusted metal, and other deteriorated items.

- D. Remove in an undamaged condition as many whole bricks and stones as possible.
 - 1. Remove mortar, loose particles, and soil from brick and stone by cleaning with hand chisels, brushes, and water.
 - 2. Remove sealants by cutting close to brick and stone with utility knife and cleaning with solvents.
 - 3. Store brick and stone for reuse, as indicated.
 - 4. Deliver cleaned brick and stone not required for reuse to Owner, unless otherwise directed.
- E. Clean masonry surrounding removal areas by removing mortar, dust, and loose particles in preparation for replacement.
- F. Install replacement masonry into bonding and coursing pattern of existing masonry, match existing mortar joints for size. If cutting is required, use a motor-driven saw designed to cut masonry with clean, sharp, unchipped edges.
- G. Lay replacement masonry units with completely filled bed, head, and collar joints. Butter ends with sufficient mortar to fill head joints and shove into place. Maintain joint width for replacement units to match existing joints.
 - 1. Bricks: Wet both replacement and surrounding bricks that have ASTM C 67 initial rates of absorption (suction) of more than 30 g/30 sq. in. per min. Use wetting methods that ensure that units are nearly saturated but surface is dry when laid.
 - 2. Tool exposed mortar joints in repaired areas to match joints of surrounding existing masonry work.
 - 3. Rake out mortar used for laying brick and stone before mortar sets and point new mortar joints in repaired area to comply with requirements for repointing existing masonry, and at same time as repointing of surrounding area.

3.4 REANCHORING VENEERS

- A. Install masonry repair anchors in horizontal mortar joints and according to manufacturer's written instructions. Install at not more than 16 inches o.c. vertically and 32 inches o.c. horizontally, unless otherwise indicated. Install at locations to avoid penetrating flashing.
- B. Recess anchors at least 5/8 inch from surface of mortar joint and fill recess with pointing mortar.

3.5 MASONRY UNIT PATCHING AND REPAIRS

- A. Patch the following masonry units:
 - 1. Units indicated to be patched.
 - 2. Units with holes.
 - 3. Units with chipped edges or corners.
 - 4. Units with small areas of deep deterioration.
- B. Remove and replace existing patches, unless otherwise indicated or approved by Architect.
- C. Patching Bricks:

1. Remove loose material from brick surface. Remove additional material so patch will not have feathered edges and will be at least 1/4 inch thick, but not less than recommended by patching compound manufacturer.
2. Mask or remove surrounding mortar joints if patch will extend to edge of brick.
3. Mix patching compound in individual batches to match each unit being patched. Combine one or more colors of patching compound, as needed, to produce exact match.
4. Rinse surface to be patched and leave damp, but without standing water.
5. Brush-coat surfaces with slurry coat of patching compound according to manufacturer's written instructions.
6. Place patching compound in layers as recommended by patching compound manufacturer, but not less than 1/4 inch or more than 2 inches thick. Roughen surface of each layer to provide a key for next layer.
7. Trowel, scrape, or carve surface of patch to match texture and surface plane of surrounding brick. Shape and finish surface before or after curing, as determined by testing, to best match existing brick.
8. Keep each layer damp for 72 hours or until patching compound has set.

D. Stone Repairs and Partial Stone Replacement (Dutchman Repair):

1. At locations indicated, remove rectangular portion of stone units. Carefully remove stone by making vertical and horizontal saw cuts at face of stone and demolishing corner portion of stone unit to depth required for fitting partial replacement (Dutchman). Make edges of stone at cuts smooth and square to each other and to finished surface. Make back of removal area flat and parallel to stone face.
2. Remove mortar from joints that abut area of stone removal to same depth as stone was removed. Remove loose mortar particles and other debris from surfaces to be bonded and surfaces of adjacent stone units that will receive mortar by cleaning with stiff-fiber brush.
3. Trim partial replacement (Dutchman) to accurately fit area where stone was removed.
4. Apply stone-to-stone adhesive to comply with adhesive manufacturer's written instructions. Coat bonding surfaces of existing stone and partial replacement, completely filling all crevices and voids.
 - a. Apply partial replacement or fit stone fragments onto building stone while adhesive is still tacky and hold fragment securely in place until adhesive has cured.
 - b. Use shims, clamps, wedges, or other devices as necessary to align face of partial replacement with face of stone unit being repaired.
5. After adhesive has fully cured, further anchor partial replacements where indicated with 1/4-inch- diameter, plain stainless-steel rods set into 1/4-inch- diameter holes drilled at a 45-degree downward angle through face of stone. Center and space anchor rods between 3 and 5 inches apart and at least 2 inches from any edge. Insert rods at least 2 inches into backing stone and 2 inches into partial replacements with end countersunk at least 3/4 inch from exposed face of stone.
6. Clean residual adhesive from exposed surfaces.

3.6 CLEANING MASONRY, GENERAL

- A. Examination: Examine all surfaces scheduled for cleaning, for roughness, contaminants, unsound structural substrates, or other conditions that may impair the application. Notify the Engineer in writing of any such conditions; do not continue work until directed by Architect on how to proceed.

1. Monitor weather prior to work to ensure that air temperatures remain between 50°F and 85°F, or as recommended by the manufacturer of chemical compounds and proprietors of cleaning methods.
 2. Ensure that building components not to be cleaned, adjacent persons, property, and plant life are protected from all cleaning activities and wind drift. Test adjacent non-masonry materials for reaction with cleaning materials. Mask all windows, ornamental fixtures, hardware, wood doors, or other non-masonry surfaces.
- B. Proceed with cleaning in an orderly manner; work from top to bottom of each scaffold width and from one end of each elevation to the other.
- C. Use only those cleaning methods indicated for each masonry material and location.
1. Do not use wire brushes or brushes that are not resistant to chemical cleaner being used. Do not use plastic-bristle brushes if natural-fiber brushes will resist chemical cleaner being used.
 2. Use spray equipment that provides controlled application at volume and pressure indicated, measured at spray tip. Adjust pressure and volume to ensure that cleaning methods do not damage masonry.
 - a. Equip units with pressure gages.
 - b. Provide spray applications as follows:
 - 1) Low-Pressure Spray: 100 to 400 psi; 4 to 6 gpm.
 - 2) Medium-Pressure Spray: 400 to 800 psi; 4 to 6 gpm.
 - 3) High-Pressure Spray: 800 to 1200 psi; 4 to 6 gpm.
 3. For chemical cleaner spray application, use low-pressure tank or chemical pump suitable for chemical cleaner indicated, equipped with cone-shaped spray tip.
 4. For water spray application, use fan-shaped spray tip that disperses water at an angle of 25 to 50 degrees.
 5. For high-pressure water spray application, use fan-shaped spray tip that disperses water at an angle of at least 40 degrees.
 6. For heated water spray application, use equipment capable of maintaining temperature between 140 and 160 deg F at flow rates indicated.
 7. For steam application, use steam generator capable of delivering live steam at nozzle.
- D. Perform each cleaning method indicated in a manner that results in uniform coverage of all surfaces, including corners, moldings, and interstices, and that produces an even effect without streaking or damaging masonry surfaces.
- E. Removing Plant Growth: Completely remove plant, moss, and shrub growth from masonry surfaces. Carefully remove plants, creepers, and vegetation by cutting at roots and allowing to dry as long as possible before removal. Remove loose soil and debris from open masonry joints to whatever depth they occur.
- F. Preliminary Cleaning: Before beginning general cleaning, remove extraneous substances that are resistant to cleaning methods being used. Extraneous substances include paint, calking, asphalt, and tar.
1. Carefully remove heavy accumulations of material from surface of masonry with a sharp chisel. Do not scratch or chip masonry surface.
 2. Remove paint and calking with alkaline paint remover.

- a. Comply with requirements for paint removal.
 - b. Repeat application up to two times if needed.
3. Remove asphalt and tar with solvent-type paint remover.
 - a. Apply only to asphalt and tar by brush without prewetting.
 - b. Allow paint remover to remain on surface for 10 to 30 minutes.
 - c. Rinse off with water using low-pressure spray.
 - d. Repeat application if needed.

G. Water Application Methods:

1. Water Soak Application, for Stone: Soak stone surfaces by applying water continuously and uniformly to limited area for time indicated. Apply water at low pressures and low volumes in multiple fine sprays using perforated hoses or multiple spray nozzles. Erect a protective enclosure constructed of polyethylene sheeting to cover area being sprayed.
2. Spray Applications, for Brick and Stone: Unless otherwise indicated, hold spray nozzle at least 6 inches from surface of stone and apply water in horizontal back and forth sweeping motion, overlapping previous strokes to produce uniform coverage.

H. Steam Wash: Apply steam to masonry surfaces at pressures not exceeding 80 psi. Hold nozzle at least 6 inches from surface of masonry and apply steam in horizontal back and forth sweeping motion, overlapping previous strokes to produce uniform coverage.

I. Chemical Cleaner Application Methods: Apply chemical cleaners to masonry surfaces to comply with chemical cleaner manufacturer's written instructions; use brush or spray application methods, at Contractor's option. Do not spray apply at pressures exceeding 50 psi. Do not allow chemicals to remain on surface for periods longer than those indicated or recommended by manufacturer.

J. Rinse off chemical residue and soil by working upward from bottom to top of each treated area at each stage or scaffold setting. Periodically during each rinse, test pH of rinse water running off of cleaned area to determine that chemical cleaner is completely removed.

1. Apply neutralizing agent and repeat rinse, if necessary, to produce tested pH of between 6.7 and 7.5.

K. After cleaning is complete, remove protection no longer required. Remove tape and adhesive marks.

3.7 PAINT REMOVAL

A. Paint Removal with Alkaline Paste Paint Remover:

1. Apply paint remover to dry, painted masonry with brushes.
2. Allow paint remover to remain on surface for period recommended by manufacturer.
3. Rinse with water applied by low-pressure spray to remove chemicals and paint residue.
4. Repeat process, if necessary, to remove all paint.
5. Apply acidic cleaner to masonry, while surface is still wet, using low-pressure spray equipment or soft-fiber brush. Let cleaner remain on surface for period recommended by chemical cleaner manufacturer.
6. Rinse with cold water applied by low-pressure spray to remove chemicals and soil.

B. Paint Removal with Covered or Skin-Forming Alkaline Paint Remover:

1. Apply paint remover to dry, painted masonry with trowel, spatula, or as recommended by manufacturer.
2. Apply cover, if required by manufacturer, per manufacturer's written instructions.
3. Allow paint remover to remain on surface for period recommended by manufacturer or as determined in test panels.
4. Scrape off paint and remover and collect for disposal.
5. Rinse with water applied by low-pressure spray to remove chemicals and paint residue.
6. Use alkaline paste paint remover according to "Paint Removal with Alkaline Paste Paint Remover" Paragraph, if necessary, to remove remaining paint.
7. Apply acidic cleaner to masonry, while surface is still wet, using low-pressure spray equipment or soft-fiber brush. Let cleaner remain on surface for period recommended by chemical cleaner manufacturer.
8. Rinse with cold water applied by low-pressure spray to remove chemicals and soil.

C. Paint Removal with Solvent-Type Paint Remover:

1. Apply thick coating of paint remover to painted masonry with natural-fiber cleaning brush, deep-nap roller, or large paint brush.
2. Allow paint remover to remain on surface for period recommended by manufacturer. Agitate periodically with stiff-fiber brush.
3. Rinse with cold water applied by low-pressure spray to remove chemicals and paint residue.

3.8 MASONRY CLEANING

A. Cold-Water Wash: Use cold water applied by low-pressure spray.

B. Cold Water Soak:

1. Apply cold water by intermittent soaking.
2. Use perforated hoses or other means that will apply a fine water mist to entire surface being cleaned.
3. Apply water in cycles with at least 30 minutes between cycles.
4. Continue water application until surface encrustation has softened sufficiently to permit its removal by water wash, as indicated by cleaning tests.
5. Remove soil and softened surface encrustation from masonry with cold water applied by low-pressure spray.

C. Hot-Water Wash: Use hot water applied by low-pressure spray.

D. Steam Cleaning: Apply steam at pressures not exceeding 80 psi.

E. Detergent Cleaning:

1. Wet masonry with water applied by low-pressure spray.
2. Scrub masonry with detergent solution using medium-soft brushes until soil is thoroughly dislodged and can be removed by rinsing. Use small brushes to remove soil from mortar joints and crevices. Dip brush in solution often to ensure that adequate fresh detergent is used and that masonry surface remains wet.
3. Rinse with water applied by low-pressure spray to remove detergent solution and soil.

4. Repeat cleaning procedure above where required to produce cleaning effect established by mockup.

F. Mold, Mildew, and Algae Removal:

1. Wet masonry with water applied by low-pressure spray.
2. Apply mold, mildew, and algae remover by brush or low-pressure spray.
3. Scrub masonry with medium-soft brushes until mold, mildew, and algae are thoroughly dislodged and can be removed by rinsing. Use small brushes for mortar joints and crevices. Dip brush in mold, mildew, and algae remover often to ensure that adequate fresh cleaner is used and that masonry surface remains wet.
4. Rinse with water applied by low-pressure spray to remove mold, mildew, and algae remover and soil.
5. Repeat cleaning procedure above where required to produce cleaning effect established by mockup.

G. Nonacidic Gel Chemical Cleaning:

1. Wet masonry with water applied by low-pressure spray.
2. Apply nonacidic gel cleaner in 1/8-inch thickness by brush, working into joints and crevices. Apply quickly and do not brush out excessively so area will be uniformly covered with fresh cleaner and dwell time will be uniform throughout area being cleaned.
3. Let cleaner remain on surface for period indicated below:
 - a. As recommended by chemical cleaner manufacturer.
 - b. As established by mockup.
4. Remove bulk of nonacidic gel cleaner by squeegeeing into containers for disposal.
5. Rinse with water applied by low-pressure spray to remove chemicals and soil.
6. Repeat cleaning procedure above where required to produce cleaning effect established by mockup. Do not repeat more than once. If additional cleaning is required, use steam wash.

H. Nonacidic Liquid Chemical Cleaning:

1. Wet masonry with water applied by low-pressure spray.
2. Apply cleaner to masonry in two applications by brush. Let cleaner remain on surface for period indicated below:
 - a. As recommended by chemical cleaner manufacturer.
 - b. As established by mockup.
 - c. Two to three minutes.
3. Rinse with water applied by low-pressure spray to remove chemicals and soil.
4. Repeat cleaning procedure above where required to produce cleaning effect established by mockup. Do not repeat more than once. If additional cleaning is required, use steam wash.

I. Mild Acidic Chemical Cleaning:

1. Wet masonry with cold water applied by low-pressure spray.

2. Apply cleaner to masonry in two applications by brush or low-pressure spray. Let cleaner remain on surface for period indicated below:
 - a. As recommended by chemical cleaner manufacturer.
 - b. As established by mockup.
 - c. Two to three minutes.
3. Rinse with cold water applied by low-pressure spray to remove chemicals and soil.
4. Repeat cleaning procedure above where required to produce cleaning effect established by mockup. Do not repeat more than once. If additional cleaning is required, use steam wash.

3.9 REPOINTING MASONRY

- A. Rake out and repoint mortar joints to the following extent:
 1. All joints in areas indicated.
 2. Joints where mortar is missing or where they contain holes.
 3. Cracked joints where cracks can be penetrated at least 1/4 inch by a knife blade 0.027 inch thick.
 4. Cracked joints where cracks are 1/8 inch or more in width and of any depth.
 5. Joints where they sound hollow when tapped by metal object.
 6. Joints where they are worn back 1/4 inch or more from surface.
 7. Joints where they are deteriorated to point that mortar can be easily removed by hand.
 8. Joints, other than those indicated as sealant-filled joints, where they have been filled with substances other than mortar.
- B. Do not rake out and repoint joints where not required.
- C. Rake out joints as follows:
 1. Remove mortar from joints to depth of 2 times joint width, but not less than 1/2 inch or not less than that required to expose sound, unweathered mortar.
 2. Remove mortar from masonry surfaces within raked-out joints to provide reveals with square backs and to expose masonry for contact with pointing mortar. Brush, vacuum, or flush joints to remove dirt and loose debris.
 3. Do not spall edges of masonry units or widen joints. Replace or patch damaged masonry units as directed by Architect.
 - a. Cut out mortar by hand with chisel and mallet. Do not use power-operated grinders without Architect's written approval based on submission by Contractor of a satisfactory quality-control program and demonstrated ability of operators to use tools without damaging masonry. Quality-control program shall include provisions for supervising performance and preventing damage due to worker fatigue.
 - b. Cut out center of mortar bed joints using angle grinders with diamond-impregnated metal blades. Remove remaining mortar by hand with chisel and mallet. Strictly adhere to written quality-control program. Quality-control program shall include provisions for demonstrating ability of operators to use tools without damaging masonry, supervising performance, and preventing damage due to worker fatigue.
- D. Notify Architect of unforeseen detrimental conditions including voids in mortar joints, cracks, loose masonry units, rotted wood, rusted metal, and other deteriorated items.

E. Point joints as follows:

1. Rinse masonry-joint surfaces with water to remove dust and mortar particles. Time rinsing application so, at time of pointing, joint surfaces are damp but free of standing water. If rinse water dries, dampen masonry-joint surfaces before pointing.
2. Apply pointing mortar first to areas where existing mortar was removed to depths greater than surrounding areas. Apply in layers not greater than 3/8 inch until a uniform depth is formed. Fully compact each layer thoroughly and allow it to become thumbprint hard before applying next layer.
3. After low areas have been filled to same depth as remaining joints, point all joints by placing mortar in layers not greater than 3/8 inch. Fully compact each layer and allow to become thumbprint hard before applying next layer.
 - a. Where existing bricks have worn or rounded edges, slightly recess finished mortar surface below face of masonry to avoid widened joint faces.
 - b. Take care not to spread mortar over edges onto exposed masonry surfaces or to feathered edge mortar.
4. When mortar is thumbprint hard, tool joints to match original appearance of joints. Remove excess mortar from edge of joint by brushing.

F. Cure mortar by maintaining in thoroughly damp condition for at least 72 hours including weekends and holidays.

1. Acceptable curing methods include covering with wet burlap and plastic sheeting, periodic hand misting, and periodic mist spraying using system of pipes, mist heads, and timers.
2. Adjust curing methods to ensure that pointing mortar is damp throughout its depth without eroding surface mortar.

G. Where repointing work precedes cleaning of existing masonry, allow mortar to harden at least 30 days before beginning cleaning work.

3.10 FINAL CLEANING

- A. After mortar has fully hardened, thoroughly clean exposed masonry surfaces of excess mortar and foreign matter; use wood scrapers, stiff-nylon or -fiber brushes, and clean water, spray applied at low pressure.
1. Do not use metal scrapers or brushes.
 2. Do not use acidic or alkaline cleaners.
- B. Wash adjacent woodwork and other nonmasonry surfaces. Use detergent and soft brushes or cloths.
- C. Clean masonry debris from roof; remove debris from gutters and downspouts. Rinse off roof and flush gutters and downspouts.
- D. Sweep and rake adjacent pavement and grounds to remove masonry debris. Where necessary, pressure wash surfaces to remove mortar, dust, dirt, and stains.

3.11 FIELD QUALITY CONTROL

- A. Inspectors: Owner will engage qualified independent inspectors to perform inspections and prepare test reports. Coordinate with inspectors and provide access. Allow inspectors use of lift devices and scaffolding, as needed, to perform inspections.

END OF SECTION

SECTION 042000

UNIT MASONRY

(Part of Work of Section 040001 - MASONRY WORK, Filed Sub-Bid Required)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
1. Concrete masonry units.
 2. Face brick.
 3. Embedded flashing.
 4. Stone trim units.
 5. Installation of cast stone trim units.
 6. Mortar and grout.
 7. Reinforcing steel, masonry joint reinforcement, ties and anchors.
 8. Hoisting Equipment: The Masonry subcontractor shall furnish, install, and maintain in safe and adequate condition, all mechanical hoisting equipment, operating personnel, and rigging that is necessary for the proper execution of the Work of this Section. The requirements of Section 010000 – GENERAL REQUIREMENTS, Temporary Facilities and Controls, in relation to hoisting and rigging being the responsibility of the General Contractor, do not apply to the work of this Section.
 9. Staging, Planking and Scaffolding: The Masonry subcontractor shall furnish, install and maintain in safe and adequate condition, all staging, planking and scaffolding up to eight feet in height that is necessary for the proper execution of the Work in this Section. The General Contractor shall furnish, install, and maintain in safe and adequate condition all staging, planking, and scaffolding above eight feet in height.
- B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council. Refer to Section 018110, SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.
- C. Items To Be Installed Only:
1. Section 055000 - METAL FABRICATIONS:
 - a. Lintels, miscellaneous metal and iron sleeves, anchors, inserts and plates to be built into masonry walls.

2. Section 055100 - METAL STAIRS AND RAILINGS:
 - a. Miscellaneous metal and iron sleeves, anchors, inserts and plates to be built into masonry walls.
3. Section 061000 - ROUGH CARPENTRY:
 - a. Wood nailers and blocking built into masonry.
4. Section 083110 - ACCESS DOORS AND FRAMES
 - a. Access doors and frames in masonry openings.
5. Section 142100 - ELECTRIC TRACTION ELEVATORS:
 - a. Elevator rail bracket inserts.

D. Items To Be Furnished Only:

1. Section 033000 - CAST-IN-PLACE CONCRETE:
 - a. Dovetail slots for masonry anchors.
2. Section 051200 - STRUCTURAL STEEL FRAMING:
 - a. Anchor sections of adjustable masonry anchors for connecting to structural frame.

E. Related Work: The following items are not included in this Section and are specified under the designated Sections:

1. Section 047200 - CAST STONE MASONRY for cast stone units.
2. Section 061600 - SHEATHING for gypsum sheathing on cold-formed metal framing.
3. Section 072100 - THERMAL INSULATION for cavity wall insulation.
4. Section 072700 - AIR BARRIERS for membrane air barrier.
5. Section 078440 - FIRE-RESISTIVE JOINT SYSTEMS for fire-resistive joint systems openings in masonry walls and at heads of masonry walls.
6. Section 079200 - JOINT SEALANTS for sealing control and expansion joints in unit masonry.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. LEED Submittals:
 1. Building Product Disclosure and Optimization, Environmental Product Declarations (EPD):
 - a. Option 1: For steel reinforcements (rebars), submit industry-wide EPDs.
- C. Shop Drawings: For the following:

1. Masonry Units: Show sizes, profiles, coursing, and locations of special shapes.
 2. **Stone Trim Units: Show sizes, profiles, and locations of each stone trim unit required.**
 3. Reinforcing Steel: Detail bending and placement of unit masonry reinforcing bars. Comply with ACI 315, "Details and Detailing of Concrete Reinforcement."
- D. Samples for Verification: For each type and color of the following:
1. Exposed concrete masonry units.
 2. Face brick, in the form of straps of five or more bricks.
 3. Pigmented mortar. Make Samples using same sand and mortar ingredients to be used on Project. Label Samples to indicate types and amounts of pigments used.
 4. **Stone trim.**
 5. Weep holes/vents.
 6. Accessories embedded in masonry.
- E. Qualification Data: For testing agency.
- F. Material Certificates: Include statements of material properties indicating compliance with requirements including compliance with standards and type designations within standards. Provide for each type and size of the following:
1. Masonry units:
 - a. Include material test reports substantiating compliance with requirements.
 - b. For bricks, include size-variation data verifying that actual range of sizes falls within specified tolerances.
 - c. For exposed brick, include material test report for efflorescence according to ASTM C 67.
 - d. For masonry units used in structural masonry, include data and calculations establishing average net-area compressive strength of units.
 2. Cementitious materials. Include brand, type, and name of manufacturer.
 3. Mortar mixes. Include description of type and proportions of ingredients.
 4. Grout mixes. Include description of type and proportions of ingredients.
 5. Reinforcing bars.
 6. Joint reinforcement.
 7. Anchors, ties, and metal accessories.
- G. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.
1. Include test reports, per ASTM C 780 for mortar mixes required to comply with property specification.
 2. Include test reports, per ASTM C 1019 for grout mixes required to comply with compressive strength requirement.
- H. Cold-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with cold-weather requirements.

1.4 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An independent agency qualified according to ASTM C 1093 for testing indicated.
- B. 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, through one source from a single manufacturer for each product required.
- C. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from a single manufacturer for each cementitious component and from one source or producer for each aggregate.
- D. Preconstruction Testing Service: The Owner will engage a qualified independent testing agency to perform preconstruction testing indicated below. Payment for these services will be made by the Owner. Retesting of materials that fail to meet specified requirements shall be done at Contractor's expense.
 - 1. Prism Test: For each type of construction required, per ASTM C 1314.
- E. Fire-Resistance Ratings: Where indicated, provide materials and construction identical to those of assemblies with fire-resistance ratings determined per ASTM E 119 by a testing and inspecting agency, by equivalent concrete masonry thickness, or by other means, as acceptable to authorities having jurisdiction.
- F. Sample Panels: Build sample panels to verify selections made under sample submittals and to demonstrate aesthetic effects. Comply with requirements in Division 01 for mockups.
 - 1. Build sample panels for typical exterior and interior walls in sizes approximately 48 inches long by 48 inches high by full thickness.
 - 2. Where masonry is to match existing, erect panels adjacent and parallel to existing surface.
 - 3. Clean one-half of exposed faces of panels with masonry cleaner indicated.
 - 4. Protect approved sample panels from the elements with weather-resistant membrane.
 - 5. Approval of sample panels is for color, texture, and blending of masonry units; relationship of mortar and sealant colors to masonry unit colors; tooling of joints; aesthetic qualities of workmanship; and other material and construction qualities specifically approved by Architect in writing.
 - a. Approval of sample panels does not constitute approval of deviations from the Contract Documents contained in sample panels unless such deviations are specifically approved by Architect in writing.
- G. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to exceed tolerances and to contain chips, cracks, or other defects exceeding limits stated in the standard. Do not use units where such defects, including dimensions that vary from specified dimensions by more than stated tolerances, will be exposed in the completed Work or will impair the quality of completed masonry.
- H. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01. Agenda shall include protection of air barrier membrane during construction.

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. Deliver preblended, dry mortar mix in moisture-resistant containers designed for lifting and emptying into dispensing silo. Store preblended, dry mortar mix in delivery containers on elevated platforms, under cover, and in a dry location or in a metal dispensing silo with weatherproof cover.
- E. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.6 PROJECT CONDITIONS

- A. Protection of Air Barrier Membrane: During construction, protect air barrier membrane from penetrations which allow air to pass through air barrier assemblies. Engage original installer to repair damage promptly using identical materials and methods of installation, and to the satisfaction of the Architect.
- B. 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 and hold cover securely in place.
 - 2. Where 1 wythe of multiwythe masonry walls is completed in advance of other wythes, secure cover a minimum of 24 inches down face next to unconstructed wythe and hold cover in place.
- C. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least 3 days after building masonry walls or columns.
- D. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.
 - 1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
 - 2. Protect sills, ledges, and projections from mortar droppings.
 - 3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
 - 4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.

- E. 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 above and will remain so until masonry has dried, but not less than 7 days after completing cleaning.
- F. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

PART 2 - PRODUCTS

2.1 CONCRETE MASONRY UNITS (CMUS)

- A. Regional Materials: Provide CMUs that have been manufactured within 500 miles of Project site, from aggregates and cement that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles of Project site.
- B. Concrete Masonry Units: ASTM C 90, normal weight unless indicated otherwise manufactured to dimensions 3/8 inch less than nominal dimensions.
- C. Shapes: Provide standard shapes indicated and as required for building configuration. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.
- D. Decorative Concrete Masonry Units: ASTM C 90.
 - 1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 2000 psi
 - 2. Weight Classification: Normal weight.
 - 3. Size (Width): Manufactured to dimensions specified in "Concrete Masonry Units" Paragraph above.
 - 4. Pattern and Texture:
 - a. Standard pattern, ground finish.
 - 5. Colors: As selected by Architect from manufacturer's full range.
 - 6. Special Aggregate: Provide units made with aggregate matching aggregate in Architect's sample.
 - 7. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. A Jandris & Sons
 - b. Trenwyth Industries.
 - c. Westbrook Concrete Block Co.
- E. Integral Water Repellent: Provide units made with integral water repellent for exterior exposed units.

1. Integral Water Repellent: Liquid polymeric, integral water-repellent admixture that does not reduce flexural bond strength. Units made with integral water repellent, when tested as a wall assembly made with mortar containing integral water-repellent manufacturer's mortar additive according to ASTM E 514, with test period extended to 24 hours, show no visible water or leaks on the back of test specimen. Available products include:
 - a. ACM Chemistries: RainBlock
 - b. Addiment Incorporated, a Div. of Grace Construction Products; Block Plus W-10.
 - c. GCP Applied Technologies (formerly W.R. Grace); Dry-Block.
 - d. BASF Construction Chemicals; Masterpel.

2.2 BRICK

- A. Regional Materials: Provide brick that has been manufactured within 500 miles of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles of Project site.
- B. Face Brick: ASTM C 216, Grade SW, Type FBS.
 1. Trade Reference and Color: As selected by Architect.
 2. Size (Actual Dimensions): As selected by Architect.
 3. Initial Rate of Absorption: Less than 30 g/30 sq. in. per minute when tested per ASTM C 67.
 4. Efflorescence: Provide brick that has been tested according to ASTM C 67 and is rated "not effloresced."
 5. Where shown to "match existing," provide face brick matching color range, texture, and size of existing adjacent brickwork.
- C. Building (Common) Brick where Concealed: ASTM C 62, Grade SW.
- D. General: Provide shapes indicated and as follows:
 1. For ends of sills and caps and for similar applications that would otherwise expose unfinished brick surfaces, provide units without cores or frogs and with exposed surfaces finished.
 2. Provide special shapes for applications where stretcher units cannot accommodate special conditions, including those at corners, movement joints, bond beams, sashes, and lintels.
 3. Provide special shapes for applications requiring brick of size, form, color, and texture on exposed surfaces.
 4. Provide special shapes for applications where shapes produced by sawing would result in sawed surfaces being exposed to view.
 5. Units which are sawn and less than one-half full size shall not be used.

2.3 STONE TRIM UNITS

- A. Granite: Provide granite complying with ASTM C 615 and NBGQA's "Specifications for Architectural Granite" and as follows:
 1. Varieties, Cut and Finish: As selected by Architect.

- B. Limestone: Provide limestone complying with ASTM C 568 and ILI's "Indiana Limestone Handbook" and as follows:
 - 1. Varieties, Cut and Finish: As selected by Architect.
- C. Provide stone units accurately shaped, with exposed faces dressed true, and with beds and joints at right angles to faces.
 - 1. For granite, comply with recommendations in NBGQA's "Specifications for Architectural Granite."
 - 2. For limestone, comply with recommendations in ILI's "Indiana Limestone Handbook."

2.4 MORTAR AND GROUT MATERIALS

- A. Regional Materials: Provide aggregate for mortar and grout, cement, and lime that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles of Project site.
- B. Portland Cement: ASTM C 150, Type I 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.
- C. Hydrated Lime: ASTM C 207, Type S.
- D. Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes. Use only pigments with a record of satisfactory performance in masonry mortar.
 - 1. Available Products:
 - a. LanXess; Bayferrox Iron Oxide Pigments.
 - b. Davis Colors; True Tone Mortar Colors.
 - c. Solomon Grind-Chem Services, Inc.; SGS Mortar Colors.
- E. Aggregate for Mortar: ASTM C 144. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
- F. Aggregate for Grout: ASTM C 404.
- G. Water-Repellent Admixture: Liquid water-repellent mortar admixture intended for use with concrete masonry units, containing integral water repellent by same manufacturer. Available products include:
 - 1. Addiment Incorporated, a Div. of Grace Construction Products; Mortar Tite.
 - 2. GCP Applied Technologies (formerly W.R. Grace); Dry-Block Mortar Admixture.
 - 3. BASF Construction Chemicals; MasterPel Mortar Admixture.
- H. Water: Potable.

2.5 REINFORCEMENT

- A. Environmental Product Declarations (EPD): Industry-wide EPDs for steel reinforcements (rebars) are available from the Concrete Reinforcing Steel Institute (CRSI).

- B. Uncoated Steel Reinforcing Bars: ASTM A 615/A 615M or ASTM A 996/A 996M, Grade 60.
- C. 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 and Spacing: As required by Code.
 - 4. Provide in lengths of not less than 10 feet, with prefabricated corner and tee units.
- D. Masonry Joint Reinforcement for Multiwythe Masonry:
 - 1. Ladder type with 1 side rod at each face shell of hollow masonry units more than 4 inches in width, plus 1 side rod at each wythe of masonry 4 inches or less in width.

2.6 TIES AND ANCHORS

- A. Materials: Provide ties and anchors specified in subsequent paragraphs that are made from materials that comply with subparagraphs below, unless otherwise indicated.
 - 1. Mill-Galvanized, Carbon-Steel Wire: ASTM A 82; with ASTM A 641/A 641M, Class 1 coating.
 - 2. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A 82; with ASTM A 153/A 153M, Class B-2 coating.
 - 3. Stainless-Steel Wire: ASTM A 580/A 580M, Type 316.
 - 4. Galvanized Steel Sheet: ASTM A 653/A 653M, Commercial Steel, G60 zinc coating.
 - 5. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
 - 6. Stainless Steel Bars: ASTM A 276 or ASTM A 666, Type 304.
- B. Adjustable Anchors for Connecting to Structure: 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, hot-dip galvanized steel. Mill-galvanized wire may be used at interior walls, unless otherwise indicated.
- C. Partition Top Anchors: 0.097-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.
- D. Stone Anchors: Fabricate dowels, cramps, and other stone anchors from stainless steel.
- E. Adjustable Masonry-Veneer Anchors: POS-I-TIE
 - 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, with structural performance capable of withstanding a 100-lbf load in both tension and compression without deforming or developing play in excess of 0.05 inch.
 - 2. Screw-Attached, Masonry-Veneer Anchors: Units, equal to Pos-I-Tie Brick Veneer Anchoring System by Heckmann Building Products Inc., consisting of a wire tie and a metal anchor section.

- a. Anchor Section: Zinc-alloy barrel section with flanged head with wing-nut eye and corrosion-resistant, self-drilling screw. Eye designed to receive wire tie and to serve as head for drilling fastener into framing. Barrel length to suit sheathing thickness, allowing screw to seat directly against framing with flanged head covering hole in sheathing.
 - b. Wire Ties: Triangular-, rectangular-, or T-shaped wire ties fabricated from 0.188-inch-diameter, hot-dip galvanized steel wire.
- F. Adjustable Masonry-Veneer Anchors: **SGH FAVORITE, Lance Robson too.**
 - 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, with structural performance capable of withstanding a 100-lbf load in both tension and compression without deforming or developing play in excess of 0.05 inch.
 - 2. Screw-Attached, Masonry-Veneer Anchors: Units equal to HB-213 Adjustable Veneer Anchor by Hohmann & Barnard, Inc., consisting of a wire tie and a metal anchor section.
 - a. Anchor Section: Rib-stiffened, sheet metal plate with 9/32 inch diameter screw holes top and bottom, 2-3/4 inches wide by 3 inches high; with projecting tabs having slotted holes with 1-1/4 inch maximum allowable eccentricity, sized to prevent in-and-out movement beyond allowable tolerances, for inserting vertical legs of wire tie specially formed to fit anchor section.
 - b. Wire Ties: Rectangular-shaped wire ties fabricated from 0.188-inch-diameter, hot-dip galvanized steel wire.
- G. Adjustable Masonry-Veneer Anchors – Thermally-Broken:
 - 1. General: Provide thermally-broken 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, with structural performance capable of withstanding a 100-lbf load in both tension and compression without deforming or developing play in excess of 0.05 inch.
 - 2. Screw-Attached, Masonry-Veneer Anchors: Units consisting of a wire tie and a metal anchor section.
 - a. Anchor Section: Stainless steel barrel section, polymer coated screw with hex head with plastic-encapsulated steel wing and corrosion-resistant, self-drilling screw. Wing designed to receive wire tie. Barrel length to suit sheathing thickness, allowing screw to seat directly against framing with flanged head covering hole in sheathing.
 - b. Wire Ties: Triangular-, rectangular-, or T-shaped wire ties fabricated from 0.188-inch-diameter, hot-dip galvanized steel wire.
 - c. Basis-of-Design: 2-Seal Thermal Wing Nut Anchor by Hohmann & Barnard or approved equal by Posi-Tie (thermally broken), or equal.
- H. 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, with structural performance capable of withstanding a 100-lbf load in both tension and compression without deforming or developing play in excess of 0.05 inch.

2. Screw-Attached, Masonry-Veneer Anchors: Units equal to DW-10-X Veneer Anchoring System by Hohmann & Barnard, consisting of a wire tie and a metal anchor section:
 - a. Anchor Section: Gasketed sheet metal plate, 1-1/4 inches wide by 6 inches long, with screw holes top and bottom; top and bottom ends bent to form pronged legs of length to match thickness of insulation or sheathing; and raised rib-stiffened strap, 5/8 inch wide by 6 inches long, stamped into center to provide a slot between strap and plate for inserting wire tie. Provide anchor manufacturer's standard, self-adhering, modified bituminous gaskets manufactured to fit behind anchor plate and extend beyond pronged legs.
 - b. Fabricate sheet metal anchor sections and other sheet metal parts from 0.067-inch-thick, steel sheet, galvanized after fabrication.
 - c. Wire Ties: Triangular wire ties fabricated from 0.25-inch-diameter, hot-dip galvanized steel wire.

2.7 MISCELLANEOUS ANCHORS

- A. Anchor Bolts: 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/A 153M, Class C; of dimensions indicated.

2.8 EMBEDDED FLASHING MATERIALS

- A. Metal Flashing: Provide metal flashing complying with Section 076200 - SHEET METAL FLASHING AND TRIM and as follows:
 1. Stainless Steel: ASTM A 240/A 240M, Type 304, 0.016 inch (0.40 mm) thick.
 2. Configuration: Provide continuous flashing including preformed outside, inside corners, and end dams with smooth uninterrupted soldered seams and hemmed edges to maintain continuity. See drawings for profiles required.

B. Flexible Laminated Stainless Steel Flashing:

1. Available Products:

- a. Hohmann & Barnard, Inc.; Mighty-Flash Stainless Steel Fabric Flashing.
- b. Illinois Products, Inc.; IPCO Stainless Steel Fabric Flashing.
- c. STS Coatings, Inc.; Gorilla Flash Stainless Fabric.
- d. TK Products, Inc.; TK TWF.
- e. York Manufacturing, Inc.; Multi-Flash SS.

2. Materials:

- a. Type: Stainless steel core with polymer fabric laminated to one stainless steel face with non-asphalt adhesive.
- b. Stainless steel type: 304, ASTM A666.
- c. Fabric: Polymer fabric; laminated back face of stainless steel core.

3. Accessories:

- a. Sealant: Provide sealants as recommended by flashing manufacturer.

- b. **Splice Tape: Provide minimum 4" wide self-adhering strips and as recommended by flashing manufacturer.**
 - c. **Termination Bar: Provide stainless steel termination bars with sealant catch lip.**
 - d. **Preformed Shapes: Provide Type 304, 0.016 inch (0.40 mm) thick stainless steel preformed end dams, outside and inside corners.**
- C. Solder and Sealants for Sheet Metal Flashings: As specified in Section 076200 – SHEET METAL FLASHING AND TRIM.
- D. 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. Verify compatibility between flashing materials and substrates.
- E. Transition Strips: Provide long-term compatible 6" wide transition strips to seal embedded flashing terminations to air barrier membrane.
- F. Drip Edge: Provide type 316, 0.016 inch (0.40 mm) thick stainless steel drip edge plates with factory applied adhesive strip for all through-wall flashing conditions. Provide preformed outside and inside corner drip plate corners with smooth uninterrupted soldered seams and hemmed drip edges to maintain continuity. Custom sizes will be required see drawings for profiles required.

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 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, organic roofing felt complying with ASTM D 226, Type I (No. 15 asphalt felt).
- D. Weep/Vent Products: Free-draining mesh; made from polyethylene strands, 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: Free-draining mesh, made from polymer strands that will not degrade within the wall cavity. Provide strips, full-depth of cavity and 10 inches wide, with dovetail shaped notches 7 inches deep that prevent mesh from being clogged with mortar droppings or equivalent. Available products:
 - 1. Advanced Building Products Inc.; Mortar Break II.
 - 2. Archovations, Inc.; CavClear Masonry Mat.
 - 3. Hohmann & Barnard; MortarTrap.
 - 4. Mortar Net USA, Ltd.; Mortar Net.

2.10 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. Available Manufacturers:

- a. Diedrich Technologies, Inc.
- b. EaCo Chem, Inc.
- c. ProSoCo, Inc.

2.11 MORTAR AND GROUT MIXES

A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures, unless otherwise indicated.

1. Do not use calcium chloride in mortar or grout.
2. Limit cementitious materials in mortar to portland cement and lime.

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 or needed to provide required compressive strength of masonry.

1. For masonry below grade or in contact with earth, use Type M.
2. For reinforced masonry, use Type S.
3. For exterior, above-grade, load-bearing 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.

C. Pigmented Mortar: Use colored cement product. Pigments shall not exceed 10 percent of portland cement by weight.

D. 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/C 143M.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.

1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.
2. Verify that foundations are within tolerances specified.

- 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. Do not use units cut to less than one-half size.
- E. Do not install concrete masonry units with more than 5 percent damage to the face. Do not install brick units which will show defects after installation.
- F. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures. Mix units from several pallets or cubes as they are placed.
- G. **Matching Existing Masonry: Match coursing, bonding, color, and texture of existing masonry.**
- H. Comply with construction tolerances in ACI 530.1/ASCE 6/TMS 602 and with the following:
 - 1. 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.
 - 2. 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.
 - 3. 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.
 - 4. For exposed 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. Do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch.
 - 5. 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.
 - 6. 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.

3.3 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 bond pattern indicated on Drawings; do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs. Prior to installation review bond pattern with Architect.
- C. 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.
- D. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.
- E. Fill space between steel frames and masonry solidly with mortar, unless otherwise indicated.
- F. Fill cores in hollow concrete masonry units with grout 24 inches under bearing plates, beams, lintels, posts, and similar items, unless otherwise indicated.
- G. Build non-load-bearing interior partitions full height of story to underside of solid floor or roof structure above, unless otherwise indicated.
 - 1. Install compressible filler in joint between top of partition and underside of structure above.
 - 2. Fasten partition top anchors to structure above and build into top of partition. Grout cells of CMUs solidly around plastic tubes of anchors and push tubes down into grout to provide 1/2-inch clearance between end of anchor rod and end of tube. Space anchors 48 inches o.c., unless otherwise indicated.
 - 3. Wedge non-load-bearing partitions against structure above with small pieces of tile, slate, or metal. Fill joint with mortar after dead-load deflection of structure above approaches final position.
 - 4. At fire-rated partitions, treat joint between top of partition and underside of structure above to comply with Section 078440 – FIRE-RESISTIVE JOINT SYSTEMS.

3.4 MORTAR BEDDING AND JOINTING

- A. Lay hollow brick and concrete masonry units 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 stone trim units in full bed of mortar with full vertical joints. Fill dowel, anchor, and similar holes.
 - 1. Clean soiled surfaces with fiber brush and soap powder and rinse thoroughly with clear water.
 - 2. Allow cleaned surfaces to dry before setting.
- 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.

3.5 CAVITY WALLS

- A. Bond wythes of cavity walls together using one of the following methods:
 - 1. Masonry Joint Reinforcement: Installed in horizontal mortar joints. Where one wythe is of clay masonry and the other of concrete masonry, use adjustable (two-piece) type reinforcement with continuous horizontal wire in facing wythe attached to ties to allow for differential movement regardless of whether bed joints align.
 - 2. Masonry Veneer Anchors: Comply with requirements for anchoring masonry veneers.
- B. Bond wythes of cavity walls together using bonding system indicated on Drawings.
- C. 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.
- D. Coordinate and allow access for air and vapor barrier membrane installed in cavity under Section 072700 - AIR BARRIERS.

3.6 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. Space reinforcement not more than 16 inches o.c.
- B. Interrupt joint reinforcement at control and expansion joints, unless otherwise indicated.
- C. Provide continuity at wall intersections by using prefabricated T-shaped units.
- D. Provide continuity at corners by using prefabricated L-shaped units.

3.7 ANCHORING MASONRY TO STRUCTURAL MEMBERS

- A. Anchor masonry to structural members where masonry abuts or faces structural members to comply with the following:

1. Provide an open space not less than 1 inch in width between masonry and structural member, unless otherwise indicated. Keep open space free of mortar and other rigid materials.
2. Anchor masonry to structural members 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.

3.8 ANCHORING MASONRY VENEERS

- A. Anchor masonry veneers with masonry-veneer anchors to comply with the following requirements:
 1. Fasten screw-attached anchors through insulation and sheathing to wall framing and to concrete and masonry backup as applicable with metal fasteners of type indicated.
 2. Embed tie sections in masonry joints. Provide air space indicated on the Drawings between back of masonry veneer and face of insulation.
 3. Locate anchor sections to allow maximum vertical differential movement of ties up and down.
 4. Space anchors as required by Code.

3.9 CONTROL AND EXPANSION JOINTS

- A. General: Install control and expansion joint materials in unit masonry as masonry progresses. Do not allow materials to span control and expansion joints without provision to allow for in-plane wall or partition movement.
- B. Form control joints in concrete masonry using one of the following methods:
 1. Fit bond-breaker strips into hollow contour in ends of concrete masonry units on one side of control joint. Fill resultant core with grout and rake out joints in exposed faces for application of sealant.
 2. Install preformed control-joint gaskets designed to fit standard sash block.
 3. Install interlocking units designed for control joints. Install bond-breaker strips at joint. Keep head joints free and clear of mortar or rake out joint for application of sealant.
 4. Install temporary foam-plastic filler in head joints and remove filler when unit masonry is complete for application of sealant.
- C. Form expansion joints in brick made from clay or shale as follows:
 1. Build flanges of metal expansion strips into masonry. Lap each joint 4 inches in direction of water flow. Seal joints below grade and at junctures with horizontal expansion joints if any.
 2. Build flanges of factory-fabricated, expansion-joint units into masonry.
 3. Build in compressible joint fillers where indicated.
 4. 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 Section 079200 - JOINT SEALANTS.
- D. 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 Section 079200 - JOINT SEALANTS but not less than 3/8 inch.

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

3.10 LINTELS

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

3.11 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.
- 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 1-1/2 inches into the inner wythe. Form 1/4-inch hook in edge of flashing embedded in inner wythe.
 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 covered with elastomeric membrane, 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. Install air barrier transition strips to seal embedded flashings in masonry to air barrier membrane in accordance with Section 072700 – AIR BARRIERS.
- C. Install reglets and nailers for flashing and other related construction where they are shown to be built into masonry.
- D. Install metal drip edge plate in accordance with architectural details and manufacturer's requirements.
- 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 to form weep holes.
 2. Space weep holes 24 inches o.c., unless otherwise indicated.
- F. Place cavity drainage material in cavities to comply with configuration requirements for cavity drainage material in Part 2 "Miscellaneous Masonry Accessories" Article.
- G. Install vents in head joints in exterior wythes at spacing indicated.

3.12 REINFORCED UNIT MASONRY INSTALLATION

- A. Temporary Formwork and Shores: Construct formwork and shores as needed to support reinforced masonry elements during construction.
 - 1. Construct formwork to provide shape, line, and dimensions of completed masonry as indicated. Make forms sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
 - 2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and other temporary loads that may be placed on them during construction.
- B. Placing Reinforcement: Comply with requirements in ACI 530.1/ASCE 6/TMS 602.
- C. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure. 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.

3.13 FIELD QUALITY CONTROL

- A. Inspectors: Owner will engage qualified independent inspectors to perform inspections and prepare reports. Allow inspectors access to scaffolding and work areas, as needed to perform inspections. Place grout only after inspectors have verified compliance of grout spaces and grades, sizes, and locations of reinforcement.
- B. Testing Agency: Engage a qualified independent testing and inspecting agency to perform field tests and inspections indicated below and prepare test reports. Retesting of materials failing to comply with specified requirements shall be done at Contractor's expense.
- C. Testing Frequency: One set of tests for each 5000 sq. ft. of wall area or portion thereof. Test types as determined by the independent testing and inspection agency.

3.14 REPAIRING, POINTING, AND CLEANING

- A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.
- B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, around penetrations and where indicated.
- C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.
- D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
 - 1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.

2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
3. Protect adjacent stone and nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
5. Clean concrete masonry by cleaning method indicated in NCMA TEK 8-2A applicable to type of stain on exposed surfaces.
6. Clean brick by bucket-and-brush hand-cleaning method described in BIA Technical Notes 20.
7. Clean stone trim to comply with stone supplier's written instructions.

3.15 MASONRY WASTE DISPOSAL

- A. Salvageable Materials: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.
- B. 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 - EARTHWORK.
 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 the Site.

END OF SECTION

SECTION 044313

CALCIUM SILICATE MASONRY VENEER

(Part of Work of Section 040001 - MASONRY WORK, Filed Sub Bid Required)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Calcium silicate masonry veneer units.
- B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design. Refer to Section 018110, SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 054000 - COLD-FORMED METAL FRAMING for metal framing at exterior wall.
 - 2. Section 061600 - SHEATHING for substrate.
 - 3. Section 076200 - SHEET METAL FLASHING AND TRIM for metal flashing.

1.3 SUBMITTALS

- A. Product Data: For each variety of stone, stone accessory, and manufactured product.
- B. Sustainable Design Submittals: Refer to Section 018110 – SUSTAINABLE DESIGN REQUIREMENTS and provide submittals and documentation as required to indicate that materials and products specified in this section comply with the sustainable design requirements for this project.
- C. Samples:
 - 1. For each stone type indicated.
 - 2. For each color of mortar required.

1.4 FIELD CONDITIONS

- A. Protection of Stone Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work.

- B. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. 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 above and will remain so until masonry has dried.
- C. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

PART 2 - PRODUCTS

2.1 MANUFACTURER

- A. Manufacturer: Subject to compliance with requirements, furnish either calcium-silicate-based manufactured stone units or quarried limestone from one of the following manufacturers:
 - 1. Arriscraft International.
 - 2. Meno Natural Stone
 - 3. Earthworks Stone
 - 4. Approved equal.
- B. Basis of Design Arriscraft.
 - 1. Size: 2-3/8" high, 3-3/4" bed, random lengths up to 23-5/8".
 - 2. Texture: smooth exposed face and ends with battered edges / split faced texture.
 - 3. Color: TBD.
 - 4. Product and Manufacturer's Name: Linear Series Brick by Arriscraft International.

2.2 CALCIUM SILICATED UNITS

- A. Calcium Silicate Masonry Units: ASTM C73, Grade SW; solid units that have been pressure formed and autoclaved; and then cut to thickness indicated; special shapes as indicated; and as follows:
 - 1. Compressive Strength: 6600 psi, to ASTM C170.
 - 2. Absorption: 8.8 percent, to ASTM C97.
 - 3. Density: 120 lbs/ft³, to ASTM C97.
 - 4. Modulus of Rupture: 770 psi, to ASTM C99.
- B. Fabricate Calcium Silicate Units to the following tolerances:
 - 1. Unit Length: plus or minus 1/16".
 - 2. Unit Height: plus or minus 1/16".
 - 3. Deviation From Square: plus or minus 1/16", with measurement taken using the longest edge as the base.
 - 4. Bed Depth: plus or minus 1/8".
 - 5. Custom Dimensions: plus or minus 1/8".
 - 6. Unit Face Deviations: plus or minus 3/8".

2.3 MATERIALS AND ACCESSORIES

- A. Air and Water Barrier Membrane: Laticrete Air & Water Barrier to be thin, cold applied, single component liquid and load bearing. Waterproofing Membrane to be non-toxic, non-flammable, and non-hazardous during storage, mixing, application and when cured:
1. Air Barrier Test (AC 212): Pass.
 2. Air Permeance (ASTM E2178): Pass.
 3. Elongation @ break (ASTM D751): 20-30%.
 4. 7 day Tensile Strength (ANSI A118.10): >265 psi (1.8 MPa).
 5. 7 day Shear Bond Strength (ANSI A118.10) >200 psi (1.4 MPa).
 6. 28 Day Shear Bond Strength (ANSI A118.4): >214 psi (1.48 – 2.4 MPa).
 7. Service Rating (TCA/ASTM C627): Extra Heavy.
 8. Total VOC Content: < 0.05 mg/m³.
- B. Epoxy Waterproofing Flashing Mortar: Latapoxy Waterproof Flashing Mortar to be 3 component epoxy, trowel applied specifically designed to be used under adhered masonry veneer:
1. Breaking Strength (ANSI A118.10): 450-530 psi (3.1-3.6 MPa).
 2. Waterproofness (ANSI A118.10): No Water penetration.
 3. 7 day Shear Bond Strength (ANSI A118.10): 110-150 psi (0.8-1 MPa).
 4. 28 Day Shear Bond Strength (ANSI A118.10): 90-120 psi (0.6–0.83 MPa).
 5. 12 Week Shear Bond Strength (ANSI A118.10): 110-130 psi (0.8-0.9 MPa).
 6. Total VOC Content: <3.4 g/L.
- C. Slip Sheet Material: 15 pound asphalt saturated, non-perforated roofing felt complying with ASTM D226, 15 pound coal tar saturated, non-perforated roofing felt complying with ASTM D227 or 4.0 mils (0.1 mm) thick polyethylene plastic film complying with ASTM D4397.

2.4 MORTAR MATERIALS

- A. Latex-Portland Cement Mortar for leveling beds and scratch/plaster coats: Laticrete Premium Mortar Bed to meet the following physical requirements:
1. Compressive Strength (ANSI A118.4 Modified): >4000 psi (27.6 MPa).
 2. Water Absorption (ANSI A118.6): ≤ 5%.
 3. Service Rating (TCA/ASTM C627): Extra Heavy.
 4. Smoke & Flame Contribution (ASTM E84 Modified): 0.
 5. Total VOC Content: < 0.05 mg/m³.
- B. Latex Portland Cement Mortar: LATICRETE Hi Bond Masonry Veneer Mortar to be weather, frost, shock resistant, non-flammable and meet the following physical requirements:
1. Compressive strength (ANSI A118.4): >2500 psi (17.2 MPa).
 2. Bond strength (ANSI A118.4): >450 psi (3.1 MPa).
 3. Smoke & Flame Contribution (ASTM E84 Modified): 0.
 4. Total VOC Content: < 0.05 mg/m³.
- C. Latex Portland Cement Pointing Mortar / Grout: Laticrete Premium Masonry Pointing Mortar to be weather, frost and shock resistant, as well as meet the following physical requirements:
1. Compressive Strength (ANSI A118.7): 4500 psi (31 MPa).

2. Tensile Strength (ANSI A118.7): >500 psi (3.45 MPa).
3. Flexural Strength (ANSI A118.7): >1250 psi (8.6 MPa).
4. Water Absorption (ANSI A118.7): < 5%.
5. Linear Shrinkage (ANSI A118.7): < 0.05 %.
6. Smoke & Flame Contribution (ASTM E84 Modified): 0.
7. Total VOC Content: < 0.05 mg/m³.

- D. Water: Potable.

PART 3 - EXECUTION

3.1 CUTTING OF THIN CALCIUM SILICATE UNITS

- A. Cut thin Calcium Silicate Units with a wet-saw.
- B. Pre-soak units using clean water prior to cutting.
- C. Clean cut units using a stiff fiber brush and clean water. Allow units to surface dry prior to placement.
- D. Thin calcium silicate units shall be cut accurately to shape and dimensions and full to the square, with jointing as shown on drawings
- E. Any miscellaneous cutting and drilling of thin calcium silicate units necessary to accommodate other trades will be the responsibility of the installer.
- F. Incidental cutting such as for window frame clips, etc., which is normally not considered to be the responsibility of the thin calcium silicate unit supplier, will be provided only by arrangement by the Contractor with the thin calcium silicate units supplier.

3.2 INSTALLATION OF MASONRY VENEER

- A. Comply with manufacturer's recommendations.
- B. Install flashing over sheathing and behind weather-resistant sheathing paper by fastening through sheathing into framing.
- C. Coat backs of units and face of scratch coat with cement-paste bond coat, then butter both surfaces with setting mortar. Use sufficient setting mortar so a slight excess will be forced out the edges of stone units as they are set. Tap units into place, completely filling space between units and scratch coat.
- D. Rake out joints for pointing with mortar to depth of not less than 3/4 inch before setting mortar has hardened. Rake joints to uniform depths with square bottoms and clean sides.

3.3 POINTING

- A. Prepare stone-joint surfaces for pointing with mortar by removing dust and mortar particles. Where setting mortar was removed to depths greater than surrounding areas, apply pointing mortar in layers not more than 3/8 inch deep until a uniform depth is formed.

- B. Point stone joints by placing and compacting pointing mortar in layers of not more than 3/8 inch deep. Compact each layer thoroughly and allow it to become thumbprint hard before applying next layer.
- C. Tool joints, when pointing mortar is thumbprint hard, with a smooth jointing tool to produce the following joint profile:
 - 1. Joint Profile: As indicated.

3.4 ADJUSTING AND CLEANING

- A. In-Progress Cleaning: Clean stone masonry as work progresses. Remove mortar fins and smears before tooling joints.
- B. Final Cleaning: After mortar is thoroughly set and cured, clean stone masonry as follows:
 - 1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
 - 2. Test cleaning methods on mockup; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before cleaning stone masonry.
 - 3. Protect adjacent stone and nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent, polyethylene film, or waterproof masking tape.
 - 4. Wet wall surfaces with water before applying cleaner; remove cleaner promptly by rinsing thoroughly with clear water.

3.5 EXCESS MATERIALS AND WASTE

- A. Excess Units: Stack excess units where directed by Owner for Owner's use.

END OF SECTION

SECTION 050001

MISCELLANEOUS AND ORNAMENTAL IRON

(Filed Sub-Bid Required)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.
- B. Time, Manner and Requirements for Submitting Sub-Bids:
1. Sub-bids for work under this Section shall be for the complete work and shall be filed in a sealed envelope with the _____ at a time and place as stipulated in the "NOTICE TO CONTRACTORS".
The following should appear on the upper left hand corner of the envelope:
NAME OF SUB-BIDDER: (Insert name of sub-bidder)
MASS. STATE PROJECT: ((Insert project number from top of page))
SUB-BID FOR SECTION: 050001 –Miscellaneous and Ornamental Iron
 2. Each sub-bid submitted for work under this Section shall be on forms furnished by the _____ as required by Section 44F of Chapter 149 of the General Laws, as amended. Sub-bid forms may be obtained at the office of the _____, or may be obtained by written or telephone request; telephone _____.
 3. Sub-bids filed with the _____ shall be accompanied by BID BOND or CASH or CERTIFIED CHECK or TREASURER'S CHECK or CASHIER'S CHECK issued by a responsible bank or trust company payable to the _____ in the amount of five percent of the sub-bid. A sub-bid accompanied by any other form of bid deposit than those specified will be rejected.
- C. Sub Sub-Bid Requirements: (None required under this Section.)
- D. Reference Drawings: The Work of this Filed Sub-Bid is shown on the following Contract Drawings: *To be inserted with final documents*

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
1. All Work in Section 055000 - METAL FABRICATIONS.
 2. All Work of Section 055100 - METAL STAIRS AND RAILINGS.
 3. All Work of Section 055300 - METAL GRATING.
 4. All Work of Section 057300 - DECORATIVE METAL RAILINGS.

END OF SECTION

SECTION 051200

STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.
- B. Examine all other Sections of the Specifications for requirements that affect work of this Section whether or not such work is specifically mentioned in this section.
- C. Coordinate work with that of all other trades affecting or affected by work of this Section. Coordinate with such trades to assure the steady progress of all work under the Contract.

1.2 DESCRIPTION OF WORK

- A. The work of this Section consists of furnishing and erecting all structural steel work and Exposed to View Structural Steel (EVSS) work as shown on the Drawings and as specified herein and includes, but is not limited to, the following:

- 1. Leveling plates and anchor bolts.
- 2. Columns with base plates and connections.
- 3. Beams with connections.
- 4. Channels, angles, plates, frames, anchors, and other similar pieces.
- 5. Moment connections.
- 6. Relieving angles and connections.
- 7. Steel bracing with connections.
- 8. Thermal isolation plates, bushings, and washers.
- 9. Shop paint and field touch-up paint after erection.
- 10. Galvanizing.
- 11. As-Built column and base plate surveys.

Unless noted otherwise, all structural steel that is exposed in the finish work shall be Exposed to View Structural Steel (EVSS). Coordinate locations of all EVSS with Architectural Drawings.

- B. Items To Be Furnished Only: Furnish the following items for installation by the designated Sections:
 - 1. Section 033000 - CAST-IN-PLACE CONCRETE: Anchor bolts, embedded shapes with bolts or anchors, as indicated on the Drawings.

1.3 RELATED WORK

- A. Related work shall be performed under the following Sections:

1. Section 033000 - CAST-IN-PLACE CONCRETE.
2. Section 051226 - SHEAR CONNECTORS.
3. Section 052100 - STEEL JOIST FRAMING.
4. Section 053100 - STEEL DECKING.
5. Section 055000 - METAL FABRICATIONS.
6. Section 078100 - APPLIED FIREPROOFING.
7. Section 099000 - PAINTING AND COATING.

1.4 REFERENCES (LATEST EDITIONS)

- A. "Code of Standard Practice for Steel Buildings and Bridges - 2010" and "Specifications for Structural Steel Buildings - 2010" by the American Institute of Steel Construction.
- B. The "Seismic Provisions for Structural Steel Buildings - 2010" by the American Institute of Steel Construction, Inc.
- C. The "Steel Construction Manual" by the American Institute of Steel Construction, Inc.
- D. The "Specifications for Structural Joints Using High-Strength Bolts – 2009" by the Research Council on Structural Connections (RCSC).
- E. "Structural Welding Code – Steel - 2010" by the American Welding Society.
- F. ASTM listed standards by the American Society for Testing and Materials.
- G. SSPC listed standards by the Steel Structures Painting Council.
- H. In case of conflict between the References and the Project Specification, the Project Specification shall govern. In the case of conflict between References, the more stringent shall govern.
- I. When compliance with any such References is specified herein for materials or a manufactured or fabricated product, the Contractor shall furnish an affidavit from the manufacturer or fabricator certifying that the materials or product delivered to the job meets the requirements specified. However, such certification shall not relieve the Contractor from the responsibility of complying with any added requirements specified herein.

1.5 SUBMITTALS

- A. Submit complete Shop Drawings in accordance with the provisions of Section 013300 - SUBMITTAL PROCEDURES. One set of printed shop drawings shall be delivered to the Structural Engineer within 24 hours of submitting the electronic version of those shop drawings.
- B. LEED Submittal requirements:
 1. Submit completed LEED Materials Credits Documentation Sheet (MCDS, see SECTION 018110 - SUSTAINABLE DESIGN REQUIREMENTS) for applicable material requirements as stated under "Products" in this Section, and as may be required in SECTION 018110 - SUSTAINABLE DESIGN REQUIREMENTS. Submit all required backup documentation.

2. Product substitution requests are subject to additional LEED submittal requirements; see SECTION 013301 - SUBSTITUTION/OR EQUAL REQUEST FORM.
- C. Before starting the work of the Shop and Erection Drawings, the steel fabricator shall have their representatives contact the Architect and Structural Engineer to discuss connection details, schedules, shop procedures, materials, and other concerns related to structural steel work.
- D. Prior to preparation of Shop Drawings, the fabricator shall submit typical details of all structural steel and Exposed to View Structural Steel connection types including, but not limited to, moment connections, beam to column and beam to girder connections, truss connections, column splices, beam splices, bracing connections, hanger connections, and other similar details, for approval by the Architect and Structural Engineer. Design of all connections is to be provided by the fabricator, under the supervision of a registered, professional structural engineer, registered in the state that the project is located in.
- E. Prior to submission of Shop Drawings, Contractor shall verify all dimensions, site conditions, and other similar pertinent information relating to existing conditions. Any discrepancies which affect the structural design or details shall be brought to the attention of the Architect and Structural Engineer.
- F. Prior to the submission of Shop Drawings, Contractor shall forward a schedule of Shop Drawing submittals to the Architect. Shop Drawings shall be submitted in multiple packages, reflecting the anticipated sequence of fabrication and erection of structural steel for the project.
- G. No variance from design sizes and details will be permitted on submitted Shop Drawings, but requests for modification of connection type or details to better suit their shop practice, or for any other reasons, will be considered by the Architect and Structural Engineer.
- H. Shop Drawings shall include all information required for fabrication of the component parts of the structure. Erection drawings shall clearly indicate all EVSS members. They shall indicate size and weight of members, surface preparation, type and location of shop and field connections, the type, size, and extent of all welds. Identify grinding, finish, and profile of welds. The welding symbols used on the Shop Drawings shall be as adopted by the American Welding Society. Identify type, size finish and length of bolts, distinguishing between shop and field bolts. Indicate direction of bolt head orientation at connections for all EVSS members.
- I. Approval of Shop Drawings shall be for size and arrangement of principal and auxiliary members and for strength of connections. Any errors in dimensions shown on the Shop Drawings shall be the responsibility of the Contractor.
- J. Fabrication of any material or performing of any work prior to the final approval of the Shop Drawings will be entirely at the risk of the Contractor.
- K. Provide Manufacturer's data for structural steel primers to be used.
- L. Certification: Prior to commencing installation of materials required hereunder, furnish the Architect with certification that requirements pertaining to shop painting have been performed in the manner specified.

M. Reproduction of structural plans, sections and details, and any like information by reprographic or electronic methods for use as Shop and Coordination Drawings is subject to the requirements of Section 011401 - ELECTRONIC RELEASE FORM and the following conditions:

1. The entity producing the Shop and Coordination Drawings (The "User") agrees to accept the reproduced information from Foley Buhl Roberts & Associates, Inc. without any warranties, guarantees and/or representations of any nature whatsoever regarding the correctness, dimensional and/or quantitative accuracy and/or completeness of any such information contained therein.
2. The User further agrees that such information shall be used as reference material only for the production of Shop and Coordination Drawings for the referenced project to which this Specification applies and only for that project.
3. The User further agrees to release, indemnify, hold harmless and defend Foley Buhl Roberts & Associates, Inc. with respect to any claims, costs (including the cost of litigation), losses, damages and/or liabilities which arise from (or relate to) the use, misuse, modification, interpretation, misinterpretation and/or misrepresentation of the reproduced information.

N. Reports: Submit certified copies of mill test reports for all structural steel furnished.

O. Prior to submission of erection shop drawings, plans indicating areas and/or members that will be fabricated and erected in accordance with EVSS requirements shall be submitted for approval by the Architect and Structural Engineer.

1.6 MOCKUPS

- A. At least four (4) weeks prior to fabricating EVSS, the fabricator shall construct mockups to demonstrate aesthetic effects as well as the qualities of the materials and workmanship. Mockups of details shall include a representation of each type of exposed connection or built up member.
- B. Build mockups on site for review and approval by Architect. Mockups shall be full-size pieces, unless smaller models are approved by the Architect. Mockups approved by the Architect may be part of the completed structure.
 1. Obtain Architect's approval of mockups prior to fabrication of final units.
 2. Mockups shall have a finished surface, including surface preparation and paint/fire protection system.
- C. Retain and maintain mockups during construction in an undisturbed condition, as a standard for judging the completed EVSS work.

1.7 QUALITY ASSURANCE

- A. Qualifications: The steel fabricator and erector conducting the work of this Section shall be AISC certified and experienced in fabricating EVSS similar to that required for this project.

- B. All materials and workmanship under this Section will be subject to inspection in the mill, shop, or field by the Architect, or by qualified inspectors selected by the Architect and paid directly by the Owner.
- C. A qualified Testing Agency for testing and inspection will be selected by the Owner and shall be paid directly by the Owner.
- D. However, such inspection, wherever conducted, shall not relieve Contractor of his responsibility to furnish materials and workmanship in accordance with Contract requirements, nor shall inspector's acceptance of materials or workmanship prevent later rejection of same by the Owner or Architect if defects are discovered.
- E. Inspection of welding work other than moment connections shall consist of non-destructive spot testing done by visual, magnetic particle, radiographic or ultrasonic methods, whichever is most effective for joint to be tested.
- F. Inspection of welding for work for moment connections shall be tested one hundred (100) percent either by ultrasonic or by radiography in accordance with the latest edition of the AWS Structural Welding Code. However, if, for an individual welder, the reject rate is demonstrated to be five (5) percent or less, the non-destructive testing rate may be reduced to twenty-five (25) percent for the individual welder. The evaluation of the welding shall be based on a sampling of at least forty (40) completed welds.
- G. Inspection of bolting work shall be in accordance with "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" by the American Institute of Steel Construction, latest edition. All bearing (Type N) bolts shall be fully tightened. Slip critical (Type SC) bolts shall be fully tensioned. All bolting shall be inspected per the Statement of Special Inspections.
- H. The Contractor shall give proper notice to inspection agencies designated by the Architect and shall allow access and full facilities as required for this inspection.
- I. A final letter shall be issued by the testing agency following the completion of work in this Section stating that all deficiencies have been corrected.

1.8 SUBSTITUTIONS

- A. Substitutions or any modifications of details proposed by Contractor will be considered by Architect only under the requirements of SECTION 013301 - SUBSTITUTION/OR EQUAL REQUEST FORM and the following conditions:
 - 1. That request has been made and accepted prior to submission of Shop Drawings.
 - 2. That there is a substantial cost advantage or time advantage to the Owner.
 - 3. That sufficient sketches, engineering calculations, and other data have been submitted to facilitate checking by the Architect, including cost reductions or savings in time to complete work.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Structural steel shall comply with the requirements of the following:

1. W, WT, C and MC shapes: ASTM A992 (50 ksi minimum yield).
 2. All other structural shapes: ASTM A572 (50 ksi minimum yield).
 3. Square, rectangular, and round HSS: ASTM A500 - Grade C (50 ksi minimum yield).
 4. Structural Steel Pipe: ASTM A53 - Grade B (35 ksi minimum yield).
 5. Structural Steel Plates and Bars: ASTM A572 (50 ksi minimum yield).
- B. Bolts, nuts, and washers shall comply with the requirements of ASTM A 325. Bolts shall be A 325N with washer except A 325, Type SC at slip-critical connections indicated on the drawings. All field bolts shall be tension control (TC) type, with twist-off splines.
- C. Anchor rods shall comply with the requirements of ASTM F 1554 – Grade 36, except F 1554 - Grade 105 at locations indicated on the Drawings. All anchor rods shall be headed type, with washer.
- D. Expansion bolts shall be Hilti Kwik Bolt TZ Expansion Anchors, Strong Bolt by Simpson Strong Tie, Power-Stud+SD2 by Dewalt, or an approved equal.
- E. Adhesive injection anchor bolts shall be Hilti HIT Adhesive Anchors, ET with Set XP Adhesive Anchors by Simpson Strong Tie, AC208+/Pure 110+ with Dust X+ Adhesive Anchor System by Dewalt, or an approved equal. Use renovation screens when bolting to hollow substrate.
- F. Metallic Filler: Composition of 90% ground metal and 10% epoxy binder such as "Plastic Steel" manufactured by ITW Devcon Corporation, "Scotch-Weld Adhesive 1751" by the 3M Corporation, or an equal approved by the Architect.
- G. Thermal isolating plates, washers, and bushings shall be fiber-reinforced structural thermal breaks such as "Fabreeka-TIM" by Fabreeka, "Armatherm FR" by Armadillo, "Farrat TBK" by Farrat, or equal approved by the Architect.

2.2 FABRICATION

- A. All structural steel shall be fabricated in accordance with References, approved Shop Drawings, and as hereinafter specified.
- B. All structural steel to remain exposed to view shall be fabricated to the requirements listed in this specification. Provide continuous welded joints in EVSS members. The welds shall be ground or otherwise treated as required to blend with adjacent parent metal. In addition, fabricate as follows:
1. Fabricate EVSS with exposed surfaces smooth, square and of surface quality with the approved mockups. Use special care in handling and shipping EVSS before and after shop painting.
 2. Fabricator shall grind welds of EVSS smooth. For groove welds, the welds shall be made flush to the surfaces each side and be within +1/16 inch and -0 inch of plate thickness.
 3. Remove spatter and grind where necessary for blending. Contour surfaces to match those surfaces that are adjacent. Form fillets to the smallest radii possible and still comply with the structural requirements. Provide additional metallic filler to form smooth continuous surfaces that will appear as one piece construction when primed. Grind and polish as required, to match profile on approved mockup.

4. All exposed welds shall be continuous, unless otherwise noted on the Drawings.
 5. All weld show-through shall be minimized by grinding and filling the far side with metallic filler as required to provide a smooth unblemished surface.
 6. Joint gaps between abutting members shall be uniform and minimized to 1/8 inch.
 7. Fabricate EVSS members such that piece marks are fully hidden in the final structure or use media to permit full removal.
 8. Members specified to be rolled to a final curved shape shall be fully shaped in the shop and tied during shipping to prevent stress relieving. Distortion of the web or stem and of outstanding flanges of open sections shall be visibly acceptable to the Architect from a distance of 20 feet under any lighting condition.
 9. Seal weld open ends of rectangular hollow structural sections with 3/8 inch minimum closure plates.
- C. The design of members and connections for any portions of the structure not indicated on the Drawings shall be completed by the fabricator. Unless otherwise noted on the drawings, connections shall be capable of supporting the maximum uniform load of the member for the span shown and the material specified. Consideration must be given to the additional load carrying capacity of composite steel members. In general, and unless otherwise indicated, connections for composite beams shall be designed for at least 1.75 times the end reaction derived from the AISC uniform load beam tables for the particular beam and span. Connections for composite girders which support other beams should be designed for at least 1.5 times the AISC uniform load reaction. All connection design shall be subject to approval by the Architect and Structural Engineer.
- D. Welding, as indicated on the Drawings, shall be in accordance with References and shall be done only by experienced welders who have been qualified by tests as prescribed in AWS "Standard Qualifications Procedure" for the type of work required.
- E. All shop connections shall be welded or bolted.
- F. Weld and joint details shall comply with requirements of the "Structural Welding Code - Steel" by the American Welding Society.
- G. Bolting shall comply with the requirements of AISC "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts".
- H. All field connections shall be bolted, except where welding is indicated on the Drawings. All field bolts shall be tension control (TC) type, with twist off splines.
- I. Diameter of holes in bolted parts shall be 1/16 inch greater than the nominal diameter of the bolt. No unfair holes will be accepted, and enlargement of holes shall not be accomplished by burning. Burrs resulting from drilling or punching shall be ground to the surface of the material. Shearing and punching shall be done cleanly so as not to deform or mar adjacent surfaces.
- J. Provide holes and connections as required for site assembly of steel work. Holes shall be drilled or punched and reamed in the shop. Show sizes and locations of all such holes on the Shop Drawings.
- K. Provide angles, bars, and/or other steel necessary for deck support at columns where members do not frame in from all four sides and where connections interfere with the support of metal decking.

- L. Provide angles, channels, and/or other steel necessary around all openings in roof deck at drains, fans, and other similar openings as shown in drawings. In addition to the openings shown on the Drawings, the Contract shall include an allowance and unit pricing for ten (10) additional openings not shown. Coordinate size, number, and location with Architectural, Mechanical, Electrical, and Plumbing trades.
- M. Provide angles, channels, and/or other steel as necessary to frame around all openings in floors at chases, multiple pipe sleeves and other similar penetrations as shown on the Drawings. In addition to the openings shown on the Drawings, the Contract shall include an allowance and unit pricing for ten (10) additional openings not shown. Coordinate size, number, and location with Architectural, Mechanical, Electrical, and Plumbing trades.
- N. Provide penetrations (round or rectangular) through steel beam webs as shown on the Drawings. Reinforce penetrations as shown on the Drawings. In addition to the penetrations shown on the Drawings, the Contract shall include an allowance and unit pricing for twenty (20) additional penetrations not shown on the Drawings.
- O. In general, beam to beam, and beam to column connections shall be double angle type connections, unless otherwise shown on the Drawings.

2.3 SURFACE PREPARATION AND PROTECTIVE COATINGS

- A. All structural steel shall be cleaned of all scale, rust, grease, and other foreign matter.
- A. Surface preparation for interior structural steel not exposed to view in the finished work shall be in accordance with "Steel Structures Painting Council Surface Preparation No. 3, Power Tool Cleaning". Structural steel not exposed to view shall be left unprimed.
- C. Surface preparation for interior structural steel that will remain exposed to view and designated EVSS, steel to be protected with intumescent paint, exterior steel to be hot-dip galvanized and all other exposed exterior structural steel shall be in accordance with "Steel Structures Painting Council Surface Preparation No. 6, Commercial Blast Cleaning".
- D. Primer for interior structural steel that will remain exposed to view (EVSS) and is not scheduled to be fireproofed shall be Tnemec V10-1009 Modified Alkyd Primer (grey color), Sherwin Williams Kem Bond HS Universal Primer B50WZ4 (off-white color), Benjamin Moore Super Spec HP Metal Primer KP14-70 (grey color), or equivalent approved by the Architect. Coordinate locations of EVSS with Architect.
- E. Primer for interior structural steel that will remain exposed to view and is scheduled to be fireproofed with intumescent paint shall be compatible with the intumescent paint manufacturer and approved by the Architect. Coordinate locations of intumescent fireproofing with Architect.
- F. Primer for exterior, galvanized structural steel that is exposed to view shall be a polyamide epoxy primer; "TNE MEC" 27-FC Typoxy primer (4.0-6.0 mils d.f.t.) or equal approved by the Architect. Primer shall be compatible with finish paint as specified in section 099000 - PAINTING AND COATING.
- G. Where primer is required on steel members, omit the primer at the following locations:

1. Surfaces embedded in concrete.
 2. Surfaces to be field welded.
 3. Surfaces at slip-critical connections.
 4. The tops of steel beams where deck and/or shear studs are to be welded.
 5. Surfaces to be spray fireproofed.
- H. Primer shall be applied in accordance with manufacturer's instruction to provide a minimum dry film thickness of 3.0 to 3.5 mils. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces. Primer paint shall be applied in accordance with manufacturer's directions to ensure no running or sagging.
- I. Shop and field touch-up paint shall be compatible with paint to be used for finish painting in the field as required under Section 078100 - APPLIED FIREPROOFING and Section 099000 - PAINTING AND COATING.
- J. After erection, all scarred areas shall be touched up with the same paint as the shop coat.
- 2.4 GALVANIZING
- A. All steel items noted on the Drawings to be galvanized shall be galvanized by the hot dip process conforming to ASTM A 123 with the addition of nickel to zinc bath. All galvanizing shall be done after fabrication. All galvanized material to be painted shall be primed by the galvanizer within twelve hours after galvanizing and shall be force cured in a facility capable of maintaining 150 degrees F. All hot dip galvanized steel shall be safeguarded against embrittlement according to ASTM A 143.
- B. The galvanizer shall inspect all members for compliance with this Specification and shall mark each member with a stamp indicating the ASTM number and the weight of the zinc coating in ounces per square foot.
- C. Vent holes for HSS members to be galvanized shall be located at lower elevations/sides of members and at areas not exposed to view. Vent holes shall be sealed following galvanizing with zinc plugs to match the appearance of the surrounding galvanizing. Vent hole plugs shall prevent moisture entering the HSS members.

PART 3 - EXECUTION

3.1 STORAGE AND HANDLING

- A. Care and protection shall be given to all structural steel during handling and storage. If items are to be stored prior to installation, they shall not be placed in contact with the ground. Care shall be taken to avoid abrasions and other damage.

3.2 ERECTION

- A. All structural steel shall be anchored and erected in accordance with References, approved Shop Drawings, and as hereinafter specified.

- B. All structural steel to remain exposed to view (EVSS) shall have continuous shop and field welds at all connections, unless otherwise indicated on the Drawings. The following additional requirements shall apply:
1. Grind all field welds of EVSS smooth. For groove welds, the welds shall be made flush to the surfaces each side and be within +1/16 inch and -0 inch of plate thickness.
 2. Remove spatter and grind where necessary for blending. Contour surfaces to match those surfaces that are adjacent. Form fillets to the smallest radii possible and still comply with the structural requirements. Provide additional metallic filler to form smooth continuous surfaces that will appear as one-piece construction when primed. Grind and polish as required, to match profile on approved mockup.
 3. All exposed welds shall be continuous, unless otherwise noted on the Drawings. Provide uniform size and profile.
 4. All weld show-through shall be minimized by grinding and filling the far side with metallic filler, as required to provide a smooth unblemished surface.
 5. Bolt heads shall be oriented as shown on the approved Shop Drawings.
 6. Run-out tabs, angles, erection bolts and other steel members added to connections to allow for alignment, fit-up and welding in the field shall be removed from the structure. Remove backer bars, fill all "rat" holes, and grind smooth at groove welded joints. Fill or plug weld holes for temporary erection bolts and grind smooth. All areas shall be touched up with the appropriate shop primer.
 7. Splice members only approved on the submitted Shop Drawings.
- C. All work shall be accurately set to established lines and elevations and rigidly fastened in place with suitable attachments to the construction of the building.
- D. Temporary bracing, guying, and support shall be provided to keep the structure safe and aligned at all times during construction, and to prevent danger to persons and property. Check all temporary loads and stay within safe capacity of all building components.
- E. Except as otherwise indicated on the Drawings, all field connections shall be bolted in accordance with AISC "Specifications for Structural Joints using ASTM A 325 or A 490 Bolts". All bearing (Type N) bolts shall be fully tightened. Slip critical (Type SC) bolts shall be fully tensioned. All twist-off splines shall be removed. Bolts that are hand tightened shall be clearly marked upon completion. Use not less than one (1) washer placed under the turning part of the assembly. Do not enlarge unfair holes in members by burning or by using drift pins. Ream holes that must be enlarged to admit bolts. Replace connection plates that are misaligned where holes cannot be aligned with acceptable final appearance.
- F. The initial installations of expansion bolts and epoxy injection anchor bolts shall be witnessed by the manufacturer's representative and load tests shall be performed to test their adequacy.
- G. Do not cut or alter any member in the field without Architect's written approval for each specific condition.
- H. Welding, as indicated on the Drawings, shall be in accordance with References and shall be done only by experienced welders who have been qualified by tests as prescribed in AWS "Standard Qualifications Procedure" for the type of work required.

- I. After erection, all structural steel members and connections shall be touched up with the appropriate primer.
- J. Prior to field welding of any galvanized steel element, galvanizing in the general area to be welded must be removed by grinding.
- K. All galvanized steel elements shall be touched up with a zinc-rich paint at areas scarred by welding or bolting.
- L. Install fiberglass-reinforced laminate composite thermal isolated plates, washers, and bushings at all exterior steel to interior steel connections and as shown on the Drawings. Coordinate locations with Architectural Drawings.

3.3 SURVEY

- A. Engage the services of a licensed Engineer or Surveyor to survey elevations and locations of all column and arch bases, prior to start of erection of structural steel. Any discrepancies shall be brought to the attention of the Architect. Erection shall not proceed until any required remedial measures have been completed.
- B. Upon completion of the building frame, provide a survey of perimeter building columns that indicates the plan deviation (as applicable) from the column grid in each direction at each level.

3.4 TOLERANCES

- A. Individual structural steel members shall be plumbed, leveled, and aligned in accordance with the requirements of Chapter 7 of the "Code of Standard Practice for Steel Buildings and Bridges", except as follows:
 - 1. All tolerances (such as rolling, fabrication, and erection) combined shall result in a framing in the complete structure being located within $\frac{3}{4}$ inches of its theoretical location, except that members at connections to columns shall be within $\frac{1}{8}$ inch vertically of their theoretical elevations.
 - 2. Tolerances for Exposed to View Structural Steel (EVSS) shall not exceed one-half those permitted for structural steel.

END OF SECTION

SECTION 051226
SHEAR CONNECTORS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.
- B. Examine all other Sections of the Specifications for requirements that affect work of this Section whether or not such work is specifically mentioned in this section.
- C. Coordinate work with that of all other trades affecting or affected by work of this Section. Coordinate with such trades to assure the steady progress of all work under the Contract.

1.2 DESCRIPTION OF WORK

- A. The work of this Section consists of furnishing and installing all shear connectors as shown on the Drawings and as specified herein and includes, but is not limited to the following:

- 1. Headed shear connectors.

1.3 RELATED WORK

- A. Related work shall be performed under the following Sections:

- 1. Section 033000 - CAST-IN-PLACE CONCRETE.
- 2. Section 051200 - STRUCTURAL STEEL FRAMING.
- 3. Section 053100 - STEEL DECKING.

1.4 REFERENCES (LATEST EDITIONS)

- A. "Specification for Structural Steel Buildings" by the American Institute of Steel Construction.
- B. "Structural Welding Code - Steel" by the American Welding Society.
- C. ASTM listed standards by the American Society for Testing and Materials.
- D. In case of conflict between the References and the Project Specification, the Project Specification shall govern. In the case of conflict between References, the more stringent shall govern.
- E. When compliance with such References is specified for materials or a manufactured or fabricated product, the Contractor shall furnish an affidavit from the manufacturer or fabricator, certifying that the materials or product delivered to the job meets the requirements specified. However, such certification shall not relieve the Contractor from the responsibility of complying with any added requirements specified herein.

1.5 SUBMITTALS

- A. Submit complete Shop Drawings in accordance with the provisions of Section 013300 - SUBMITTAL PROCEDURES.
- B. LEED Submittals: For each product specified, complete and submit the Materials Submittal Cover Sheet - See Section 018110 - SUSTAINABLE DESIGN REQUIREMENTS.
 - 1. Show percentage of product that is post-consumer and/or post-industrial recycled content. Provide backup documentation as described in Section 018110.
 - 2. Show installed costs for all items listed.
- C. Shop Drawings shall indicate size and position of all shear connectors. Shop Drawings shall indicate fastening methods for connectors.
- D. Approval of Shop Drawings will be for size and arrangement of shear connectors. Errors in dimensions shown on the Shop Drawings shall be the responsibility of the Contractor.
- E. Purchasing of any materials or performing any work prior to the final approval of Shop Drawings will be entirely at the risk of the Contractor.
- F. Reproduction of structural plans, sections and details, and any like information by reprographic or electronic methods for use as Shop and Coordination Drawings is subject to the requirements of Section 011401 - ELECTRONIC RELEASE FORM and the following conditions:
 - (1) The entity producing the Shop and Coordination Drawings (The "User") agrees to accept the reproduced information from Foley Buhl Roberts & Associates, Inc. without any warranties, guarantees and/or representations of any nature whatsoever regarding the correctness, dimensional and/or quantitative accuracy and/or completeness of any such information contained therein.
 - (2) The User further agrees that such information shall be used as reference material only for the production of Shop and Coordination Drawings for the referenced project to which this Specification applies and only for that project.
 - (3) The User further agrees to release, indemnify, hold harmless and defend Foley Buhl Roberts & Associates, Inc. with respect to any claims, costs (including the cost of litigation), losses, damages and/or liabilities which arise from (or related to) the use, misuse, modification, interpretation, misinterpretation and/or misrepresentation of the reproduced information.

1.6 QUALITY ASSURANCE

- A. All materials and workmanship under this Section will be subject to inspection in the mill, shop, or field by the Architect, or by qualified inspectors selected by the Architect and paid directly by the Owner.
- B. However, such inspection, wherever conducted, shall not relieve the Contractor of his responsibility to furnish materials and workmanship in accordance with Contract requirements,

nor shall inspector's acceptance of materials or workmanship prevent later rejection of it by the Owner or Architect if defects are discovered.

- C. A minimum of two (2) shear connector studs shall be welded at the start of each production period to determine proper settings for the generator, control unit, and stud welder. These studs shall be capable of being bent 45 degrees from vertical without weld failure. If, after welding, visual inspection reveals that a sound, full 360 degree weld has not been achieved for any particular stud, that stud shall be struck with a hammer and bent approximately 15 degrees from vertical towards the nearest end of the beam, or bent away from the opening in the fillet weld. Studs meeting this test shall be considered acceptable and shall be left in this position. Studs failing under this test shall be replaced.
- D. The Contractor shall give proper notice to inspection agencies designated by the Architect and shall allow access and full facilities as required for this inspection.
- E. A final letter shall be issued by the testing agency following the completion of the work of this Section.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. All shear connector studs shall be made from cold drawn bar stock conforming to the requirements of ASTM A 108, Grades 1015 through 1020, either semi- or fully- killed. See drawings for lengths and diameter.
- B. Tensile requirements of shear connector studs, as determined by tests (ASTM A 370) of bar stock after drawing, or of full diameter finished studs, at the manufacturer's option, shall conform to the following:
 - 1. Tensile strength, (psi) minimum: 60,000
 - 2. Elongation in two inches, (%) minimum: 20
 - 3. Reduction in area, (%) minimum: 50
- C. Studs shall be of uniform diameter; heads shall be concentric and normal to shaft; and the weld shall be chamfered and solid fluxed. Studs shall not be painted or galvanized.

PART 3 - EXECUTION

3.1 STORAGE

- A. Care and protection shall be given to all shear connectors during handling and storage. If connectors are to be stored prior to installation, they shall not be placed in contact with the ground and shall be protected from the elements and kept dry.

3.2 INSTALLATION

- A. Shear connector studs shall be installed by an automatic welding system, in the number and spacing shown on approved Shop Drawings and as herein specified.

- B. Steel in the area to which the stud is to be directly welded should be free of loose mill scale, heavy rust, dirt, and paint. In addition, where studs are to be welded through metal deck, verify that no water has become entrapped between the beam and the deck, prior to welding studs.
- C. Studs should not be welded when the temperature falls below 10 degrees Fahrenheit, or when the surface is wet with rain or snow.
- D. All welding shall be in accordance with The Structural Welding Code.
- E. After welding, break off ceramic arc shields and dispose of them properly.

END OF SECTION

SECTION 052100

STEEL JOIST FRAMING

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.
- B. Examine all other Sections of the Specifications for requirements that affect work of this Section whether or not such work is specifically mentioned in this section.
- C. Coordinate work with that of all other trades affecting or affected by work of this Section. Coordinate with such trades to assure the steady progress of all work under the Contract.

1.2 DESCRIPTION OF WORK

- A. Provide labor, materials, and equipment necessary to the complete the work of this Section, including, but not limited to, the following:
 - 1. Longspan steel joists, LH-Series and Deep Longspan steel joists, DLH-Series.
 - 2. Bridging, anchors, extended ends, ceiling extensions, and special seats.
 - 3. Shop paint and field touch-up paint after erection.
- B. Products furnished but not installed in this Section include the following:
 - 1. Not applicable.
- C. Products installed but not furnished in this Section include the following:
 - 1. Not applicable.

1.3 RELATED WORK

- A. Related work shall be performed under the following Sections:
 - 1. Section 051200 STRUCTURAL STEEL FRAMING.
 - 2. Section 053100 STEEL DECKING.
 - 3. Section 054000 COLD-FORMED METAL FRAMING.
 - 4. Section 055000 METAL FABRICATIONS.
 - 5. Section 099000 PAINTING AND COATING.
 - 6. Section 102220 OPERABLE PARTITIONS.
 - 7. Section 114843 SCOREBOARD.
 - 8. Section 116620 ATHLETIC EQUIPMENT.
 - 9. Section 220000 PLUMBING.
 - 10. Section 230000 HEATING, VENTILATING AND AIR-CONDITIONING.
 - 11. Section 260000 ELECTRICAL.
- B. Coordinate steel joist design and details with the requirements of other trades; including, but not limited to gymnasium equipment, scoreboards, rooftop HVAC units and acoustic/visual screens, MEP/FP components/services, frames for roof drains and exhaust fans, photovoltaic (PV) racking systems, operable partitions, netting, ceilings, and cold-formed metal framing.

1.4 REFERENCES (LATEST EDITIONS)

- A. "Standard Specifications, Load Tables and Weight Tables for Steel Joists and Joist Girders," by the Steel Joist Institute.
- B. "Structural Welding Code - Steel" by the American Welding Society.
- C. "Code of Standard Practice for Steel Buildings and Bridges" and "Specifications for the Design, Fabrication and Erection of Structural Steel Buildings" by the American Institute of Steel Construction.
- D. ASTM listed standards by the American Society for Testing and Materials.
- E. SSPC listed standards by the Steel Structures Painting Council.
- F. In case of conflict between the Reference Standards and the Project Specification, the Project Specification shall govern. In the case of conflict between Reference Standards, the more stringent shall govern.
- G. When compliance with any Reference Standard is specified herein for materials or a manufactured or fabricated product, the Contractor shall furnish an affidavit from the manufacturer or fabricator certifying that the materials or product delivered to the job meets the requirements specified. However, such certification shall not relieve the Contractor from the responsibility of complying with any added requirements specified herein.

1.5 SUBMITTALS

- A. Submit complete Shop Drawings in accordance with the provisions of Section 013300 - SUBMITTAL PROCEDURES.
- B. LEED Submittals: For each product specified, complete and submit the Materials Submittal Cover Sheet - See Section 018110 - SUSTAINABLE DESIGN REQUIREMENTS.
 - 1. Show percentage of product that is post-consumer and/or post-industrial recycled content. Provide backup documentation as described in Section 018110.
 - 2. Show installed costs for all items listed.
- C. Shop drawings shall indicate type, number, sizes, details, and spacing of all members. Shop Drawings shall indicate fastening methods for joists, bridging, anchors, and all other details for installation.
- D. Approval of Shop Drawings will be for size and arrangement of principal and auxiliary members and for strength of connections. Any errors in dimensions shown on the Shop Drawings shall be the responsibility of the Contractor.
- E. Fabrication of any material or performing of any work prior to the final approval of the Shop Drawings shall be entirely at the risk of the Contractor.
- F. Reproduction of structural plans, sections and details, and any like information by reprographic or electronic methods for use as Shop and Coordination Drawings is subject to the requirements of Section 011401 - ELECTRONIC RELEASE FORM. Reproduction of structural plans, sections and details, and any like information by reprographic or electronic methods for use as Shop and Coordination Drawings is subject to the following conditions:

- (1) The entity producing the Shop and Coordination Drawings (The "User") agrees to accept the reproduced information from Foley Buhl Roberts & Associates, Inc. without any warranties, guarantees and/or representations of any nature whatsoever regarding the correctness, dimensional and/or quantitative accuracy and/or completeness of any such information contained therein.
- (2) The User further agrees that such information shall be used as reference material only for the production of Shop and Coordination Drawings for the referenced project to which this Specification applies and only for that project.
- (3) The User further agrees to release, indemnify, hold harmless and defend Foley Buhl Roberts & Associates, Inc. with respect to any claims, costs (including the cost of litigation), losses, damages and/or liabilities which arise from (or relate to) the use, misuse, modification, interpretation, misinterpretation and/or misrepresentation of the reproduced information.

G. Reports: Submit certified copies of mill test reports for all structural steel furnished.

1.6 QUALITY ASSURANCE

- A. All materials and workmanship under this Section will be subject to inspection in the mill, shop, or field by the Architect or by the Testing Agency. However, such inspection, wherever conducted, shall not relieve Contractor of his responsibility to furnish materials and workmanship in accordance with Contract requirements, nor shall the Testing Agency's acceptance of materials or workmanship prevent later rejection of it by the Owner or Architect if defects are discovered.
- B. A qualified Testing Agency for testing and inspection will be selected by the Owner and shall be paid directly by the Owner.
- C. Inspection of welding work will consist of non-destructive spot testing done by visual, magnetic particle, radiographic or ultrasonic methods, whichever is most effective for joint to be tested.
- D. Inspection of bolting work shall be in accordance with "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" by the American Institute of Steel Construction, latest edition. All bolting shall be visually inspected per the Statement of Special Inspections.
- E. The Contractor shall give proper notice to Testing Agency, including notification of at least 24 hours prior to the time of concrete placement, and shall allow access and full facilities as required for this inspection.
- F. A final letter shall be issued by the Testing Agency following the completion of work in this Section.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. All steel joists and accessories shall be formed of material in accordance with the Reference Standards. See Drawings for type, depth, and size.

2.2 FABRICATION

- A. All steel joists and accessories shall be designed and fabricated in accordance with the Reference Standards, approved Shop Drawings, and as hereinafter specified.
- B. Coordinate steel joist design and details with the requirements of other trades; including, but not limited to gymnasium equipment, scoreboards, rooftop HVAC units and acoustic/visual screens, MEP/FP components/services, frames for roof drains and exhaust fans, photovoltaic (PV) racking systems, operable partitions, netting, ceilings, and cold-formed metal framing.
- C. All steel joists and accessories shall be fabricated by a member of the Steel Joist Institute.
- D. All steel joists shall be fabricated with a standard camber unless noted otherwise.

2.3 PROTECTIVE COATING

- A. All items shall be cleaned of all scale, rust, weld slag and weld spatter and other foreign matter and be given one (1) shop coat of rust inhibitive paint, one mil dry film thickness and approved by the Architect. Primer shall be compatible with the finish paint, as specified in Section 099000 PAINTING AND COATING.
- B. Shop and field touch-up paint shall be compatible with paint to be used for finish painting in the field under another Section as indicated on the Shop Drawings.
- C. After erection, all scarred areas shall be touched up with the same paint as the shop coat.

PART 3 - EXECUTION

3.1 STORAGE AND HANDLING

- A. Care and protection shall be given to all steel joists during handling and storage. If items are to be stored prior to installation, they shall not be placed in contact with the ground.

3.2 FABRICATION

- A. All steel joists shall be fabricated in accordance with Reference Standards, approved Shop Drawings, and as hereinafter specified.
- B. The design of members and connections for any portions of the structure not indicated on the Drawings shall be completed by the fabricator. Connections shall be capable of supporting the maximum uniform load of the member for the span shown and the material specified. All connection design shall be subject to approval by the Architect and Structural Engineer.
- C. Welding, as indicated on the Drawings, shall be in accordance with Reference Standards and shall be done only by experienced welders who have been qualified by tests as prescribed in AWS "Standard Qualifications Procedure" for the type of work required.

3.3 ERECTION

- A. All steel joists and accessories shall be installed in accordance with the Reference Standards, approved Shop Drawings, and as hereinafter specified.
- B. Longspan and Deep Longspan steel joists shall be welded to steel supports with two - ¼ inch welds, each at least three inches long.

- C. All bridging shall be installed in accordance with the Reference Specifications and as shown on the Drawings.
- D. Joists shall be permanently fastened to supports and all bridging and anchors completely installed before any construction loads (other than workers) are placed on the joists.
- E. All field welding shall be in accordance with the Reference Standards and shall be done only by experienced welders who have previously been qualified by tests as prescribed in AWS "Standard Qualification Procedure" to perform the type of work required.

END OF SECTION

SECTION 053100

STEEL DECKING

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.
- B. Examine all other Sections of the Specifications for requirements that affect work of this Section whether or not such work is specifically mentioned in this section.
- C. Coordinate work with that of all other trades affecting or affected by work of this Section. Coordinate with such trades to assure the steady progress of all work under the Contract.

1.2 DESCRIPTION OF WORK

- A. The work of this Section consists of furnishing and installing all metal deck work as shown on the Drawings and as specified herein and includes, but is not limited to, the following:
 - 1. Metal roof deck.
 - 2. Acoustic metal roof deck.
 - 3. Metal floor deck.
 - 4. Roof deck accessories: finish strips, butt strips, ridge plates, valley plates, splice plates, side lap screws, sump pans, acoustical batts, and rubber closures.
 - 5. Floor deck accessories: finish strips, butt strips, closures and pour stops.
 - 6. Field touch-up paint after erection.

1.3 RELATED WORK

- A. Related work shall be performed under the following Sections:
 - 1. Section 033000 - CAST-IN-PLACE CONCRETE.
 - 2. Section 051200 - STRUCTURAL STEEL FRAMING.
 - 3. Section 051226 - SHEAR CONNECTORS.
 - 4. Section 052100 - STEEL JOIST FRAMING.
 - 5. Section 054000 - COLD-FORMED METAL FRAMING.
 - 6. Section 099000 - PAINTING AND COATING.

1.4 REFERENCES (LATEST EDITIONS)

- A. "Basic Design Specifications for Steel Deck Construction" by the Steel Deck Institute.
- B. "Specifications for the Design of Light Gauge Cold Formed Structural Members" by the American Iron and Steel Institute.
- C. ASTM listed standards by the American Society for Testing and Materials.

- D. "Structural Welding Code - Steel" by the American Welding Society.
- E. In case of conflict between the References and the Project Specification, the Project Specification shall govern. In the case of conflict between References, the more stringent shall govern.
- F. When compliance with such References is specified for materials or a manufactured or fabricated product, the Contractor shall furnish an affidavit from the manufacturer or fabricator, certifying that the materials or product delivered to the job meets the requirements specified. However, such certification shall not relieve the Contractor from the responsibility of complying with any added requirements specified herein.

1.5 SUBMITTALS

- A. Submit complete Shop Drawings in accordance with the provisions of Section 013300 - SUBMITTAL PROCEDURES.
- B. LEED Submittals: For each product specified, complete and submit the Materials Submittal Cover Sheet - See Section 018110 - SUSTAINABLE DESIGN REQUIREMENTS.
 - 1. Show percentage of product that is post-consumer and/or post-industrial recycled content. Provide backup documentation as described in Section 018110.
 - 2. Show installed costs of all items listed.
- C. Shop Drawings shall indicate size and location of framing supports and the location, lengths, types, gauges, and markings of deck units. Shop Drawings shall indicate fastening methods for deck units, and the type of connections, welds or screws, and other items as hereinafter called for.
- D. Shop Drawings shall also show all accessories and methods of attachment to the building frame.
- E. Approval of Shop Drawings will be for size and arrangement of units and for strength of connections. Errors in dimensions shown on the shop drawings shall be the responsibility of the Contractor.
- F. Fabrication of any material or performing any work prior to the final approval of the Shop Drawings shall be entirely at the risk of the Contractor.
- G. Reproduction of structural plans, sections and details, and any like information by reprographic or electronic methods for use as Shop and Coordination Drawings is subject to the requirements of Section 011401 - ELECTRONIC RELEASE FORM and the following conditions:
 - (1) The entity producing the Shop and Coordination Drawings (The "User") agrees to accept the reproduced information from Foley Buhl Roberts & Associates, Inc. without any warranties, guarantees and/or representations of any nature whatsoever regarding the correctness, dimensional and/or quantitative accuracy and/or completeness of any such information contained therein.
 - (2) The User further agrees that such information shall be used as reference material only for the production of Shop and Coordination Drawings for the referenced project to which this Specification applies and only for that project.

- (3) The User further agrees to release, indemnify, hold harmless and defend Foley Buhl Roberts & Associates, Inc. with respect to any claims, costs (including the cost of litigation), losses, damages and/or liabilities which arise from (or related to) the use, misuse, modification, interpretation, misinterpretation and/or misrepresentation of the reproduced information.

1.6 QUALITY ASSURANCE

- A. All materials and workmanship under this Section will be subject to inspection in the mill, shop, or field by the Architect, or by qualified inspectors selected by the Architect and paid directly by the Owner. All deck fastening shall be visually inspected.
- B. However, such inspection, wherever conducted, shall not relieve the Contractor of his responsibility to furnish materials and workmanship in accordance with Contract requirements, nor shall inspector's acceptance of materials or workmanship prevent later rejection of same by the Owner or Architect if defects are discovered.
- C. A qualified testing agency for testing and inspection will be selected by the Owner and will be paid directly by the Owner.
- D. The Contractor shall give proper notice to inspection agencies designated by the Architect and shall allow access and full facilities for this inspection.
- E. A final letter shall be issued by the testing agency following the completion of the work in this Section.

1.7 SUBSTITUTIONS

- A. Substitutions or any modifications of details proposed by Contractor will be considered by Architect only under the requirements of SECTION 013300 - SUBSTITUTION/OR EQUAL REQUEST FORM and the following conditions:
 1. That request has been made and accepted prior to submission of Shop Drawings.
 2. That there is a substantial cost advantage or time advantage to the Owner.
 3. That sufficient sketches, engineering calculations, and other data have been submitted to facilitate checking by the Architect, including cost reductions or savings in time to complete work.

PART 2 - PRODUCTS

2.1 METAL ROOF DECK

- A. Typical metal roof deck shall be formed of steel sheets conforming to ASTM A 653 Grade 33, with a minimum yield strength of 33,000 psi with nestable side lap. All metal roof deck shall have a maximum nominal top-side gap between flutes of 2³/₄ inches. Galvanized coating shall conform to ASTM A 653 G 60. See Drawings for deck type, gauge, and depth.
- B. Acoustic metal roof deck shall be cellular type and formed of steel sheets conforming to ASTM A 653 Grade 33 with a minimum yield strength of 33,000 psi with interlocking side lap and perforated bottom plate. Galvanized coating shall conform to ASTM A 653 G 60. Sound absorbing batts shall be inert non-organic mineral fiber and shall be placed in each cell prior to

delivery to the job site. Do not place sound absorbing batts in deck at exterior, exposed conditions. To facilitate field painting of perforated surfaces, the sound absorbing elements shall be supported above the surface by spacers. The minimum Noise Reduction Coefficient (NRC) shall be 0.85. The minimum Sound Absorption Coefficients for various frequencies shall be as follows (frequency (Hz)/coefficient): 125/0.40, 250/0.50, 500/0.85, 1000/0.90, 2000/0.75, and 4000/0.60. Refer to the Drawings for deck type, gauge, and depth.

- C. Typical metal roof deck units shall be cut so that end joints will occur over supporting members and be lapped a minimum of two inches. Typical lengths shall extend over three (3) or more spans, where possible.
- D. Acoustic metal roof deck units shall be cut so that end joints will butt over supporting members. Typical lengths shall extend over three or more spans, where possible.
- E. Accessory metal sections shall be of the same material, gauge, and finish as the metal deck units, unless otherwise indicated.
- F. Sump pans shall be recessed and not lighter than 14 gauge galvanized sheets. Size of the hole to be field cut to match the roof drain.
- G. Closures shall be flexible rubber to seal flutes.
- H. All exposed surfaces shall be shop primed and ready for job site finish painting.

2.2 COMPOSITE METAL FLOOR DECK

- A. Typical metal floor deck shall be formed of steel sheets conforming to ASTM Standard A 653 minimum Grade 40, with a minimum yield strength of 40,000 psi. All metal floor deck shall be the composite type with six inches wide (nominal) flutes top and bottom sides at 12 inches on center and interlocking side laps. Galvanized coating shall conform to ASTM A 653 G 60. Refer to the Drawings for gauge and depth. Units shall have vented bottom flutes. Vent openings shall account for 0.5% of the surface area covered by the decking. Products used shall be Factory Mutual – Global approved.
- B. Metal floor deck units shall be cut so that end joints will butt over supporting members. Typical lengths shall extend over three or more spans where possible.
- C. The deck manufacturer shall be selected to meet strength requirements during concrete placement and shall provide temporary shoring for spans where indicated on the plans.
- D. Accessory metal sections shall be of the same material, gauge, and finish as the metal deck units, unless otherwise indicated.
- E. Pour stops shall be not lighter than 18 gauge and be of the same material and finish as the metal deck units. Use heavier gauge where indicated on the Drawings.
- F. All exposed surfaces shall be shop primed and ready for job site finish painting.

2.3 PROTECTIVE COATINGS

- A. Metal deck units shall be cleaned of scale, rust, grease, oil, or other foreign matter and be given a phosphate conversion coating. Acoustic metal deck shall then be shop coated with approved

synthetic enamel primer. The primer shall be verified by the field painting contractor for compatibility with approved field top coat paints under Section 099000 - PAINTING AND COATING.

- B. Shop and field touch-up paint shall be compatible with paint to be used for finish painting in the field under Section 099000 - PAINTING AND COATING.

PART 3 - EXECUTION

3.1 STORAGE

- A. Care and protection shall be given to all metal decking material during handling and storage. During unloading and hoisting, extra care shall be given to prevent damage to the ends, sides, and distortion of the individual items. If items are to be stored prior to installation, they shall not be placed in contact with the ground and should be stored with a sloping ventilated waterproof covering.

3.2 INSTALLATION

- A. Deck shall be erected and fastened in accordance with manufacturer's specifications, approved Shop Drawings, and as hereinafter specified.
- B. Place metal deck units on supporting framework and adjust to final position with proper bearings, end and side laps before permanently securing work.
- C. Welds to steel supports shall be fusion type. Puddle welds shall be at least 5/8 inch diameter or an elongated weld having an equal perimeter.
- D. Typical metal roof deck units shall be fastened to the supporting structure (minimum requirements) as follows:
 - 1. Panel ends and end laps: Welded at each rib.
 - 2. Intermediate supports: Welded at each rib.
 - 3. Longitudinal edges at marginal supports: Welded maximum spacing of 12 inches.
 - 4. Side laps of adjacent units: Screw fastened between supports at intervals not exceeding 24 inches.
- E. Acoustic metal roof deck units shall be fastened to the supporting structure (minimum requirements) as follows:
 - 1. Panel ends and end laps: Welded at each rib.
 - 2. Intermediate supports: Welded at each rib.
 - 3. Longitudinal edges at marginal supports: Welded, maximum spacing of 12 inches.
 - 4. Side laps of adjacent units: 1½ inch long seam welds (E7018 electrode with proper amperage recommended) between supports at intervals not exceeding 24 inches.
- F. Typical composite metal floor deck units shall be fastened to the supporting structure (minimum requirements) as follows:
 - 1. Panel ends and end laps: Welded at each rib.
 - 2. Intermediate supports: Welded at each rib.

3. Longitudinal edges at marginal supports: Welded, maximum spacing of 12 inches.
 4. Side laps of adjacent units: button punched or screw fastened, maximum spacing of 24 inches.
- G. Fasten accessories to deck by welding.
- H. Fasteners for overlying roofing material shall be concealed within the depth of the roof deck ribs.
- I. Holes and openings that are indicated on the Structural Drawings shall be cut by the deck erector. Coordinate locations with respective trades. Holes not so indicated, but which are required for work by other trades, shall be located and cut by the respective trades. No architectural, mechanical, electrical, plumbing, fire protection or other components shall be hung from metal roof deck.
- J. All welding shall be in accordance with the References and shall be done only by experienced welders who have previously been qualified to perform the type of work required.
- K. After erection, all scarred areas of decking, including cuts, drill holes, rust spots, welds, and weld scars, shall be touched up with a zinc-rich paint.
- L. Install rubber closures where indicated on the Drawings.
- M. Provide field fabricated sheet closures at all perimeter and interior columns, breaks at perimeter pour stops, and at all similar locations for a complete job.
- N. Omit acoustic batts at exterior applications or portions of decking with exterior exposure.

END OF SECTION

SECTION 054000

COLD-FORMED METAL FRAMING

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Exterior non-load-bearing wall framing.
- B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council. Refer to Section 018110, SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 055000 - METAL FABRICATIONS for masonry shelf angles and connections.
 - 2. Section 061600 - SHEATHING for exterior sheathing applied to cold-formed metal framing.
 - 3. Section 092110 - GYPSUM BOARD ASSEMBLIES for interior non-load-bearing, metal-stud framing and ceiling-suspension assemblies.
 - 4. Section 092120 - GYPSUM BOARD SHAFT-WALL ASSEMBLIES for interior non-load-bearing, metal-stud-framed, shaft-wall assemblies.

1.3 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design framing, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. Structural Performance: Provide cold-formed metal framing capable of withstanding design loads within limits and under conditions indicated.
 - 1. Design Loads: As required by Code.
 - 2. Deflection Limits: Design framing systems to withstand design loads within deflections greater than the following:
 - a. Exterior Non-Load-Bearing Framing:

- 1) Horizontal deflection of $l/240$ of the wall height for metal panel systems.

COLD-FORMED METAL FRAMING

- 2) Horizontal deflection of $1/240$ of the wall height for EIFS systems.
 - 3) Horizontal deflection of $1/600$ of the wall height for masonry systems.
 - 3. Design framing systems to provide for movement of framing members without damage or overstressing, sheathing failure, connection failure, undue strain on fasteners and anchors, or other detrimental effects when subject to a maximum ambient temperature change of 120 deg F.
 - 4. Design framing system to maintain clearances at openings, to allow for construction tolerances, and to accommodate live load, plus superimposed dead load, deflection of primary building structure.
 - C. Cold-Formed Steel Framing, General: Design according to AISI's "Standard for Cold-Formed Steel Framing - General Provisions."
 - 1. Design exterior non-load-bearing wall framing to accommodate horizontal deflection without regard for contribution of sheathing materials.
 - D. 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.
- 1.4 SUBMITTALS
- A. Product Data: For each type of cold-formed metal framing product and accessory indicated.
 - B. LEED Submittal:
 - 1. Building Product Disclosure and Optimization, Environmental Product Declarations (EPD):
 - a. Option 1: For cold-formed metal framing, submit EPDs.
 - 2. Building Product Disclosure and Optimization, Sourcing of Raw Materials:
 - a. General: For credit achievement calculation, submit location of products sourced (extracted, manufactured, and purchased), indicating number of miles from the project site.
 - b. Option 2, Leadership Extraction Practices:
 - 1) Recycled Content: For cold-formed metal framing, submit percentages by weight of postconsumer and preconsumer recycled content for products having recycled content. Include statement indicating costs for each product having recycled content.
 - 3. Low-Emitting Materials, General Emissions Evaluation: Building products must be tested and determined compliant in accordance with California Department of Public Health (CDPH) Standard Method v1.1–2010.
 - a. For interior field-applied paints and coatings, submit test results, including TVOC emissions and VOC content.

- b. For wet-applied products, submit volume used.
- C. Shop Drawings: Show layout, spacings, sizes, thicknesses, and types of cold-formed metal framing; fabrication; and fastening and anchorage details, including mechanical fasteners. Show reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.
 - 1. Shop drawings shall be signed and sealed by a professional engineer currently licensed in the Commonwealth of Massachusetts.
- D. Delegated-Design Submittal: For framing indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- E. Welding certificates.
- F. Qualification Data: For professional engineer.
- G. Product Test Reports: From a qualified testing agency, unless otherwise stated, indicating that each of the following complies with requirements, based on evaluation of comprehensive tests for current products:
 - 1. Steel sheet.
 - 2. Expansion anchors.
 - 3. Power-actuated anchors.
 - 4. Mechanical fasteners.
 - 5. Vertical deflection clips.
 - 6. Miscellaneous structural clips and accessories.

1.5 QUALITY ASSURANCE

- A. Engineering Responsibility: Preparation of Shop Drawings, design calculations, and other structural data by a qualified professional engineer.
- B. Professional Engineer Qualifications: A professional structural engineer who is legally qualified to practice in the jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of cold-formed metal framing that are similar to those indicated for this Project in material, design, and extent.
- C. Product Tests: Mill certificates or data from a qualified independent testing agency, or in-house testing with calibrated test equipment indicating steel sheet complies with requirements, including base-metal thickness, yield strength, tensile strength, total elongation, chemical requirements, ductility, and metallic-coating thickness.
- D. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code--Steel," and AWS D1.3, "Structural Welding Code--Sheet Steel."
- E. AISI Specifications and Standards: Comply with AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members" and its "Standard for Cold-Formed Steel Framing - General Provisions."

1. Comply with AISI's "Standard for Cold-Formed Steel Framing - Truss Design."
2. Comply with AISI's "Standard for Cold-Formed Steel Framing - Header Design."

- F. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Protect cold-formed metal framing from corrosion, deformation, and other damage during delivery, storage, and handling.
- B. Store cold-formed metal framing, protect with a waterproof covering, and ventilate to avoid condensation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering cold-formed metal framing that may be incorporated into the Work include, but are not limited to, the following:
1. California Expanded Metals Co. (CEMCO).
 2. ClarkDietrich Building Systems.
 3. EB Metal U.S.
 4. Marino\WARE.

2.2 MATERIALS

- A. Recycled Content of Steel Products: Provide products with an 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 Sheet: ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of grade and coating weight as follows:
1. Grade: As required by structural performance.
 2. Coating: G90.
- C. Steel Sheet for Vertical Deflection Clips: ASTM A 653/A 653M, structural steel, zinc coated, of grade and coating as follows:
1. Grade: As required by structural performance.
 2. Coating: G90 (Z275).

2.3 EXTERIOR NON-LOAD-BEARING WALL FRAMING

- A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:
1. Minimum Base-Metal Thickness: 0.0428 inch (18 gauge).

- B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and as follows:
 - 1. Minimum Base-Metal Thickness: Matching steel studs.
 - 2. Flange Width: 1-1/4 inches.
- C. Vertical Deflection Clips: Manufacturer's standard clips, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web.
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. ClarkDietrich Building Systems.
 - b. MarinoWARE, a division of Ware Industries.
 - c. The Steel Network, Inc.

2.4 FRAMING ACCESSORIES

- A. Fabricate steel-framing accessories from steel sheet, ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of same grade and coating weight used for framing members.
- B. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated.

2.5 ANCHORS, CLIPS, AND FASTENERS

- A. Steel Shapes and Clips: ASTM A 36/A 36M, zinc coated by hot-dip process according to ASTM A 123/A 123M.
- B. Anchor Bolts: ASTM F 1554, threaded carbon-steel bolts, and carbon-steel nuts; and flat, hardened-steel washers; zinc coated by hot-dip process according to ASTM A 153/A 153M, Class C.
- C. Expansion Anchors: Fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 5 times design load, as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.
 - 1. Acceptable Manufacturers: Kwik-Bolt 3 by Hilti, Inc., TruBolt Wedge Anchor by ITW Red Head or Power-Stud by Powers Fasteners.
- D. Power-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 10 times design load, as determined by testing per ASTM E 1190 conducted by a qualified independent testing agency.
- E. Mechanical Fasteners: ASTM C 1513, corrosion-resistant-coated, self-drilling, self-tapping steel drill screws.
 - 1. Head Type: Low-profile head beneath sheathing, manufacturer's standard elsewhere.

- F. Welding Electrodes: Comply with AWS standards.

2.6 MISCELLANEOUS MATERIALS

- A. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.
 - 1. Provide interior, field-applied primer with a VOC content of 250 g/L or less.
- B. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.
 - 1. Basis of Design: Sika; SikaGrout 212.
 - 2. VOC Content: 0 g/L.
- C. Shims: Load bearing, high-density multimonomer plastic, nonleaching.
- D. Sill Sealer Gaskets: Closed-cell foam, 1/4 inch thick, selected from manufacturer's standard widths to match width of bottom track or rim track members.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine supporting substrates and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance.
 - 1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Before sprayed fire-resistive materials are applied, attach continuous angles, supplementary framing, or tracks to structural members indicated to receive sprayed fire-resistive materials.
- B. After applying sprayed fire-resistive materials, remove only as much of these materials as needed to complete installation of cold-formed framing without reducing thickness of fire-resistive materials below that are required to obtain fire-resistance rating indicated. Protect remaining fire-resistive materials from damage.
- C. Install sill sealer gaskets to isolate the underside of wall bottom track or rim track and the top of foundation wall or slab at stud or joist locations.

3.3 INSTALLATION, GENERAL

- A. Cold-formed metal framing may be shop or field fabricated for installation, or it may be field assembled.
- B. Install cold-formed metal framing according to AISI's "Standard for Cold-Formed Steel Framing - General Provisions" and to manufacturer's written instructions unless more stringent requirements are indicated.

- C. Install cold-formed metal framing and accessories plumb, square, and true to line, and with connections securely fastened.
 - 1. Cut framing members by sawing or shearing; do not torch cut.
 - 2. Fasten cold-formed metal framing members by welding, screw fastening, clinch fastening, or riveting. Wire tying of framing members is not permitted.
- D. Install framing members in one-piece lengths unless splice connections are indicated for track or tension members.
- E. Install temporary bracing and supports to secure framing and support loads comparable in intensity to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.
- F. Do not bridge building expansion and control joints with cold-formed metal framing. Independently frame both sides of joints.
- G. Fasten hole reinforcing plate over web penetrations that exceed size of manufacturer's standard punched openings.
- H. Erection Tolerances: Install cold-formed metal framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:
 - 1. Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

3.4 EXTERIOR NON-LOAD-BEARING WALL INSTALLATION

- A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure as indicated.
- B. Fasten both flanges of studs to top and bottom track, unless otherwise indicated. Space studs as follows:
 - 1. Stud Spacing: 16 inches.
- C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar requirements.
- D. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.
- E. Install horizontal bridging in wall studs, spaced in rows indicated on Shop Drawings but not more than 48 inches apart. Fasten at each stud intersection.
- F. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, fasteners, and stud girts, to provide a complete and stable wall-framing system.

3.5 FIELD QUALITY CONTROL

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

3.6 REPAIRS AND PROTECTION

- A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed metal framing with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.
- B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that cold-formed metal framing is without damage or deterioration at time of Substantial Completion.

END OF SECTION

SECTION 055000

METAL FABRICATIONS

(Part of Work of Section 050001 - MISCELLANEOUS AND ORNAMENTAL IRON,
Filed Sub-Bid Required)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following. Requirements for materials, hot-dip galvanizing, and shop-applied primers are included with each item as applicable.

1. Loose steel bearing and leveling plates, **including bearing plates for steel joists**, galvanized at exterior locations and in exterior walls.
2. Galvanized steel lintels with shop-applied primer at exterior locations.
3. Steel lintels with shop-applied zinc-rich primer at interior locations.
4. Galvanized shelf angles with shop applied primer at exterior locations.
5. Shelf angles with zinc-rich shop-applied primer at interior locations.
6. Steel elevator machine beams.
7. Steel support angles for elevator door sills.
8. Cants in elevator hoistways made from sheet steel.
9. Miscellaneous steel framing and supports:
 - a. Steel framing and supports with shop applied primer for operable partitions.
 - b. Galvanized steel framing and supports for overhead doors.
 - c. Galvanized steel framing and supports for mechanical and electrical equipment.
 - d. Steel framing and supports for applications where framing and supports are not specified in other Sections; galvanized at exterior locations and in exterior walls.
 - e. Prefinished slotted steel channel support framing.
 - f. Steel framing and supports with shop-applied primer for countertops.
 - g. Steel framing and supports for toilet partitions.
10. Ladders:
 - a. Steel ladders to all roof levels, galvanized at exterior locations.
 - b. Steel ladders at interior locations, shop-primed.
 - c. Ladder vertical lifeline fall arrest system.
 - d. Steel ships' ladders with shop-applied primer.
 - e. Steel elevator pit ladders.
 - f. Alternating tread devices.

11. Miscellaneous steel trim including steel angle corner guards, steel edgings, and loading-dock edge angles, galvanized at exterior locations and in exterior walls.
 12. Galvanized steel bollards with shop-applied primer.
 13. Galvanized pipe guards with shop-applied primer.
 14. Steel floor plate and frame.
 15. Cast gray iron nosings.
 16. Cast gray iron wheel guards.
 17. Cast gray iron downspout boots.
- B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council. Refer to Section 018110, SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.
- C. Items To Be Furnished Only: Furnish the following items for installation by the designated Sections
1. Section 033000 - CAST-IN-PLACE CONCRETE:
 - a. Lintels, sleeves, anchors, inserts, plates and similar items.
 2. Section 042000 - UNIT MASONRY:
 - a. Lintels, miscellaneous metal and iron sleeves, anchors, inserts and plates to be built into masonry walls.
- D. Related Work: The following items are not included in this Section and are specified under the designated Sections:
1. Section 051200 - STRUCTURAL STEEL FRAMING for structural steel items.
 2. Section 055100 - METAL STAIRS AND RAILINGS for steel stairs, handrails, and guardrails.
 3. Section 055300 - METAL GRATINGS for metal bar gratings
 4. Section 099000 - PAINTING AND COATING for field painting work of this section.
- 1.3 PERFORMANCE REQUIREMENTS
- A. Delegated Design: Design ladders and miscellaneous framing and supports, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. Structural Performance of Ladders: Provide ladders capable of withstanding the effects of loads and stresses within limits and under conditions specified in ANSI A14.3.
1. For ladders exceeding 24 feet, include loads imposed by fall arrest system.
- C. Thermal Movements: Provide exterior metal fabrications 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 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 (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

1.4 SUBMITTALS

- A. Product Data: For each product.
- B. LEED Submittals:
 1. Building Product Disclosure and Optimization, Environmental Product Declarations (EPD):
 - a. Option 1: For aluminum extrusions, cold-rolled sheet, and hot-rolled sheet, submit industry-wide EPDs.
 2. Low-Emitting Materials, General Emissions Evaluation: Building products must be tested and determined compliant in accordance with California Department of Public Health (CDPH) Standard Method v1.1–2010.
 - a. For interior field-applied paints and coatings, submit test results, including TVOC emissions and VOC content.
 - b. For wet-applied products, submit volume used.
- C. 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.
 2. Provide templates for anchors and bolts specified for installation under other Sections.
 3. Where fabrications are to receive sprayed-on fireproofing, include statement that primer is compatible with fireproofing proposed for use.
- D. Delegated-Design Submittal: For installed products indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- E. Welding certificates.
- F. Qualification Data: For professional engineer.

1.5 QUALITY ASSURANCE

- A. Engineering Responsibility: Preparation of Shop Drawings, design calculations, and other structural data by a qualified professional engineer.
- B. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in the jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of metal fabrications that are similar to those indicated for this Project in material, design, and extent.
- C. Welding: Qualify procedures and personnel according to the following:

1. AWS D1.1, "Structural Welding Code--Steel."
2. AWS D1.3, "Structural Welding Code--Sheet Steel."
3. AWS D1.6, "Structural Welding Code--Stainless Steel."
4. AWS D1.2, "Structural Welding Code--Aluminum."

- D. 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.

1.6 PROJECT CONDITIONS

- A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications 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 dimensions and proceed with fabricating metal fabrications without field measurements. Coordinate wall and other contiguous construction to ensure that actual dimensions correspond to established dimensions.
 2. Provide allowance for trimming and fitting at site.

1.7 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of anchorages for metal fabrications. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.
- C. Coordinate installation of steel weld plates and angles for casting into concrete that are specified in this Section but required for work of another Section. Deliver such items to Project site in time for installation.

PART 2 - PRODUCTS

2.1 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/A 36M.
- C. Stainless-Steel Sheet, Strip, Plate, and Flat Bars: ASTM A 666, Type 304 at interior, Type 316L at exterior.
- D. Stainless-Steel Bars and Shapes: ASTM A 276, Type 304 at interior, Type 316L at exterior.

- E. Rolled-Steel Floor Plate: ASTM A 786/A 786M, rolled from plate complying with ASTM A 36/A 36M or ASTM A 283/A 283M, Grade C or D.
- F. Steel Tubing: ASTM A 500, cold-formed steel tubing.
- G. Steel Pipe: ASTM A 53/A 53M, standard weight (Schedule 40), unless another weight is indicated or required by structural loads.
- H. Slotted Channel Framing: Cold-formed metal channels with continuous slot complying with MFMA-4.
 - 1. Basis of Design: Unistrut Corp.
- I. Cast Iron: ASTM A 48/A 48M, Class 30, unless another class is indicated or required by structural loads.

2.2 NONFERROUS METALS

- A. Environmental Product Declarations (EPD): Industry-wide EPDs for aluminum extrusions, cold-rolled sheet, and hot-rolled sheet are available from the Aluminum Association.
- B. Aluminum Plate and Sheet: ASTM B 209/B 209M, Alloy 6061-T6.
- C. Aluminum Extrusions: ASTM B 221/221M, Alloy 6063-T6.
- D. Aluminum-Alloy Rolled Tread Plate: ASTM B 632/B 632M, Alloy 6061-T6.
- E. Aluminum Castings: ASTM B 26/B 26M, Alloy 443.0-F.

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, Class Fe/Zn 5, at exterior walls. Provide stainless-steel fasteners for fastening aluminum. Select fasteners for type, grade, and class required.
- B. Anchor Bolts: ASTM F 1554, Grade 36. Provide hot-dip or mechanically deposited, zinc-coated anchor bolts where item being fastened is indicated to be galvanized.
- C. Cast-in-Place Anchors in Concrete: Anchors capable of sustaining, without failure, a load equal to four times the load imposed, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.
 - 1. Threaded or wedge type; galvanized ferrous castings, either ASTM A 47/A 47M malleable iron or ASTM A 27/A 27M cast steel. Provide bolts, washers, and shims as needed, hot-dip galvanized per ASTM A 153/A 153M.
- D. Expansion Anchors: Anchor bolt and sleeve assembly with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency. Anchors shall have an ICC-ES report with approval for use in cracked concrete.

1. Acceptable Manufacturers: Kwik-Bolt TZ by Hilti, Inc., TruBolt Wedge Anchor by ITW Red Head, Power-Stud+ by Powers Fasteners, or Strong Bolt by Simpson.

- E. 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. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.
- C. Zinc-Rich Primer: Urethane zinc-rich primer compatible with topcoat Specified in Section 099000 - PAINTS AND COATINGS.
 1. Available Products: Tnemec; Series 394 PerimePrime, or approved equal.
 2. VOC Content: 250 g/L or less.
- D. Galvanizing Repair Paint: High-zinc-dust-content (95% by weight) paint for regalvanizing welds in steel, complying with SSPC-Paint 20.
 1. Available Products: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Duncan Galvanizing; ZiRP.
 - b. ZRC Worldwide; Galvilite Galvanizing Repair, low VOC type.
 2. VOC Content: 250 g/L or less.
- E. Isolation Coating (Bituminous Paint): ASTM D 1187, cold-applied asphalt emulsion, VOC compliant, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.
- F. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.
 1. Available Products: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Dayton Superior; 1107 Advantage Grout.
 - b. Sika; SikaGrout 212.
 2. VOC Content: 0 g/L.

2.5 FABRICATION, GENERAL

- A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.
- B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch, unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- D. Form exposed work true to line and level with accurate angles and surfaces and straight edges.
- E. Weld corners and seams continuously to comply with the following:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) screws or bolts, unless otherwise indicated. Locate joints where least conspicuous.
- G. Fabricate seams and other connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.
- H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.
- I. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.

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.

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. Weld adjoining members together to form a single unit where indicated.
- B. Size loose lintels to provide bearing length at each side of openings equal to 1/12 of clear span but not less than 8 inches, unless otherwise indicated.

2.8 SHELF ANGLES

- A. Fabricate shelf angles from steel angles of sizes indicated and for attachment to concrete framing. Provide horizontally slotted holes to receive 3/4-inch bolts, spaced not more than 6 inches from ends and 24 inches o.c., unless otherwise indicated.
 - 1. Provide mitered and welded units at corners.
 - 2. Provide open joints in shelf angles at expansion and control joints. Make open joint approximately 2 inches larger than expansion or control joint.
- B. For cavity walls, provide vertical channel brackets to support angles from backup masonry and concrete.
- C. Furnish wedge-type concrete inserts, complete with fasteners, to attach shelf angles to cast-in-place concrete.

2.9 MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.
- B. Fabricate units from steel shapes, plates, and bars of welded construction, unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction retained by framing and supports. Cut, drill, and tap units to receive hardware, hangers, and similar items.
 - 1. Fabricate units from slotted channel framing where indicated.
 - 2. Furnish inserts if units are installed after concrete is placed.
- C. Fabricate supports for operable partitions from continuous steel beams of sizes indicated with attached bearing plates, anchors, and braces as indicated. Drill bottom flanges of beams to receive partition track hanger rods; locate holes where indicated on operable partition Shop Drawings.

2.10 METAL LADDERS

- A. General:
 - 1. Comply with ANSI A14.3, unless otherwise indicated.
 - 2. For elevator pit ladders, comply with ASME A17.1.
 - 3. Support each ladder at top and bottom and not more than 60 inches o.c. with welded or bolted brackets, made from same metal as ladder.
 - 4. Provide nonslip surfaces on top of each rung, either by coating rung with aluminum-oxide granules set in epoxy-resin adhesive or by using a type of manufactured rung filled with aluminum-oxide grout.

2.11 LADDER FALL ARREST DEVICES

- A. General: Provide personal fall arrest system for fixed ladders exceeding 24-feet in height.
- B. Manufactured system to consist of pre-swaged stainless-steel cable and galvanized steel channels or pipe, designed to be secured to ladder. Include mounting brackets, rung clamps,

cable tensioner, automatic pass-through traveling devices and energy absorbing lanyard for complete installed system.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, include but are not limited to, the following:
 - a. FixFastUSA; KattClimb Ladder Fall Arrest.
 - b. Honeywell Industrial Safety; Miller Vi-Go.
 - c. MSA; Latchways Vertical Ladder Kit.
2. Cable: 3/16-inch (5 mm) diameter, 1-by-7 wire cable made from stainless steel wire Type 316.
3. Carriers: Automatic locking with anti-inversion feature, with no more than 20-inch (500 mm) movement in a fall event.
4. Arrest Capacity: Single person use; 1400 lbs. (635 kg) rated.
5. Performance Standards: Units to meet or exceed OSHA 1910.28, ANSI A14.3 and ANSI Z359.16.

- C. Mount personal fall arrest system to ladder rungs in accordance with manufacturer's instructions, and approved submittals.

2.12 METAL SHIPS' LADDERS

- A. Provide metal ships' ladders where indicated. Fabricate of open-type construction with channel or plate stringers, pipe and tube railings, and bar grating treads, unless otherwise indicated. Provide brackets and fittings for installation.

2.13 ALTERNATING TREAD DEVICES

- A. Alternating Tread Devices: Fabricate alternating tread devices to comply with ICC's International Building Code. Fabricate of open-type construction with channel or plate stringers and pipe and tube railings unless otherwise indicated. Provide brackets and fittings for installation.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Lapeyre Stair Inc.
 - b. Precision Ladders, LLC.
 - c. Vestil Manufacturing Company.
2. Fabricate from steel and assemble by welding or with stainless-steel fasteners.
3. Comply with applicable railing requirements in Section 055100 - METAL STAIRS AND RAILINGS.

- B. Galvanize exterior steel alternating tread devices, including treads, railings, brackets, and fasteners.

2.14 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 not less than two integrally welded steel strap anchors for embedding in concrete.

2.15 MISCELLANEOUS STEEL TRIM

- A. Unless otherwise indicated, fabricate units from steel shapes, plates, and bars of profiles shown with continuously welded joints and smooth exposed edges. Miter corners and use concealed field splices where possible.
- B. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work.
 - 1. Provide with integrally welded steel strap anchors for embedding in concrete or masonry construction.

2.16 METAL BOLLARDS

- A. Fabricate metal bollards from Schedule 40 steel pipe.
- B. Fabricate bollards with 3/8-inch-thick steel baseplates for bolting to concrete slab. Drill baseplates at all 4 corners for 3/4-inch anchor bolts.
 - 1. Where bollards are to be anchored to sloping concrete slabs, angle baseplates for plumb alignment of bollards.

2.17 PIPE GUARDS

- A. Fabricate pipe guards from 3/8-inch-thick by 12-inch--wide steel plate, bent to fit flat against the wall or column at both ends and to fit around pipe with 2-inch clearance between pipe and pipe guard. Drill each end for two 3/4-inch anchor bolts.

2.18 METAL FLOOR PLATE

- A. Fabricate from rolled-steel floor plate of minimum 1/4 inch steel unless thicker units are required for anticipated loadings.
- B. Include steel angle stiffeners, and fixed and removable sections as indicated.
- C. Provide flush steel bar drop handles for lifting removable sections, one at each end of each section.

2.19 ABRASIVE METAL NOSINGS

- A. Cast-Metal Units: Cast gray iron, Class 20 with an integral abrasive finish consisting of aluminum oxide, silicon carbide, or a combination of both. Fabricate units in sizes and configurations indicated and in lengths necessary to accurately fit openings or conditions.

- B. Drill for mechanical anchors and countersink. Locate not more than 4 inches from ends and not more than 12 inches o.c., evenly spaced between ends, unless otherwise indicated. Provide closer spacing if recommended by manufacturer.
- C. Apply isolation coating to concealed bottoms, sides, and edges of cast-metal units set into concrete.

2.20 CAST-IRON WHEEL GUARDS

- A. Provide wheel guards of 3/4-inch-thick, hollow-core, gray-iron castings; of size and shape indicated. Provide holes for countersunk anchor bolts and grouting.

2.21 METAL DOWNSPOUT BOOTS

- A. Provide downspout boots made from cast gray iron in heights indicated with inlets of size and shape to suit downspouts.

2.22 SECURITY SCREENS

- A. Security Screens: Factory-finished interior steel security screens, Kane Screens, Level 5, Aluminum Crime Shield Security Barrier Model E-C21-O by Kane Innovations or equal.
 - 1. Security Level: Heavy per CFR 200.935.
 - 2. Infill: 12 mesh, 0.028 diameter stainless steel wire cloth.
 - 3. Frames: Aluminum, clear anodized.
 - 4. Provide tamper evident stickers.

2.23 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.

2.24 STEEL PRIMERS AND FINISHES

- A. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with minimum requirements indicated below for SSPC surface preparation specifications and environmental exposure conditions of installed metal fabrications:
 - 1. Exteriors (SSPC Zone 1B) and Items Indicated to Receive Zinc-Rich Urethane Primer: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 - 2. Interiors (SSPC Zone 1A): SSPC-SP 7, "Brush Off Blast Cleaning."
 - 3. Apply shop primer to uncoated surfaces of metal fabrications, except those with galvanized finishes and those to be field welded, embedded in concrete or masonry, unless otherwise indicated. Extend priming of partially embedded members to a depth of 2 inches.
 - 4. Comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.
 - 5. Comply with SSPC-PA 2, "Measurement of Dry Coating Thickness with magnetic Gages."

- B. Zinc-Rich Primer: Urethane zinc-rich primer compatible with topcoat Specified in Section 099000 - PAINTS AND COATINGS.

1. Available Products: Tnemec; Series 394 PerimePrime, or approved equal.
2. VOC Content: 340 g/L or less.

2.25 HOT-DIP GALVANIZING

- A. Hot-Dip Galvanizing: For steel exposed to the elements, weather or corrosive environments and other steel indicated to be galvanized, provide coating for iron and steel fabrications applied by the hot-dip process.

1. Basis-of-Design: Duragalv by Duncan Galvanizing.
2. Comply with ASTM A 123 for fabricated products and ASTM A 153 for hardware.
3. Provide thickness of galvanizing specified in referenced standards.
4. Galvanizing bath shall contain special high grade zinc and other earthly materials.
5. Fill vent holes after galvanizing, if applicable, and grind smooth.

2.26 HOT-DIP GALVANIZING AND FACTORY-APPLIED PRIMER

- A. Hot-Dip Galvanizing: For steel exposed to the elements, weather or corrosive environments and other steel indicated to be galvanized, provide coating for iron and steel fabrications applied by the hot-dip process.

1. Basis-of-Design: Duragalv by Duncan Galvanizing.
2. Comply with ASTM A 123 for fabricated products and ASTM A 153 for hardware.
3. Provide thickness of galvanizing specified in referenced standards.
4. Galvanizing bath shall contain special high grade zinc and other earthly materials.
5. Fill vent holes after galvanizing, if applicable, and grind smooth.

- B. Factory-Applied Primer over Galvanized Steel: Provide factory-applied prime coat, certified OTC/VOC compliant less than 2.8 lbs/gal. and conforming to EPA and local requirements. Apply primer within 12 hours after galvanizing at the same galvanizer's plant in a controlled environment meeting applicable environmental regulations and as recommended by the primer coating manufacturer. Primer coat shall exhibit a rugosity (smoothness) not greater than 4 rug (16-20 microns of variation) when measured by a profilometer over a 1 inch straight line on the surface of architectural and structural elements that are less than 24 pounds per running foot. Profilometer shall be capable of operating in 1 micron increments. Blast cleaning of the surface is unacceptable for surface preparation. Primer shall have a minimum two year re-coat window for application of finish coat. Coatings must meet or exceed the following performance criteria as stipulated by the coatings manufacturer:

1. Basis-of-Design: Primergalv by Duncan Galvanizing.
2. Abrasion Resistance: ASTM D 4060 (CS17 Wheel, 1,000 grams load).1kg load, 200 mg loss.
3. Adhesion: ASTM D4541, 1050 psi.
4. Corrosion Weathering: ASTM D5894, 13 cycles, 4,368 hours; rating 10 per ASTM D714 for blistering and rating 7 per ASTM D610 for rusting.
5. Direct Impact Resistance: ASTM D2794, 160 in. lbs.
6. Flexibility: Method: ASTM D522, 180 degree bend, 1 inch mandrel, passes.
7. Pencil Hardness: ASTM D3363, 3B.

8. Moisture Condensation Resistance: ASTM D4585, 100 degrees F, 2000 hours; passes, no cracking or delamination.
9. Dry Heat Resistance: Method: ASTM D2485, 250 degrees F.
10. Warranty: Provide galvanizer's warranty that materials will be free from 10 percent or more visible rust for a period of 20 years.

2.27 HOT-DIP GALVANIZING AND FACTORY-APPLIED ARCHITECTURAL FINISH

- A. Hot-Dip Galvanizing: For steel exposed to the elements, weather or corrosive environments and other steel indicated to be galvanized, provide coating for iron and steel fabrications applied by the hot-dip process.
 1. Basis-of-Design: Duragalv by Duncan Galvanizing.
 2. Comply with ASTM A 123 for fabricated products and ASTM A 153 for hardware.
 3. Provide thickness of galvanizing specified in referenced standards.
 4. Galvanizing bath shall contain special high grade zinc and other earthly materials.
 5. Fill vent holes after galvanizing, if applicable, and grind smooth.
- B. Architectural Finish Over Hot-Dip Galvanizing: For steel exposed to the elements, weather or corrosive environments and other steel indicated to be galvanized, provide coating over hot-dip galvanizing.
 1. Basis-of-Design: Colorgalv by Duncan Galvanizing.
 2. Primer coat shall be factory-applied polyamide epoxy primer. Apply primer within 12 hours after galvanizing at the same galvanizer's plant in a controlled environment meeting applicable environmental regulations and as recommended by the primer coating manufacturer.
 3. Finish coat shall be factory-applied color-pigmented architectural finish. Apply finish coating at the galvanizer's plant, in a controlled environment meeting applicable environmental regulations and as recommended by the finish coating manufacturer. Finish coat shall exhibit a rugosity (smoothness) not greater than 4 rug (16-20 microns of variation) when measured by a profilometer over a 1 inch straight line on the surface of architectural and structural elements that are less than 24 pounds per running foot. Profilometer shall be capable of operating in 1 micron increments.
 4. Coatings shall be certified OTC/VOC compliant and conform to applicable regulations and EPA standards.
 5. Apply the galvanizing, primer, and coating within the same facility and provide single-source responsibility for galvanizing, priming and finish coating.
 6. Clean galvanized surface to create an acceptable profile for coatings. Galvanizer shall certify that performance will be met without blast cleaning and coating will be applied within 12 hours of galvanizing at the galvanizer's plant. If blasted, galvanizer shall certify that rugosity standards are met.
 7. Primer shall meet or exceed the following performance criteria:
 - a. Abrasion Resistance per ASTM D 4060 (CS17 Wheel, 1,000 grams load), 1kg Load: 200 mg loss.
 - b. Adhesion per ASTM D4541: 1050 psi.
 - c. Corrosion Weathering per ASTM D5894, 13 Cycles, 4,368 Hours: Rating 10 per ASTM D714 for blistering; Rating 7 per ASTM D610 for rusting.
 - d. Direct Impact Resistance per ASTM D2794: 160 in. lbs.
 - e. Flexibility per ASTM D522, 180° Bend, 1 in. Mandrel: Passes.
 - f. Pencil Hardness per ASTM D3363: 3B.

- g. Moisture Condensation Resistance per ASTM D4585, 100° F, 2000 Hours: Passes, no cracking or delamination.
 - h. Dry Heat Resistance per ASTM D2485: 250° F.
8. Topcoat shall meet or exceed the following performance criteria:
- a. Abrasion Resistance per ASTM D 4060, CS17 Wheel, 1,000 Cycles 1kg Load: 87.1 mg loss.
 - b. Adhesion per ASTM D 4541: 1050 psi.
 - c. Direct Impact Resistance per ASTM D2794: >28 in. pounds.
 - d. Indirect Impact Resistance per ASTM D2794: 12-14 in. pounds.
 - e. Dry Heat Resistance per ASTM D2485: 200° F.
 - f. Salt Fog Resistance per ASTM B 117 9,000 Hours: Rating 10 per ASTM D714 for blistering.
 - g. Flexibility per ASTM D522, 180° Bend, 1/8 in. Mandrel: Passes.
 - h. Pencil Hardness per ASTM D3363: 2H.
 - i. Moisture Condensation Resistance per ASTM D4585, 100° F, 1000 Hours: No blistering or delamination Xenon Arc Test per ASTM D 4798: Pass 300 hours

2.28 STAINLESS-STEEL FINISHES

- A. Remove tool and die marks and stretch lines or blend into finish.
- B. Grind and polish surfaces to produce uniform, directionally textured, polished finish indicated, free of cross scratches. Run grain with long dimension of each piece.
- C. Bright, Directional Satin Finish: No. 4.
- D. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

2.29 ALUMINUM FINISHES

- A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
- B. As-Fabricated Finish: AA-M10 (Mechanical Finish: as fabricated, unspecified).
- C. Class I, Clear Anodic Finish: AA-M12C22A41 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 611.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

- B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
- C. Field Welding: Comply with the following requirements:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag bolts, wood screws, and other connectors.
- E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.
- F. Corrosion Protection: Coat concealed surfaces of steel that will come into contact with grout, concrete, masonry, wood, or dissimilar metals with a heavy coat of isolation coating.

3.2 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 grout, either metallic or nonmetallic, in concealed locations where not exposed to moisture; use nonshrink, nonmetallic grout in exposed locations, unless otherwise indicated.
 - 2. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.3 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.
- C. Support steel girders on solid grouted masonry, concrete, or steel pipe columns. Secure girders with anchor bolts embedded in grouted masonry or concrete or with bolts through top plates of pipe columns.

1. Where grout space under bearing plates is indicated for girders supported on concrete or masonry, install as specified in this Section.

- D. Install pipe columns on concrete footings with grouted baseplates. Position and grout column baseplates as specified in this Section.

1. Grout baseplates of columns supporting steel girders after girders are installed and leveled.

3.4 INSTALLING PIPE BOLLARDS

- A. Anchor bollards to existing construction with anchor bolts. Provide four 3/4-inch bolts at each bollard unless otherwise indicated.

1. Embed anchor bolts at least 4 inches in concrete.

- B. Fill bollards solidly with concrete, mounding top surface to shed water.

3.5 INSTALLING PIPE GUARDS

- A. Provide pipe guards at exposed vertical pipes in parking garage where not protected by curbs or other barriers. Install by bolting to wall or column with expansion anchors. Provide four 3/4-inch bolts at each pipe guard. Mount pipe guards with top edge 26 inches above driving surface.

3.6 INSTALLING NOSINGS, TREADS, AND THRESHOLDS

- A. Center nosings on tread widths.

- B. For nosings embedded in concrete steps or curbs, align nosings flush with riser faces and level with tread surfaces.

- C. Seal thresholds exposed to exterior with elastomeric sealant complying with Section 079200 - JOINT SEALANTS to provide a watertight installation.

3.7 INSTALLING CAST-IRON WHEEL GUARDS

- A. Anchor wheel guards to concrete or masonry construction to comply with manufacturer's written instructions. Fill cores solidly with concrete.

3.8 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. Touch-Up and Repair for Galvanized Surfaces: For damaged and field-welded metal coated surfaces, clean welds, bolted connections and abraded areas.

1. For galvanized surfaces, apply organic zinc repair paint complying with requirements of ASTM A 780, modified to 95 percent zinc in dry film. Thickness of applied galvanizing repair paint shall be not less than coating thickness required by ASTM A 123 or A 153 as applicable. Touch-up of galvanized surfaces with silver paint, brite paint, or aluminum paints is not acceptable.
2. For factory-applied finish coatings, field-touch-up shall be performed by factory approved personnel. Touch-up shall be such that repair is not visible from a distance of 6 feet.
3. A touch-up repair kit or touchup instructions shall be provided to the Owner for each type of factory-applied finish.

END OF SECTION

SECTION 055100

METAL STAIRS AND RAILINGS

(Part of Work of Section 050001 - MISCELLANEOUS AND ORNAMENTAL IRON,
Filed Sub-Bid Required)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Preassembled steel stairs with concrete filled treads.
 - 2. Steel railings, handrails and guardrails, interior and exterior.
 - 3. Steel mesh infill panels.
- B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council. Refer to Section 018110, SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.
- C. Items To Be Furnished Only: Furnish the following items for installation by the designated Sections
 - 1. Section 033000 - CAST-IN-PLACE CONCRETE:
 - a. Sleeves, anchors, inserts, plates and similar items.
 - 2. Section 042000 - UNIT MASONRY:
 - a. Miscellaneous metal and iron sleeves, anchors, inserts and plates to be built into masonry walls.
- D. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 055000 - METAL FABRICATIONS for metal treads and nosings not installed in metal stairs.
 - 2. Section 057300 - DECORATIVE METAL RAILINGS for stainless steel railings.
 - 3. Section 061000 - ROUGH CARPENTRY for wood blocking for anchoring railings.
 - 4. Section 092110 - GYPSUM BOARD ASSEMBLIES for metal backing for anchoring railings.

METAL STAIRS AND RAILINGS

5. Section 099000 - PAINTING AND COATING for field painting work of this section.

1.3 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design stairs and railings, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. Structural Performance of Stairs: Provide metal stairs capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
 - 1. Uniform Load and Concentrated Loads: As required by Code.
 - 2. Stair Framing: Capable of withstanding stresses resulting from railing loads in addition to loads specified above.
 - 3. Limit deflection of treads, platforms, and framing members to $L/360$ or $1/4$ inch, whichever is less.
- C. Structural Performance of Railings: Provide railings capable of withstanding the effects of gravity loads and Code required loads and stresses within limits and under conditions indicated.
- D. Seismic Performance: Provide metal stairs capable of withstanding the effects of earthquake motions determined according to Code.

1.4 SUBMITTALS

- A. Product Data: For each product.
 - 1. Manufacturer's product lines of railings assembled from standard components.
 - 2. Grout, anchoring cement, and paint products.
- B. LEED Submittals:
 - 1. Low-Emitting Materials, General Emissions Evaluation: Building products must be tested and determined compliant in accordance with California Department of Public Health (CDPH) Standard Method v1.1–2010.
 - a. For interior field-applied paints and coatings, submit test results, including TVOC emissions and VOC content.
 - b. For wet-applied products, submit volume used.
- C. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
 - 1. Provide templates for anchors and bolts specified for installation under other Sections.
 - 2. Shop drawings shall be signed and sealed by a professional engineer currently licensed in the Commonwealth of Massachusetts.
- D. Delegated-Design Submittal: For stairs and railings indicated to comply with performance requirements and design criteria, including structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- E. Welding certificates.
- F. Qualification Data: For professional engineer.

1.5 QUALITY ASSURANCE

- A. Engineering Responsibility: Preparation of Shop Drawings, design calculations, and other structural data by a qualified professional engineer.
- B. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in the jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of metal stairs and railings that are similar to those indicated for this Project in material, design, and extent.
- C. Installer Qualifications: Fabricator of products.
- D. NAAMM Stair Standard: Comply with "Recommended Voluntary Minimum Standards for Fixed Metal Stairs" in NAAMM AMP 510, "Metal Stairs Manual," for class of stair designated, unless more stringent requirements are indicated.
 - 1. **Preassembled** Stairs: Commercial class.
 - 2. **Industrial Type Stairs:** Industrial class.
 - 3. Ornamental Stairs: Architectural class.
- E. Welding: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1, "Structural Welding Code--Steel."
 - 2. AWS D1.3, "Structural Welding Code--Sheet Steel."
 - 3. **AWS D1.6, "Structural Welding Code--Stainless Steel."**

1.6 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of anchorages for metal stairs. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.
- C. Coordinate locations of hanger rods and struts with other work so that they will not encroach on required stair width and will be within the fire-resistance-rated stair enclosure.

PART 2 - PRODUCTS

2.1 METALS, GENERAL

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

- B. Recycled Content of Steel Products: 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.

2.2 FERROUS METALS

- A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- B. Steel Tubing: ASTM A 500 (cold formed) or ASTM A 513, Type 5 (mandrel drawn).
- C. Steel Bars for Grating Treads: ASTM A 36/A 36M or steel strip, ASTM A 1011/A 1011M or ASTM A 1018/A 1018M.
- D. Wire Rod for Grating Crossbars: ASTM A 510.
- E. Rolled-Steel Floor Plate: ASTM A 786/A 786M, rolled from plate complying with ASTM A 36/A 36M or ASTM A 283/A 283M, Grade C or D.
- F. Uncoated, Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M either commercial steel, Type B, or structural steel, Grade 30, unless another grade is required by design loads.
- G. Galvanized Steel Sheet: ASTM A 653/A 653M, G90 coating, either commercial steel, Type B, or structural steel, Grade 33, unless another grade is required by design loads.
- H. Woven-Wire Mesh, Carbon Steel: Intermediate-crimp, square pattern, 2-inch woven-wire mesh, made from 0.135-inch nominal diameter wire complying with ASTM A 510.
- I. Woven-Wire Mesh, Stainless Steel: Intermediate-crimp, square pattern, 2-inch woven-wire mesh, made from 0.12-inch nominal diameter wire, stainless steel Type 304, complying with ASTM A 555 and ASTM A 580.
- J. Welded-Wire Mesh, Stainless Steel: Square pattern, 2-inch welded-wire mesh, made from 0.188-inch nominal diameter wire, stainless steel Type 304, complying with ASTM A 555 and ASTM A 580.

2.3 FASTENERS

- A. General: Provide zinc-plated fasteners with coating complying with ASTM B 633, Class Fe/Zn 25 for exterior use, and Class Fe/Zn 5 where built into exterior walls. Select fasteners for type, grade, and class required.

2.4 MISCELLANEOUS MATERIALS

- A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
- B. Shop Primers: Provide primers that comply with Section 099000 - PAINTING AND COATING.
- C. Zinc-Rich Primer: Complying with SSPC-Paint 20 or SSPC-Paint 29 and compatible with topcoat.

1. Provide interior, field-applied primer with a VOC content of 250 g/L or less.

- D. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.
 - 1. Provide interior, field-applied primer with a VOC content of 250 g/L or less.
- E. Isolation Coating (Bituminous Paint): ASTM D 1187, cold-applied asphalt emulsion, VOC compliant, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.
- F. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.
 - 1. Available Products: Sika; SikaGrout 212, or approved equal.
 - 2. VOC Content: 0 g/L.
- G. Concrete Materials and Properties: Comply with requirements in Section 033000 - CAST-IN-PLACE CONCRETE for normal-weight, air-entrained, ready-mix concrete with a minimum 28-day compressive strength of 3000 psi, unless otherwise indicated.

2.5 FABRICATION, GENERAL

- A. Provide complete stair assemblies, including metal framing, hangers, struts, railings, clips, brackets, bearing plates, and other components necessary to support and anchor stairs and platforms on supporting structure.
 - 1. Join components by welding, unless otherwise indicated.
 - 2. Use connections that maintain structural value of joined pieces.
 - 3. Fabricate treads and platforms of exterior stairs so finished walking surfaces slope to drain.
- B. **Preamsembled** Stairs: Assemble stairs in shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.
- C. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch, unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- D. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- E. Form exposed work true to line and level with accurate angles and surfaces and straight edges.
- F. Weld connections to comply with the following:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. Weld exposed corners and seams continuously, unless otherwise indicated.

5. 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.
- G. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) screws or bolts unless otherwise indicated. Locate joints where least conspicuous.
- H. Comply with "Guideline 1: Joint Finishes", by National Ornamental & Miscellaneous Metals Association (NOMMA), as follows:
 1. Typical Railing: Type 2 or better, unless otherwise indicated.
 2. Service Stair Railing: Type 3 or better, unless otherwise indicated.
 3. Ornamental Railing: Type 1.
- I. Fabricate joints that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

2.6 STEEL-FRAMED STAIRS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 1. Alfab, Inc.
 2. American Stair, Inc.
 3. Worthington Metal Fabricators, formerly Sharon Companies Ltd. (The).
- B. Stair Framing:
 1. Fabricate stringers of steel plates or channels. Provide closures for exposed ends of stringers.
 2. Construct platforms of steel plate or channel headers and miscellaneous framing members as needed to comply with performance requirements.
 3. Weld stringers to headers; weld framing members to stringers and headers.
 4. Where stairs are enclosed by gypsum board or shaft-wall assemblies, provide hanger rods or struts to support landings from floor construction above or below. Locate hanger rods and struts where they will not encroach on required stair width and will be within the fire-resistance-rated stair enclosure.
 5. Where masonry walls support metal stairs, provide temporary supporting struts designed for erecting steel stair components before installing masonry.
- C. Metal-Pan Stairs: Form risers, subreads pans, and subplatforms to configurations shown from steel sheet of thickness needed to comply with performance requirements but not less than 0.0677 inch.
 1. Steel Sheet: Uncoated hot-rolled steel sheet, unless otherwise indicated.
 2. Directly weld metal pans to stringers; locate welds on top of subreads where they will be concealed by concrete fill. Do not weld risers to stringers.
 3. Shape metal pans to include nosing integral with riser.
 4. Provide subplatforms of configuration indicated or, if not indicated, the same as subreads. Weld subplatforms to platform framing.

- D. **Metal Bar-Grating Stairs:** Form treads and platforms to configurations shown from metal bar grating; fabricate to comply with NAAMM MBG 531, "Metal Bar Grating Manual."
1. Fabricate treads and platforms from welded steel grating with openings in gratings no more than 1/2 inch in least dimension.
 2. Surface: Serrated.
 3. Finish: Galvanized.
 4. Fabricate grating treads with rolled-steel floor plate nosing and with steel angle or steel plate carrier at each end for stringer connections. Secure treads to stringers with bolts.
 5. Fabricate grating platforms with nosing matching that on grating treads. Provide toeplates at open-sided edges of grating platforms. Weld grating to platform framing.

2.7 STEEL RAILINGS

- A. **General:** Fabricate railings to comply with requirements indicated for design, dimensions, details, finish, and member sizes, including wall thickness of tube, post spacings, and anchorage, but not less than that needed to withstand indicated loads.
- B. **Welded Connections:** Fabricate railings with welded connections. Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.
- C. Form changes in direction of railings as detailed on the Drawings.
- D. Form simple and compound curves by bending members in jigs to produce uniform curvature for each repetitive configuration required; maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.
- E. Close exposed ends of railing members with prefabricated end fittings.
- F. Provide wall returns at ends of wall-mounted handrails, unless otherwise indicated. Close ends of returns unless clearance between end of rail and wall is 1/4 inch or less.
- G. **Brackets, Flanges, Fittings, and Anchors:** Provide wall brackets, end closures, flanges, miscellaneous fittings, and anchors for interconnecting components and for attaching to other work. Furnish inserts and other anchorage devices for connecting to concrete or masonry work.
1. Connect posts to stair framing by direct welding, unless otherwise indicated.
 2. For galvanized railings, provide galvanized fittings, brackets, fasteners, sleeves, and other ferrous-metal components.
 3. For nongalvanized railings, provide nongalvanized ferrous-metal fittings, brackets, fasteners, and sleeves, except galvanize anchors embedded in exterior masonry and concrete construction.
- H. **Fillers:** Provide fillers made from steel plate, or other suitably crush-resistant material, where needed to transfer wall bracket loads through wall finishes to structural supports. Size fillers to suit wall finish thicknesses and to produce adequate bearing area to prevent bracket rotation and overstressing of substrate.

2.8 FINISHES

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Finish metal stairs after assembly.

2.9 STEEL AND IRON FINISHES

- A. Galvanizing: Hot-dip galvanize items as indicated to comply with applicable standard listed below:
 - 1. ASTM A 123/A 123M, for galvanizing steel and iron products.
 - 2. ASTM A 153/A 153M, for galvanizing steel and iron hardware.
 - 3. Fill vent and drain holes that will be exposed in finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.
 - 4. Handrails: Galvanizing shall exhibit a rugosity (smoothness) not greater than 4 rug (16-20 microns of variation) when measured by a profilometer over a 1 inch straight line on the surface of the railings.
- B. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with minimum requirements indicated below for SSPC surface preparation specifications and environmental exposure conditions of installed products:
 - 1. Exterior Stairs (SSPC Zone 1B): SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 - 2. Interior Stairs (SSPC Zone 1A): SSPC-SP 3, "Power Tool Cleaning."
- C. Apply shop primer to uncoated surfaces of metal stair components, except those with galvanized finishes and those to be embedded in concrete or masonry unless otherwise indicated. Comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

2.10 STAINLESS-STEEL FINISHES

- A. Remove tool and die marks and stretch lines or blend into finish.
- B. Grind and polish surfaces to produce uniform, directionally textured, polished finish indicated, free of cross scratches. Run grain with long dimension of each piece.
- C. Bright, Directional Satin Finish: No. 4.
- D. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing metal stairs to in-place construction. Include threaded fasteners for concrete and masonry inserts, through-bolts, lag bolts, and other connectors.

- B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal stairs. Set units accurately in location, alignment, and elevation, measured from established lines and levels and free of rack.
- C. Install metal stairs by welding stair framing to steel structure or to weld plates cast into concrete, unless otherwise indicated.
- D. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.
- E. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
- F. Field Welding: Comply with the following requirements:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- G. Place and finish concrete fill for treads and platforms to comply with Section 033000 - CAST-IN-PLACE CONCRETE.
 - 1. Install abrasive nosings with anchors fully embedded in concrete. Center nosings on tread width.

3.2 INSTALLING STEEL RAILINGS

- A. Adjust railing systems before anchoring to ensure matching alignment at abutting joints. Space posts at spacing indicated or, if not indicated, as required by design loads. Plumb posts in each direction. Secure posts and rail ends to building construction as follows:
 - 1. Anchor posts to steel by welding directly to steel supporting members.
 - 2. Anchor handrail ends to concrete and masonry with steel round flanges welded to rail ends and anchored with postinstalled anchors and bolts.
- B. Attach handrails to wall with wall brackets. Provide bracket with 1-1/2-inch clearance from inside face of handrail and finished wall surface. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads. Secure wall brackets to building construction as follows:
 - 1. Use type of bracket with flange tapped for concealed anchorage to threaded hanger bolt.
 - 2. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.
 - 3. For hollow masonry anchorage, use toggle bolts.
 - 4. For wood stud partitions, use hanger or lag bolts set into wood backing between studs. Coordinate with carpentry work to locate backing members.

5. For steel-framed gypsum board assemblies, fasten brackets directly to steel framing or concealed steel reinforcements using self-tapping screws of size and type required to support structural loads.

3.3 ADJUSTING AND CLEANING

- A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with 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

SECTION 055300

METAL GRATINGS

(Part of Work of Section 050001 - MISCELLANEOUS AND ORNAMENTAL IRON,
Filed Sub-Bid Required)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Metal bar gratings.
 - 2. Metal frames and supports for gratings.
- B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council. Refer to Section 018110, SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.
- C. Items To Be Furnished Only: Furnish the following items for installation by the designated Sections
 - 1. Section 033000 - CAST-IN-PLACE CONCRETE:
 - a. Sleeves, anchors, inserts, plates and similar items.
 - 2. Section 042000 - UNIT MASONRY:
 - a. Miscellaneous metal and iron sleeves, anchors, inserts and plates to be built into masonry walls.
- D. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 051200 - STRUCTURAL STEEL FRAMING for structural-steel framing system components.
 - 2. Section 055100 - METAL STAIRS AND RAILINGS for stairs fabricated with metal bar grating treads and platforms

1.3 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design gratings, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

- B. Structural Performance: Gratings shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated.
 - 1. Floors: Uniform load of 250 lbf/sq. ft. or concentrated load of 3000 lbf, whichever produces the greater stress.
 - 2. Sidewalks and Vehicular Driveways, Subject to Trucking: Uniform load of 250 lbf/sq. ft. or concentrated load of 8000 lbf, whichever produces the greater stress.
 - 3. Limit deflection to L/360 or 1/4 inch, whichever is less.
- C. Seismic Performance: Provide gratings capable of withstanding the effects of earthquake motions determined according to ASCE/SEI 7.

1.4 SUBMITTALS

- A. Product Data: For each product.
 - 1. Including clips and anchorage devices for gratings.
 - 2. Paint products.
- B. LEED Submittals:
 - 1. Low-Emitting Materials, General Emissions Evaluation: Building products must be tested and determined compliant in accordance with California Department of Public Health (CDPH) Standard Method v1.1–2010.
 - a. For interior field-applied paints and coatings, submit test results, including TVOC emissions and VOC content.
 - b. For wet-applied products, submit volume used.
- C. Shop Drawings: Include plans, sections, details, and attachments to other work.
- D. Delegated-Design Submittal: For installed products indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- E. Qualification Data: For qualified professional engineer.
- F. Mill Certificates: Signed by manufacturers of stainless-steel sheet certifying that products furnished comply with requirements.
- G. Welding certificates.
- H. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers certifying that shop primers are compatible with topcoats.

1.5 QUALITY ASSURANCE

- A. Metal Bar Grating Standards: Comply with NAAMM MBG 531, "Metal Bar Grating Manual" and NAAMM MBG 532, "Heavy-Duty Metal Bar Grating Manual."
- B. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

C. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.3, "Structural Welding Code - Sheet Steel."

1.6 PROJECT CONDITIONS

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

1.7 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of anchorages for gratings, grating frames, and supports. 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 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/A 36M.
- C. Steel Bars for Bar Gratings: ASTM A 36/A 36M or steel strip, ASTM A 1011/A 1011M or ASTM A 1018/A 1018M.
- D. Wire Rod for Bar Grating Crossbars: ASTM A 510.
- E. Uncoated Steel Sheet: ASTM A 1011/A 1011M, structural steel, Grade 30.
- F. Galvanized-Steel Sheet: ASTM A 653/A 653M, structural quality, Grade 33, with G90 coating.
- G. Expanded-Metal Carbon Steel: ASTM F 1267, Class 1.
- H. Expanded-Metal Galvanized Steel: ASTM F 1267, Class 2, Grade A.

2.2 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.

2. Provide stainless steel fasteners for fastening stainless steel.
- 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. 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.
- D. Plain Washers: Round, ASME B18.22.1.
- E. Lock Washers: Helical, spring type, ASME B18.21.1.
- F. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.
 1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, unless otherwise indicated.

2.3 MISCELLANEOUS MATERIALS

- A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy that is welded.
- B. Shop Primers: Provide primers that comply with Section 099000 - PAINTING AND COATING.
- C. Zinc-Rich Primer: Complying with SSPC-Paint 20 or SSPC-Paint 29 and compatible with topcoat.
 1. Provide interior, field-applied primer with a VOC content of 250 g/L or less.
- D. Galvanizing Repair Paint: High-zinc-dust-content paint for reglazing welds in steel, complying with SSPC-Paint 20.
 1. Provide interior, field-applied primer with a VOC content of 250 g/L or less.
- E. Isolation Coating (Bituminous Paint): ASTM D 1187, cold-applied asphalt emulsion, VOC compliant, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.4 FABRICATION

- A. Shop Assembly: Fabricate grating sections in shop to greatest extent possible to minimize field splicing and assembly. 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 material cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- C. Form from materials of size, thickness, and shapes indicated, but not less than that needed to support indicated loads.
- D. Fit exposed connections accurately together to form hairline joints.
- E. Welding: Comply with AWS recommendations and 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.
- F. Provide for anchorage of type indicated; coordinate with supporting structure. Fabricate and space the anchoring devices to secure gratings, frames, and supports rigidly in place and to support indicated loads.
 - 1. Fabricate toeplates to fit grating units and weld to units in shop unless otherwise indicated.
 - 2. Fabricate toeplates for attaching in the field.
 - 3. Toeplate Height: 4 inches unless otherwise indicated.

2.5 METAL BAR GRATINGS

- 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. Alabama Metal Industries Corporation; a Gibraltar Industries company.
 - 2. Fisher & Ludlow; Division of Harris Steel Limited.
 - 3. IKG Industries; a division of Harsco Corporation.
 - 4. Ohio Gratings, Inc.
- B. Removable Grating Sections: Fabricate with banding bars attached by welding to entire perimeter of each section. Include anchors and fasteners of type indicated or, if not indicated, as recommended by manufacturer for attaching to supports.
- C. Fabricate cutouts in grating sections for penetrations indicated. Arrange cutouts to permit grating removal without disturbing items penetrating gratings.
 - 1. Edge-band openings in grating that interrupt four or more bearing bars with bars of same size and material as bearing bars.
- D. Do not notch bearing bars at supports to maintain elevation.
- E. Frames and Supports for Metal Gratings: Fabricate from metal shapes, plates, and bars of welded construction to sizes, shapes, and profiles indicated and as necessary to receive gratings. Miter and weld connections for perimeter angle frames. Cut, drill, and tap units to receive hardware and similar items.

1. Unless otherwise indicated, fabricate from same basic metal as gratings.
 2. Equip units indicated to be cast into concrete or built into masonry with integrally welded anchors. Unless otherwise indicated, space anchors 24 inches o.c. and provide minimum anchor units in the form of steel straps 1-1/4 inches wide by 1/4 inch thick by 8 inches long.
- F. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes. Finish gratings, frames, and supports after assembly.
- G. 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.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing gratings to in-place construction. Include threaded fasteners for concrete and masonry inserts, through-bolts, lag bolts, and other connectors.
- B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing gratings. Set units accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.
- C. Provide temporary bracing or anchors in formwork for items that are to be built into concrete or masonry.
- D. Fit exposed connections accurately together to form hairline joints.
1. 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 the surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
- E. Attach toeplates to gratings by welding at locations indicated.
- F. 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.
- G. Corrosion Protection: Coat concealed surfaces of aluminum that will come into contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

3.2 INSTALLING METAL BAR GRATINGS

- A. General: Install gratings to comply with recommendations of referenced metal bar grating standards that apply to grating types and bar sizes indicated, including installation clearances and standard anchoring details.
- B. Attach removable units to supporting members with type and size of clips and fasteners indicated or, if not indicated, as recommended by grating manufacturer for type of installation conditions shown.
- C. Attach nonremovable units to supporting members by welding where both materials are same; otherwise, fasten by bolting as indicated above.

3.3 ADJUSTING AND CLEANING

- A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material as used for shop painting to comply with SSPC-PA 1 requirements for touching up shop-painted surfaces.
 - 1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.
- B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Division 09 painting Sections.
- C. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION

SECTION 057300

DECORATIVE METAL RAILINGS

1.1 SUMMARY

- A. This Section includes:
 - 1. Stainless-steel railings.

1.2 QUALITY ASSURANCE

- A. Mock-ups: Before beginning primary Work of this Section, provide Mock-ups at locations acceptable to the Owner's Representative and obtain acceptance of visual qualities for each type of handrail.

1.3 STAINLESS STEEL

- A. Tubing: ASTM A 554, Grade MT 301, MT 302, or MT 304, as standard with manufacturer.
- B. Pipe: ASTM A 312/A 312M, Grade TP 304.
- C. Castings: ASTM A 743/A 743M, Grade CF 8 or CF 20.
- D. Plate and Sheet: ASTM A 240/A 240M or ASTM A 666, Type 304.
- E. Woven-Wire Mesh: Intermediate-crimp, square pattern, 2-inch woven-wire mesh, made from 0.165-inch nominal diameter wire complying with ASTM A 580/A 580M, Type 304.

1.4 FABRICATION

- A. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.
- B. Connections: Fabricate railings with either welded or non-welded connections unless otherwise indicated.
- C. Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose.
- D. Form bends by use of prefabricated elbow fittings and radius bends, as applicable changes.
- E. Woven-Wire Mesh Infill Panels: Fabricate infill panels from woven-wire mesh crimped into 1 inch by ½ inch by 1/8 inch metal channel frames. Make wire mesh and frames from same metal as railings in which they are installed.
- F. Toe Boards: Where indicated, provide toe boards at railings around openings and at edge of open-sided floors and platforms. Fabricate to dimensions and details indicated.

1.5 STAINLESS-STEEL FINISHES

- A. Bright, Directional Polish: AISI No. 4 with minimal direction graining.
- B. Bright, Cold-rolled, Unpolished: AISI No. 28 Finish.
- C. Satin, Directional Polish: AISI No. 6 Finish.
- D. High Reflective, Directional Polish: AISI No. 7 Finish.
- E. Mirror-Like Reflective, Non-Directional Polish: AISI No. 8 Finish.

END OF SECTION

SECTION 057300

DECORATIVE METAL RAILINGS

(Part of Work of Section 050001 - MISCELLANEOUS AND ORNAMENTAL IRON,
Filed Sub-Bid Required)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Cable railings.
- B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council. Refer to Section 018110, SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.
- C. Items To Be Furnished Only: Furnish the following items for installation by the designated Sections:
 - 1. Section 033000 - CAST-IN-PLACE CONCRETE:
 - a. Sleeves, anchors, inserts, plates and similar items.
 - 2. Section 042000 - UNIT MASONRY:
 - a. Miscellaneous metal and iron sleeves, anchors, inserts and plates to be built into masonry walls.
- D. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 033000 - CAST-IN-PLACE CONCRETE for sleeves, anchors, inserts, plates and similar items.
 - 2. Section 055100 - METAL STAIRS AND RAILINGS for other steel stairs, handrails, and guardrails.
 - 3. Section 061000 - ROUGH CARPENTRY for wood blocking for anchoring railings.

1.3 DEFINITIONS

- A. Railings: Guards, handrails, and similar devices used for protection of occupants at open-sided floor areas, pedestrian guidance and support, visual separation, or wall protection.

1.4 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design railings, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. General: In engineering railings to withstand structural loads indicated, determine allowable design working stresses of railing materials based on the following:
 - 1. Aluminum: The lesser of minimum yield strength divided by 1.65 or minimum ultimate tensile strength divided by 1.95.
 - 2. Stainless Steel: 60 percent of minimum yield strength.
 - 3. Steel: 72 percent of minimum yield strength.
- C. Structural Performance of Railings: Provide railings capable of withstanding the effects of gravity loads and Code required loads and stresses within limits and under conditions indicated.
- D. Thermal Movements: Provide exterior railings 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 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 (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.
- E. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

1.5 SUBMITTALS

- A. Product Data: For each product.
 - 1. Manufacturer's product lines of railings assembled from standard components.
 - 2. Grout, anchoring cement, and paint products.
- B. LEED Submittals:
 - 1. EQc2, Low-Emitting Materials, General Emissions Evaluation: Building products must be tested and determined compliant in accordance with California Department of Public Health (CDPH) Standard Method v1.1–2010.
 - a. For interior field-applied paints and coatings, submit test results, including TVOC emissions and VOC content.
 - b. For wet-applied products, submit volume used.

- C. Shop Drawings: Show layout, spacings, sizes, thicknesses, and types of metal railings; fabrication; and fastening and anchorage details, including mechanical fasteners. Include plans, elevations, sections, details, and attachments to other work.
- D. Delegated-Design Submittal: For railing products indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- E. Samples for Verification: For each type of exposed finish required.
 - 1. Sections of each distinctly different linear railing member, including handrails, top rails, posts, and balusters.
 - 2. Fittings and brackets.
 - 3. Welded connections.
 - 4. Assembled Samples of railing systems, made from full-size components, including top rail, post, handrail, and infill. Show method of finishing members at intersections. Samples need not be full height.
- F. Mill Certificates: Signed by manufacturers of stainless-steel products certifying that products furnished comply with requirements.
- G. Welding certificates.
- H. Qualification Data: For professional engineer.

1.6 QUALITY ASSURANCE

- A. Engineering Responsibility: Preparation of Shop Drawings, design calculations, and other structural data by a qualified professional engineer.
- B. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in the jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of metal railings that are similar to those indicated for this Project in material, design, and extent.
- C. Installer Qualifications: Fabricator of products.
- D. Source Limitations: Obtain each type of railing through one source from a single manufacturer.
- E. Welding: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
 - 2. AWS D1.2, "Structural Welding Code--Aluminum."
 - 3. AWS D1.6, "Structural Welding Code--Stainless Steel."

1.7 PROJECT CONDITIONS

- A. Field Measurements: Verify actual locations of walls and other construction contiguous with railings 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 dimensions and proceed with fabricating railings without field measurements. Coordinate wall and other contiguous construction to ensure that actual dimensions correspond to established dimensions.

1.8 COORDINATION AND SCHEDULING

- A. Coordinate installation of anchorages for railings. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.
- B. Schedule installation so wall attachments are made only to completed walls. Do not support railings temporarily by any means that do not satisfy structural performance requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Stainless Steel Cable Railings: CarlStahl Decorcable X-TEND or equal.

2.2 METALS, GENERAL

- A. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.
- B. Brackets, Flanges, and Anchors: Same metal and finish as supported rails, unless otherwise indicated.
 1. Provide cast-metal brackets with flange tapped for concealed anchorage to threaded hanger bolt.
 2. Provide either formed- or cast-metal brackets with predrilled hole for exposed bolt anchorage.
 3. Provide extruded-aluminum brackets with interlocking pieces that conceal anchorage. Locate set screws on bottom of bracket.

2.3 STAINLESS STEEL

- A. Tubing: ASTM A 554, Grade MT 304 at interior locations and 316L at exterior locations.
- B. Pipe: ASTM A 312, Grade TP 304 at interior locations and 316L at exterior locations.
- C. Castings: ASTM A 743, Grade CF 8 or CF 20.
- D. Plate and Sheet: ASTM A 666, Type 304 at interior locations and 316L at exterior locations.
- E. Wire Rope: 1 x 19 wire rope made from wire complying with ASTM A 492, Type 316.
- F. Wire-Rope Fittings: Connectors of types indicated, fabricated from stainless steel, and with capability to sustain, without failure, a load equal to minimum breaking strength of wire rope with which they are used.

2.4 FASTENERS

- A. General: Provide the following:
 - 1. Stainless-Steel Components: Type 316 stainless-steel fasteners.
 - 2. Uncoated Steel Components: Plated-steel fasteners complying with ASTM B 633, Class Fe/Zn 25 for electrodeposited zinc coating where concealed; Type 304 stainless-steel fasteners where exposed.
 - 3. Galvanized-Steel Components: Plated-steel fasteners complying with ASTM B 633, Class Fe/Zn 25 for electrodeposited zinc coating.
 - 4. Dissimilar Metals: Type 316 stainless-steel fasteners.
- B. Fasteners for Anchoring Railings to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings to other types of construction indicated and capable of withstanding design loads.
- C. Provide concealed fasteners for interconnecting railing components and for attaching railings to other work, unless exposed fasteners are the standard fastening method for railings indicated.
- D. Anchors: Provide anchors, fabricated from corrosion-resistant materials with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and equal to four times the load imposed when installed in concrete, as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.

2.5 MISCELLANEOUS MATERIALS

- A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
- B. Isolation Coating (Bituminous Paint): ASTM D 1187, cold-applied asphalt emulsion, VOC compliant, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.
- C. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.
 - 1. Basis of Design: Sika; SikaGrout 212.
 - 2. VOC Content: 0 g/L.

2.6 FABRICATION

- A. General: Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage, but not less than that required to support structural loads.
- B. Assemble railings in the shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.

- C. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch, unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- D. Form work true to line and level with accurate angles and surfaces.
- E. Fabricate connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.
- F. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.
- G. Form changes in direction as detailed on the Drawings and as standard with system selected.
- H. Comply with "Guideline 1: Joint Finishes", by National Ornamental & Miscellaneous Metals Association (NOMMA), as follows:
 - 1. Ornamental Railing: Type 1.
- I. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work, unless otherwise indicated.
 - 1. At brackets and fittings fastened to plaster or gypsum board partitions, provide fillers made from crush-resistant material, or other means to transfer wall loads through wall finishes to structural supports and prevent bracket or fitting rotation and crushing of substrate.
- J. Provide inserts and other anchorage devices for connecting railings to concrete or masonry work. Fabricate anchorage devices capable of withstanding loads imposed by railings. Coordinate anchorage devices with supporting structure.

2.7 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 shipment.
- 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 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.

2.8 STAINLESS-STEEL FINISHES

- A. Remove tool and die marks and stretch lines or blend into finish.
- B. Grind and polish surfaces to produce uniform finish indicated, free of cross scratches.
 - 1. Run grain of directionally textured finishes with long dimension of each piece.

- C. Directional Satin Finish: No. 4.
- D. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine plaster and gypsum board assemblies, where reinforced to receive anchors, to verify that locations of concealed reinforcements have been clearly marked for Installer. Locate reinforcements and mark locations if not already done.

3.2 INSTALLATION, GENERAL

- A. Fit exposed connections together to form tight, hairline joints.
- B. Perform cutting, drilling, and fitting required for installing railings. Set railings accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.
 - 1. Do not weld, cut, or abrade surfaces of railing components that have been coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
 - 2. Set posts plumb within a tolerance of 1/16 inch in 3 feet.
 - 3. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet.
- C. Corrosion Protection: Coat concealed surfaces of aluminum and copper alloys that will be in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.
- D. Adjust railings before anchoring to ensure matching alignment at abutting joints.
- E. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing railings and for properly transferring loads to in-place construction.

3.3 ANCHORING POSTS

- A. Use steel pipe sleeves preset and anchored into concrete for installing posts. After posts have been inserted into sleeves, fill annular space between post and sleeve with nonshrink, nonmetallic grout or anchoring cement, mixed and placed to comply with anchoring material manufacturer's written instructions.
- B. Form or core-drill holes not less than 5 inches deep and 3/4 inch larger than OD of post for installing posts in concrete. Clean holes of loose material, insert posts, and fill annular space between post and concrete with nonshrink, nonmetallic grout, mixed and placed to comply with anchoring material manufacturer's written instructions.
- C. Cover anchorage joint with flange of same metal as post, attached to post with set screws.

- D. Leave anchorage joint exposed; wipe off surplus anchoring material; and leave 1/8-inch buildup, sloped away from post.
- E. Anchor steel posts to steel with flanges, angle or floor type as required by conditions, welded to posts and bolted to metal supporting members.
- F. Anchor posts to metal surfaces with flanges, angle type, or floor type as required by conditions, connected to posts and to metal supporting members as follows:
 - 1. For aluminum railings, attach posts as indicated using fittings designed and engineered for this purpose.
 - 2. For stainless-steel railings, weld flanges to posts and bolt to metal-supporting surfaces.
- G. Install removable railing sections, where indicated, in slip-fit metal sockets cast in concrete.

3.4 ANCHORING RAILING ENDS

- A. Anchor railing ends to concrete and masonry as indicated on the drawings and anchored to wall construction with anchors and bolts.
- B. Anchor railing ends to metal surfaces with flanges bolted to metal surfaces.

3.5 ATTACHING HANDRAILS TO WALLS

- A. Attach handrails to walls with wall brackets. Provide brackets with 1-1/2-inch clearance from inside face of handrail and finished wall surface.
- B. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.
- C. Secure wall brackets to building construction as follows:
 - 1. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.
 - 2. For hollow masonry anchorage, use toggle bolts.
 - 3. For steel-framed partitions, fasten brackets directly to steel framing or concealed steel reinforcements using self-tapping screws of size and type required to support structural loads.

3.6 CLEANING

- A. Clean by washing thoroughly with clean water and soap, rinsing with clean water, and wiping dry.

3.7 PROTECTION

- A. Protect finishes of railings from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at time of Substantial Completion.

- B. Restore finishes damaged during installation and construction period so no evidence remains of correction work. Return items that cannot be refinished in field to shop; make required alterations and refinish entire unit, or provide new units.

END OF SECTION

SECTION 061000

ROUGH CARPENTRY

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Wood blocking, cants, and nailers.
 - 2. Plywood backing panels.
- B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council. Refer to Section 018110, SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 042000 - UNIT MASONRY for wood nailers and blocking built into masonry.
 - 2. Section 061600 - SHEATHING for plywood and gypsum sheathing.
 - 3. Section 064020 - INTERIOR ARCHITECTURAL WOODWORK for interior woodwork not specified in this Section.
 - 4. Section 092110 - GYPSUM BOARD ASSEMBLIES for sheet metal backing.

1.3 SUBMITTALS

- A. Product Data: For each type of process and factory-fabricated product.
 - 1. Indicate component materials and dimensions and include construction and application details.
 - 2. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used, net amount of preservative retained, and chemical treatment manufacturer's written instructions for handling, storing, installing, and finishing treated material.
 - 3. 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, both before and after exposure to elevated temperatures when tested according to ASTM D 5516 and 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.

B. LEED Submittals:

1. Building Product Disclosure and Optimization, Environmental Product Declarations (EPD):
 - a. Option 1: For wood products, submit industry-wide EPDs.
2. Building Product Disclosure and Optimization, Sourcing of Raw Materials:
 - a. General: For credit achievement calculation, submit location of products sourced (extracted, manufactured, and purchased), indicating number of miles from the project site.
 - b. Option 2, Leadership Extraction Practices:
 - 1) Wood Products: Wood products must be certified by the Forest Stewardship Council or USGBC-approved equivalent. Products meeting wood products criteria are valued at 100% of their cost for the purposes of credit achievement calculation.
 - 2) Recycled Content: Submit percentages by weight of postconsumer and preconsumer recycled content for products having recycled content. Include statement indicating costs for each product having recycled content.
3. Low-Emitting Materials, General Emissions Evaluation: Building products must be tested and determined compliant in accordance with California Department of Public Health (CDPH) Standard Method v1.1–2010.
 - a. For wood composite materials, submit test results, including TVOC emissions.
 - b. For adhesives and sealants, submit test results, including TVOC emissions and VOC content.
 - c. For wet-applied products, submit volume used.

1.4 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.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Stack lumber, plywood, and other panels; place spacers between each bundle to provide air circulation. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

- A. Environmental Product Declarations (EPD): Industry-wide EPDs for wood products are available from the American Wood Council and Canadian Wood Council.
- B. Certified Wood: Materials shall be produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship."
 - 1. Salvaged wood products are exempt from FSC requirements for LEED certifications.
- C. Lumber: DOC PS 20 and applicable rules of lumber grading agencies certified by the American Lumber Standards Committee Board of Review.
 - 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.
 - 4. Provide dry lumber with 15 percent maximum moisture content at time of dressing for 2-inch nominal thickness or less, unless otherwise indicated.
- D. Plywood Panels:
 - 1. Plywood: Either DOC PS 1 or DOC PS 2, unless otherwise indicated.
 - 2. Thickness: As needed to comply with requirements specified but not less than thickness indicated.
 - 3. Factory mark panels according to indicated standard.

2.2 WOOD-PRESERVATIVE-TREATED MATERIALS

- A. Preservative Treatment by Pressure Process: AWP A U1; Use Category UC2 for interior construction not in contact with the ground, Use Category UC3b for exterior construction not in contact with the ground, and Use Category UC4a for items in contact with the ground.
 - 1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium. Do not use inorganic boron (SBX) for sill plates.
 - a. Use Borate or Copper Azole treatments. Product shall not contain creosote, arsenic or pentachlorophenol.
 - 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 material after treatment to a maximum moisture content of 19 percent for lumber and 18 percent for plywood. Do not use material that is warped or does not comply with requirements for untreated material.

- C. Mark each treated item with the treatment quality mark of an inspection agency approved by the American Lumber Standards Committee 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. Wood sills, sleepers, blocking, furring, stripping, and similar concealed members in contact with masonry or concrete in exterior walls.
- E. Available Products: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Hoover Treated Wood Products; PyroGuard.
 - 2. Koppers Performance Chemicals; LifeWood MicroPro Treatment.
 - 3. Sustainable Northwest Wood; Pressure Treated Wood with Copper Azule.

2.3 FIRE-RETARDANT-TREATED MATERIALS

- A. General: For **fire-rated exterior walls**, all interior use materials, and where fire-retardant-treated materials are indicated, materials shall comply with requirements in this article, that are acceptable to authorities having jurisdiction, and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.
- B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested according to ASTM E 84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet (3.2 m) beyond the centerline of the burners at any time during the test.
 - 1. Treatment shall not promote corrosion of metal fasteners.
 - 2. Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated lumber and plywood by pressure process after being subjected to accelerated weathering according to ASTM D 2898. Use for exterior locations and where indicated.
 - 3. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D 3201 at 92 percent relative humidity. Use where exterior type is not indicated.
 - 4. Design Value Adjustment Factors: Treated lumber shall be tested according to ASTM D 5664 and design value adjustment factors shall be calculated according to ASTM D 6841.
 - 5. Product shall not contain creosote, arsenic or pentachlorophenol.
- C. Kiln-dry lumber after treatment to maximum moisture content of 19 percent. Kiln-dry plywood after treatment to maximum moisture content of 15 percent.
- D. Identify fire-retardant-treated wood with appropriate classification marking of qualified testing agency.
- E. Available Products: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Technologies Boralife Inc.; Boraflame.

2.4 MISCELLANEOUS LUMBER

- A. General: Provide FRTW lumber for support or attachment of other construction, including, but not limited to, the following: Rooftop equipment bases and support curbs, blocking, cants, nailers, furring and grounds.
- B. For items of dimension lumber size, provide Construction, Stud, or No. 2 grade lumber with 15 percent moisture content.

2.5 PANEL PRODUCTS

- A. Miscellaneous Concealed Plywood: Exposure 1 sheathing, span rating to suit framing in each location, and thickness as indicated but not less than 1/2 inch.
- B. Telephone and Electrical Equipment Backing Panels: DOC PS 1, Exposure 1, C-D Plugged, fire-retardant treated, in thickness indicated or, if not indicated, not less than 1/2 inch thick.

2.6 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 of Type 304 stainless steel.
- B. Nails, Wire, Brads, and Staples: ASTM F 1667.
- C. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.
- D. Wood Screws: ASME B18.6.1.
- E. Screws for Fastening to Cold-Formed Metal Framing: ASTM C 954, except with wafer heads and reamer wings, length as recommended by screw manufacturer for material being fastened.
- F. Bolts: Steel bolts complying with ASTM A 307, Grade A with ASTM A 563 hex nuts and, where indicated, flat washers.
- G. 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; except provide stainless steel complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2, where in contact with pressure-preservative treated wood or when exposed to exterior conditions.

2.7 MISCELLANEOUS MATERIALS

- A. Adhesive, Including Gluing Furring and Sleepers to Concrete or Masonry: Formulation complying with ASTM D 3498 that is approved for use indicated by adhesive manufacturer.
 - 1. Available Products: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Henkel Corp.; Loctite PL Premium Polyurethane Construction Adhesive.
 - b. Henkel Corp.; OSI SF450 Heavy Duty Subfloor Construction Adhesive.
 - 2. Low-Emitting Materials: Provide adhesives in compliance with the 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."
 - 3. VOC Content: 70 g/L or less.
 - 4. Do not use adhesives that contain urea formaldehyde.
 - 5. Methylene chloride and perchloroethylene may not be intentionally added to adhesives.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Discard units of material with defects that impair quality of carpentry and that are too small to use with minimum number of joints or optimum joint arrangement.
- B. 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 furring, nailers, blocking, grounds, and similar supports to comply with requirements for attaching other construction.
- C. Apply field treatment complying with AWPAC M4 to cut surfaces of preservative-treated lumber and plywood.
- D. Securely attach carpentry work as indicated and according to applicable codes and the following:
 - 1. Table 2304.10.1, "Fastening Schedule," in ICC's International Building Code (IBC).
 - 2. Table R602.3(1), "Fastener Schedule for Structural Members," and Table R602.3(2), "Alternate Attachments," in ICC's International Residential Code for One- and Two-Family Dwellings.
 - 3. ICC-ES evaluation report for fastener.
- E. Countersink fastener heads on exposed carpentry work and fill holes with wood filler.
- F. Use fasteners of appropriate type and length. Predrill members when necessary to avoid splitting wood.

3.2 WOOD BLOCKING, AND NAILER INSTALLATION

- A. Install as 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

SECTION 061600

SHEATHING

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Gypsum sheathing attached to cold-formed metal framing members at exterior wall.
- B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council. Refer to Section 018110, SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 042000 - UNIT MASONRY for masonry-veneer anchors and insulation in cavity wall construction.
 - 2. Section 054000 - COLD-FORMED METAL FRAMING for metal framing at exterior wall.
 - 3. Section 061000 - ROUGH CARPENTRY for plywood backing panels.
 - 4. Section 072700 - AIR BARRIERS for modified bituminous sheet membrane over gypsum sheathing and membrane flashing.
 - 5. Section 076200 - SHEET METAL FLASHING AND TRIM for flashing applied to gypsum sheathing.

1.3 DEFINITIONS

- A. Gypsum Board Construction Terminology Standard: Refer to ASTM C 11 and GA-505 for definitions of terms for gypsum sheathing board construction not defined in this Section or in other referenced standards.

1.4 SUBMITTALS

- A. Product Data: For each product specified.
- B. LEED Submittals:
 - 1. Building Product Disclosure and Optimization, Environmental Product Declarations (EPD):

- a. Option 1: For glass-mat gypsum sheathing, submit product-specific Type III EPD.

1.5 QUALITY ASSURANCE

- A. Source Limitations: Obtain each gypsum sheathing product through one source from a single manufacturer.
- B. Fire-Resistance-Rated Assemblies: Where gypsum sheathing boards are part of fire-resistance-rated assemblies, provide assemblies as follows:
 - 1. Assemblies comply with requirements of fire-response-tested assemblies indicated by GA File Numbers in GA-600, "Fire Resistance Design Manual"; or by design designations in UL's "Fire Resistance Directory" or in certification listings of another testing and inspecting agency acceptable to authorities having jurisdiction.
 - 2. Fire-resistance ratings were determined by fire-response testing assemblies according to ASTM E 119.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in original packages, containers, or bundles, each bearing brand name and identification of manufacturer.
- B. Store materials protected against damage from weather, direct sunlight, surface contamination, corrosion, construction traffic, or other causes. Neatly stack gypsum sheathing board flat on leveled supports off the ground, under cover, and fully protected from weather.

1.7 SEQUENCING AND SCHEDULING

- A. Sequence installing sheathing with installing exterior cladding to comply with requirements indicated below:
 - 1. Do not leave glass-mat gypsum sheathing board exposed to weather for more than 180 days.

PART 2 - PRODUCTS

2.1 SHEATHING BOARD

- A. Glass-Mat Gypsum Sheathing Board: ASTM C 1177.
 - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - a. CertainTeed Corp.; GlasRoc.
 - b. Georgia-Pacific Gypsum LLC; Dens-Glass Gold.
 - c. National Gypsum Company; Gold Bond, e²XP.
 - d. USG Corporation; Securock.
 - 2. Type and Thickness: 5/8 inch, Type X.
 - 3. Building Product Disclosure and Optimization, Environmental Product Declarations (EPD): Type III EPD.

2.2 FASTENERS

- A. Screws for Fastening Gypsum Sheathing to Cold-Formed Metal Framing: Steel drill screws, in length recommended by sheathing manufacturer for thickness of sheathing board to be attached, with organic-polymer or other corrosion-protective coating having a salt-spray resistance of more than 800 hours according to ASTM B 117.
 - 1. For steel framing from 0.033 to 0.112 inch thick, attach sheathing to comply with ASTM C 954.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: Install gypsum sheathing to comply with GA-253 and manufacturer's written instructions.
- B. Cut boards at penetrations, edges, and other obstructions of the work; fit tightly against abutting construction, except provide a 3/8-inch setback where non-load-bearing construction abuts structural elements.
- C. Coordinate sheathing installation with flashing and joint sealant installation so these materials are installed in the sequence and manner that prevent exterior moisture from passing through completed exterior wall assembly.
- D. Apply fasteners so screw heads bear tightly against face of sheathing boards but do not cut into facing.
- E. Do not bridge building expansion joints with sheathing; cut and space edges to match spacing of structural support elements.
- F. Vertical Installation: Install 48-inch- wide gypsum sheathing boards vertically with vertical edges centered over flanges of steel studs. Abut ends and edges of each board with those of adjacent boards. Screw-attach boards at perimeter and within field of board to each steel stud:
 - 1. Perimeter: 6 inches on center.
 - 2. Field: 8 inches on center.

END OF SECTION

SECTION 064020

INTERIOR ARCHITECTURAL WOODWORK

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. Interior standing and running trim.
2. Interior frames and jambs.
3. Stairwork and rails.
4. Wood casework.
5. Plastic-laminate casework.
6. Wood countertops.
7. Plastic-laminate countertops.
8. Solid-surfacing-material countertops.
9. Upholstered seating.
10. Closet and utility shelving.
11. Shop finishing of interior woodwork.

- B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council. Refer to Section 018110 - SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.

- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:

1. Section 061000 - ROUGH CARPENTRY for wood furring, blocking, shims, and hanging strips required for installing woodwork and concealed within other construction before woodwork installation.
2. Section 064200 - PANELING for wood paneling.
3. Section 099000 - PAINTING AND COATING for field finishing work of this Section.

1.3 SUBMITTALS

- A. Product Data: For each type of product specified, including casework hardware and accessories, and finishing materials and processes.

1. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements.

INTERIOR ARCHITECTURAL WOODWORK

2. For fabric and padding, documentation indicating that the materials contain no chemical flame retardants.

B. LEED Submittals:

1. Building Product Disclosure and Optimization, Environmental Product Declarations (EPD):
 - a. Option 1: For wood products and plastic laminate, submit industry-wide EPDs.
2. Building Product Disclosure and Optimization, Sourcing of Raw Materials:
 - a. General: For credit achievement calculation, submit location of products sourced (extracted, manufactured, and purchased), indicating number of miles from the project site.
 - b. Option 2, Leadership Extraction Practices:
 - 1) Wood Products: Wood products must be certified by the Forest Stewardship Council or USGBC-approved equivalent. Products meeting wood products criteria are valued at 100% of their cost for the purposes of credit achievement calculation.
 - 2) Recycled Content: Submit percentages by weight of postconsumer and preconsumer recycled content for products having recycled content. Include statement indicating costs for each product having recycled content.
3. Low-Emitting Materials, General Emissions Evaluation: Building products must be tested and determined compliant in accordance with California Department of Public Health (CDPH) Standard Method v1.1–2010.
 - a. For wood composite materials, submit test results, including TVOC emissions.
 - b. For adhesives and sealants, submit test results, including TVOC emissions and VOC content.
 - c. For wet-applied products, submit volume used.

C. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.

1. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
 - a. Provide schedule of blocking required to support the Work of this Section.
2. Show locations and sizes of cutouts and holes for plumbing fixtures, electrical components and other items installed in architectural woodwork.
3. Show veneer leaves with dimensions, grain direction, exposed face, and identification numbers indicating the flitch and sequence within the flitch for each leaf.

D. Samples for Verification:

1. Lumber with or for transparent finish, not less than 5 inches wide by 12 inches long for each species and cut, finished on 1 side and 1 edge.

2. Veneer leaves representative of and selected from flitches to be used for transparent-finished woodwork.
 - a. Submit step-type range sample sets of factory finished plywood and factory finished solid wood in size illustrating wood grain and specified finish, including edge banding detail and any veneer or solid edge glue joints.
 - b. Submit one leaf for every 1000 gross square foot of veneer required.
3. Lumber and panel products with shop-applied opaque finish, 5 inches wide by 12 inches long for lumber and 8 by 10 inches for panels, for each finish system and color, with 1/2 of exposed surface finished.
4. Plastic laminates, 8 by 10 inches for each type, color, pattern, and surface finish, with 1 sample applied to core material, and specified edge material applied to 1 edge.
5. Solid-surfacing materials, 6 inches square.
6. Fabric: Full width and one pattern repeat.

E. Woodwork Quality Standard Compliance Certificates: Submit registration number for AWI Quality Certification Program.

F. Qualification Data: For Installer and fabricator.

1.4 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate products similar to those required for this Project and whose products have a record of successful in-service performance. Shop is a certified participant in AWI's Quality Certification Program.

B. Installer Qualifications: Certified participant in AWI's Quality Certification Program.

C. Source Limitations: Engage a qualified woodworking firm to assume undivided responsibility for production of interior architectural woodwork with blueprint-matched wood veneers and components.

D. Quality Standard: Unless otherwise indicated, comply with AWI/AWMAC/WI's "Architectural Woodwork Standards," latest edition, including errata, for grades of interior architectural woodwork indicated for construction, finishes, installation, and other requirements.

1. Provide AWI Quality Certification Program labels and certificates indicating that woodwork, including installation, complies with requirements of grades specified. Upon notice of award, register the work under this section with the AWI Quality Certification Program.

E. Fire-Test-Response Characteristics: Where fire-retardant materials or products are indicated, provide materials and products with specified fire-test-response characteristics as determined by testing identical products per test method indicated by UL, ITS, or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify with appropriate markings of applicable testing and inspecting agency in the form of separable paper label or, where required by authorities having jurisdiction, imprint on surfaces of materials that will be concealed from view after installation.

1. Fire-Test-Response Characteristics of Upholstery Fabric and Padding: Comply with California Technical Bulletin 117-2013 Update, with no chemical flame retardants.

- a. Full-Scale Fire Test: Where required by local jurisdiction, comply with California Technical Bulletin 133.

- F. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 - 1. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.
- G. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver woodwork until painting and similar operations that could damage woodwork have been completed in installation areas. If woodwork must be stored in other than installation areas, store only in areas where environmental conditions comply with requirements specified in "Project Conditions" Article.

1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install woodwork until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.
 - 1. The HVAC systems as specified elsewhere may not provide for humidity controls. The expected ranges of relative humidity are expected to be as high as 55% to a low of uncontrolled during the heating system. Comply with AWS Section 2, Care and Storage.
- B. Field Measurements: Where woodwork is indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
 - 1. Locate concealed framing, blocking, and reinforcements that support woodwork by field measurements before being enclosed, and indicate measurements on Shop Drawings.
 - 2. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating woodwork without field measurements. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

1.7 COORDINATION

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

PART 2 - PRODUCTS

2.1 BASIS-OF-DESIGN

- A. Basis-of-Design Products: Refer to the Finish Schedule on the Drawings.

2.2 MATERIALS

- A. General: Provide materials that comply with requirements of AWI/AWMAC/WI's "Architectural Woodwork Standards" for each type of woodwork and quality grade specified, unless otherwise indicated.
- B. Environmental Product Declarations (EPD): Industry-wide EPDs for wood products and plastic laminates are available from the American Wood Council and Canadian Wood Council.
- C. Certified Wood: Materials shall be produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship."
1. Salvaged and reclaimed wood is excluded from certified wood requirements.
- D. Recycled Content of Medium-Density Fiberboard and Particleboard: Provide products with an average recycled content so postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 percent.
- E. Wood Veneers and Lumber: Provide AWI Custom Grade materials and workmanship, unless otherwise indicated. For species not listed in the AWS comply with the following:
1. Provide AWI Lumber Grade 1 and AWI Grade A Veneer, book-matched, minimum 6 inch face veneer width. Kiln dry to 6-8 percent moisture content. Components shall be free of defects and sapwood. Match adjacent pieces for color and grain pattern.
 2. Single-Source Requirement for Wood Veneers and Solids: Intent is to provide wood which matches as closely as possible throughout the project. Provide wood veneers and solids from the same distributor, and from the same flitches and solids sources to the greatest extent possible.
- F. Wood Species and Cut for Transparent Finish: As selected by the Architect.
1. Architect's control samples for transparent finish, veneer grain and figure characteristics are available for review at the office of the Architect.
 2. Veneer Matching Requirements:
 - a. Matching Between Adjacent Veneer Leaves: Book match and architectural end match.
 - b. Matching Within Individual Panel Faces: Balance and Center Match.
 - c. Method of Matching Panels: Blueprint-matched panels and components.
- G. Wood Species for Opaque Finish: Any closed-grain hardwood.
- H. Composite Wood Products: Comply with the following:

1. Composite Wood, General: CARB II compliant or made with binder containing no added formaldehyde (NAF).
 2. Medium-Density Fiberboard (MDF): ANSI A208.2, Grade MD.
 3. Particleboard: ANSI A208.1, Grade M-2-Exterior Glue.
 4. Softwood Plywood: DOC PS 1, Medium Density Overlay (MDO).
 5. Veneer-Faced Panel Products (Hardwood Plywood): HPVA HP-1.
 - a. Resin impregnated paper backs are not permitted. Backs shall be of compatible hardwood species and cut. Contact adhesive is not permitted.
- I. High-Pressure Decorative Plastic Laminate: NEMA LD 3, grades as indicated or, if not indicated, as required by woodwork quality standard.
1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering high-pressure decorative laminates that may be incorporated into the Work include, but are not limited to, the following:
 - a. Abet Laminati, Inc.
 - b. Arborite; a division of Wilsonart.
 - c. Formica Corporation.
 - d. Lamin-Art; a division of Wilsonart.
 - e. Nevamar, Panolam, and Pionite; divisions of Panolam Surface Systems.
 - f. Wilsonart LLC.
- J. Solid-Surfacing Material: Homogeneous solid sheets of filled plastic resin complying with ISFA-2.
1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Avonite Surfaces; Aristech Surfaces.
 - b. E. I. du Pont de Nemours and Company; Corian.
 - c. Formica Corporation.
 - d. LG Hausys; Hi-Macs.
 - e. Wilsonart LLC.
- K. Solid-Surfacing Material, Quartz-Agglomerate Type: Solid sheets consisting of quartz aggregates bound together with a matrix of filled plastic resin complying with ISFA-2.
1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. CaesarStone.
 - b. Cosentino USA; Silestone.
 - c. Dal-Tile; ONE Quartz Surfaces.
 - d. DuPont; Corian Quartz.
 - e. LG Hausys; Viatera Quartz Surface.

- L. Tempered Float Glass for Casework: ASTM C 1048, Kind FT, Condition A, Type I, Class 1 (clear), Quality-Q3, with exposed edges seamed before tempering, 1/4 inch (6 mm) thick, unless otherwise indicated.

M. Cushions:

- 1. Fabric: Provide as indicated on the Finish Schedule.
- 2. Upholstery Padding: Flexible, cellular, molded or slab polyurethane foam, with no added chemical flame retardants.

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.
 - 1. Do not use treated materials that do not comply with requirements of referenced woodworking standard or that are warped, discolored, or otherwise defective.
 - 2. Use fire-retardant-treatment formulations that do not bleed through or otherwise adversely affect finishes. Do not use colorants to distinguish treated materials from untreated materials.
 - 3. Identify fire-retardant-treated materials with appropriate classification marking of UL, U.S. Testing, Timber Products Inspection, or another testing and inspecting agency acceptable to authorities having jurisdiction.
- B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Comply with performance requirements of AWPA C20 (lumber) and AWPA C27 (plywood). Use the following treatment type:
 - 1. Exterior Type: Organic-resin-based formulation thermally set in wood by kiln drying.
 - 2. Mill lumber before treatment and implement special procedures during treatment and drying processes that prevent lumber from warping and developing discolorations from drying sticks or other causes, marring, and other defects affecting appearance of treated woodwork.
 - 3. Kiln-dry materials before and after treatment to levels required for untreated materials.
- C. Fire-Retardant Particleboard: Panels complying with the following requirements, made from softwood particles and fire-retardant chemicals mixed together at time of panel manufacture to achieve flame-spread index of 25 or less and smoke-developed index of 25 or less per ASTM E 84.
 - 1. Fire-Retardant Fiberboard and Particleboard: Provide five ply construction with crossbands to prevent any ammonia fuming from the core to the face veneers.

2.4 CASEWORK HARDWARE AND ACCESSORIES

- A. General: Provide casework hardware and accessory materials associated with architectural casework, except for items specified in Section 087100 - DOOR HARDWARE.
- B. Frameless Concealed Hinges (European Type): BHMA A156.9, B01602,100 degrees of opening, self-closing.

- C. Back-Mounted Pulls: BHMA A156.9, B02011.
- D. Catches: Push-in magnetic catches, BHMA A156.9, B03131.
- E. Adjustable Shelf Standards and Supports: BHMA A156.9, B04071; with shelf rests, B04081 or BHMA A156.9, B04102; with shelf brackets, B04112.
- F. Drawer Slides: BHMA A156.9, B05091; side mounted and extending under bottom edge of drawer; full-extension type; epoxy-coated-steel with steel ball-bearings; of the following grades:
 - 1. Box Drawer Slides: Grade 1.
 - 2. File Drawer Slides: Grade 1HD-100.
 - 3. Pencil Drawer Slides: Grade 2.
 - 4. Keyboard Slides: Grade 1.
 - 5. Trash Bin Slides: Grade 1HD-100.
- G. Aluminum Slides for Sliding Glass Doors: BHMA A156.9, B07063.
- H. Door Locks: BHMA A156.11, E07121.
- I. Drawer Locks: BHMA A156.11, E07041.
- J. Grommets for Cable Passage through Countertops: Molded-plastic grommets and matching plastic caps with slot for wire passage.
- K. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with BHMA A156.18 for BHMA finish number indicated.
 - 1. Satin Stainless Steel: BHMA 630.
 - 2. Satin Aluminum, Clear Anodized: BHMA 628.
- L. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in BHMA A156.9.

2.5 MISCELLANEOUS MATERIALS

- A. Furring, Blocking, Shims, and Hanging Strips: Fire-retardant-treated softwood lumber, kiln dried to less than 15 percent moisture content.
- B. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide nonferrous-metal or hot-dip galvanized anchors and inserts on inside face of exterior walls and elsewhere as required for corrosion resistance. Provide toothed-steel or lead expansion sleeves for drilled-in-place anchors.
- C. Handrail Brackets: Cast from malleable iron with wall flange drilled [for exposed anchor and with support arm for screwing to underside of rail. Sized to provide 1-1/2-inch clearance between handrail and wall.
- D. Installation Adhesives and Wood Glues: Formulations approved for use indicated by adhesive manufacturer.

1. Low-Emitting Materials: Provide adhesives in compliance with the 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. VOC Limits: Use installation adhesives that comply with the following limits for VOC content:
 - a. Wood Glues: 30 g/L.
 - b. Contact Adhesives: Not permitted on the Project without Architect's prior approval.
3. Do not use adhesives that contain urea formaldehyde.
4. Methylene chloride and perchloroethylene may not be intentionally added to adhesives.

2.6 FABRICATION, GENERAL

- A. Wood Moisture Content: Comply with requirements of referenced quality standard for wood moisture content in relation to ambient relative humidity during fabrication and in installation areas.
- B. Sand fire-retardant-treated wood lightly to remove raised grain on exposed surfaces before fabrication.
- C. Fabricate woodwork to dimensions, profiles, and details indicated. Ease edges to radius indicated for the following:
 1. Corners of Casework and Edges of Solid-Wood (Lumber) Members and Rails: 1/16 inch.
- D. Complete fabrication, including assembly, finishing, and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.
- E. Shop-cut openings to maximum extent possible to receive hardware, appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.
 1. Seal edges of openings in countertops with a coat of varnish.
- F. Install glass to comply with applicable requirements in Section 088000 - GLAZING and in GANA's "Glazing Manual." For glass in wood frames, secure glass with removable stops.

2.7 INTERIOR STANDING AND RUNNING TRIM FOR TRANSPARENT FINISH

- A. Grade: Custom.
- B. Wood Species and Cut: As specified hereinabove.
 1. 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.
- C. For trim items wider than available lumber, use veneered construction. Do not glue for width.

- D. For rails wider or thicker than available lumber, use veneered construction. Do not glue for width or thickness.
- E. Assemble casings in plant except where limitations of access to place of installation require field assembly.

2.8 INTERIOR STANDING AND RUNNING TRIM FOR OPAQUE FINISH

- A. Grade: Custom.
- B. Wood Species: Any closed-grain hardwood.
- C. Backout or groove backs of flat trim members and kerf backs of other wide, flat members, except for members with ends exposed in finished work.
- D. Assemble casings in plant except where limitations of access to place of installation require field assembly.

2.9 INTERIOR FRAMES AND JAMBS FOR TRANSPARENT FINISH

- A. Grade: Custom.
- B. Wood Species and Cut: **As specified hereinabove**
- C. For frames or jambs wider than available lumber, use veneered construction. Do not glue for width.
- D. Fire-Rated Interior Frames and Jambs Where Indicated: Products fabricated from fire-retardant particleboard or fire-retardant medium-density fiberboard with veneered, exposed surfaces and listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to NFPA 252.

- 1. Fire Rating: 20 minutes.

2.10 INTERIOR FRAMES AND JAMBS FOR OPAQUE FINISH

- A. Grade: Custom.
- B. Wood Species: Any closed-grain hardwood.

2.11 STAIRWORK AND RAILS

- A. Grade: Custom.
- B. Wood Species and Cut for Transparent Finish: **As specified hereinabove.**
- C. Wood Species for Opaque Finish: **Any closed-grain hardwood, except that eastern white pine, sugar pine, or western white pine may be used for risers, stringers, and moldings.**
- D. Finishes for Stair Parts: As follows:

- 1. Treads: **Transparent.**

2. Risers: **Opaque.**
3. Stringers: **Opaque.**
4. Balusters: **Opaque.**
5. Handrails: **Transparent.**
6. Cove and Other Moldings: **Opaque.**

- E. Cut carriages to accurately fit treads and risers. Glue treads to risers, and glue and nail treads and risers to carriages.

1. House wall and face stringers and glue and wedge treads and risers.
2. Fabricate stairs with treads and risers no more than 1/8 inch from indicated position and no more than 1/16 inch out of position for adjacent treads and risers.

2.12 WOOD CASEWORK FOR TRANSPARENT FINISH

- A. Grade: Custom.

- B. AWI Type of Casework Construction: **Flush overlay.**

- C. Wood Species and Cut for Exposed Surfaces: **As specified hereinabove.**

1. Grain Direction: **Vertically for drawer fronts, doors, and fixed panels.**
2. Matching of Veneer Leaves: **Book match.**
3. Vertical Matching of Veneer Leaves: **End match.**
4. Veneer Matching within Panel Face: **Running match.**
5. Veneer Matching within Room: Provide casework veneers in each room or other space from a single flitch with doors, drawer fronts, and other surfaces matched in a sequenced set with continuous match where veneers are interrupted perpendicular to the grain.

- D. Semiexposed Surfaces: Provide surface materials indicated below:

1. Surfaces Other Than Drawer Bodies: **Compatible species to that indicated for exposed surfaces, stained to match.**
2. Drawer Sides and Backs: Solid-hardwood lumber, stained to match species indicated for exposed surfaces.
3. Drawer Bottoms: Hardwood plywood.

- E. **Upholstery: Fabricate fabric-covered cushions with molded padding beneath fabric and with fabric covering free of welts, creases, stretch lines, and wrinkles. For each upholstered component, install pile and pattern run in a consistent direction.**

2.13 WOOD CASEWORK FOR OPAQUE FINISH

- A. Grade: Custom.

- B. AWI Type of Casework Construction: **Flush overlay.**

- C. Species for Exposed Lumber Surfaces: Any closed-grain hardwood.

- D. Panel Product for Exposed Surfaces: Medium-density overlay.

- E. Semiexposed Surfaces: Provide surface materials indicated below:

1. Surfaces Other Than Drawer Bodies: Match materials indicated for exposed surfaces.
2. Drawer Sides and Backs: Solid-hardwood lumber.
3. Drawer Bottoms: Hardwood plywood.

2.14 PLASTIC-LAMINATE CASEWORK

- A. Grade: Custom.
- B. AWI Type of Casework Construction: **Flush overlay.**
- C. Laminate Cladding for Exposed Surfaces: High-pressure decorative laminate complying with the following requirements:
 1. Horizontal Surfaces Other Than Tops: Grade HGS.
 2. Postformed Surfaces: Grade HGP.
 3. Vertical Surfaces: Grade HGS.
 4. Edges: Grade HGS.
- D. Materials for Semiexposed Surfaces:
 1. Surfaces Other Than Drawer Bodies: High-pressure decorative laminate, Grade VGS.
 - a. Edges of Plastic-Laminate Shelves: PVC tape, 0.018-inch minimum thickness, matching laminate in color, pattern, and finish.
 - b. For semiexposed backs of panels with exposed plastic-laminate surfaces, provide surface of high-pressure decorative laminate, Grade VGS.
 2. Drawer Sides and Backs: Solid-hardwood lumber.
 3. Drawer Bottoms: Hardwood plywood.
- E. Concealed Backs of Panels with Exposed Plastic Laminate Surfaces: High-pressure decorative laminate, Grade BKL.
- F. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:
 1. As selected by Architect from laminate manufacturer's full range.

2.15 WOOD COUNTERTOPS

- A. Grade: Custom.
- B. Type of Top: Solid wood for transparent finish, edge glued, with crown direction reversed in adjacent boards, to produce widths indicated. Select boards for similarity of color and grain and arrange boards for optimum match between adjacent boards. Species and cut as follows:
 1. Wood Species and Cut: **As specified hereinabove.**
- C. Type of Top: Panel product for transparent finish (wood veneer laminated over core) as follows:
 1. Wood Species and Cut: **As specified hereinabove**
 2. Matching of Adjacent Veneer Leaves: **Book match.**

3. Matching of Adjacent Veneer Leaves: End match.
4. Veneer Matching within Panel Face: **Running** match.
5. Edge Treatment: **Solid wood matching face for species and cut.**
6. Core Material: Exterior-grade plywood.

2.16 PLASTIC-LAMINATE COUNTERTOPS

- A. Grade: Custom.
- B. High-Pressure Decorative Laminate Grade: HGS.
- C. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:
 1. As selected by Architect from manufacturer's full range.
- D. Edge Treatment: As indicated.
- E. Core Material: Exterior-grade plywood.
- F. Backer Sheet: Provide plastic-laminate backer sheet, Grade BKL, on underside of countertop substrate.

2.17 SOLID-SURFACING-MATERIAL COUNTERTOPS

- A. Grade: Custom.
- B. Colors, Patterns, and Finishes: Provide materials and products that result in colors of solid-surfacing material complying with the following requirements:
 1. As selected by Architect from manufacturer's full range.
- C. Fabricate tops in one piece, unless otherwise indicated. Comply with solid-surfacing-material manufacturer's written recommendations for adhesives, sealers, fabrication, and finishing.
 1. Fabricate tops with shop-applied edges of materials and configuration indicated.
 2. Fabricate tops with loose backsplashes for field application.
- D. Drill holes in countertops for plumbing fittings and soap dispensers in shop.

2.18 CLOSET AND UTILITY SHELVING

- A. Grade: Custom.
- B. Shelf Material: 1-inch plastic laminate-faced panel product with solid-lumber edge.
- C. Cleats: 3/4-inch solid lumber.
- D. Standards for Adjustable Shelf Brackets: BHMA A156.9, B04102; powder-coat-finished steel.
- E. Adjustable Shelf Brackets: BHMA A156.9, B04112; powder-coat-finished steel.

- F. Clothes Rods: 1-5/16-inch-diameter, chrome-plated-steel tubes.

1. Rod Flanges: Chrome-plated steel.

2.19 SHOP FINISHING

- A. General: Comply with AWI/AWMAC/WI's "Architectural Woodwork Standards" for factory finishing.

1. Finish architectural woodwork at fabrication shop as specified in this Section. Defer only final touchup, cleaning, and polishing until after installation.

- B. Preparation for Finishing: Comply with referenced quality standard for sanding, filling countersunk fasteners, sealing concealed surfaces, and similar preparations for finishing architectural woodwork, as applicable to each unit of work.

1. Backpriming: Apply one coat of sealer or primer, compatible with finish coats, to concealed surfaces of woodwork. Apply two coats to back of paneling and to end-grain surfaces. Concealed surfaces of plastic-laminate-clad woodwork do not require backpriming when surfaced with plastic laminate, backing paper, or thermoset decorative panels.

- C. Shop Priming: Shop apply the prime coat including backpriming, if any, for opaque-finished items specified to be field finished. Refer to Section 099000 - PAINTING AND COATING for material and application requirements.

- D. Transparent Finish: Comply with requirements indicated below for grade, finish system, staining, and sheen with sheen measured on 60-degree gloss meter per ASTM D 523:

1. Grade: Same as item to be finished.
2. AWS Finish System 5: Conversion varnish.
3. Washcoat for Closed-Grain Woods: Apply washcoat sealer to woodwork made from closed-grain wood before staining and finishing
4. Staining: Match approved sample for color.
5. Open Finish for Open-Grain Woods: Do not apply filler to open-grain woods.
6. Sheen: Satin, 30-50 gloss units.
7. Effect: Partially filled pore.

- E. Opaque Finish: Comply with requirements indicated below for grade, finish system, color, effect, and sheen, with sheen measured on 60-degree gloss meter per ASTM D 523.

1. Grade: Same as item to be finished.
2. AWS Finish System 5: Conversion varnish.
3. Color: As selected by Architect from manufacturer's full range.
4. Sheen: Satin, 30-50 gloss units.

PART 3 - EXECUTION

3.1 PREPARATION

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

3.2 INSTALLATION

- A. Grade: Install woodwork to comply with requirements for the same grade specified in Part 2 for fabrication of type of woodwork involved.
- B. Assemble woodwork and complete fabrication at Project site to comply with requirements for fabrication in Part 2, to extent that it was not completed in the shop.
- C. Install woodwork level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb (including tops) to a tolerance of 1/8 inch in 96 inches.
- D. Scribe and cut woodwork to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
- E. Fire-Retardant-Treated Wood: Handle, store, and install fire-retardant-treated wood to comply with chemical treatment manufacturer's written instructions, including those for adhesives used to install woodwork.
- F. Anchor woodwork to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing as required for complete installation. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with woodwork and matching final finish if transparent finish is indicated.
- G. Standing and Running Trim: Install with minimum number of joints possible, using full-length pieces (from maximum length of lumber available) to greatest extent possible. Do not use pieces less than 60 inches long, except where shorter single-length pieces are necessary. Scarf running joints and stagger in adjacent and related members.
 - 1. Fill gaps, if any, between top of base and wall with plastic wood filler, sand smooth, and finish same as wood base if finished.
 - 2. **Install wall railings on indicated metal brackets securely fastened to wall framing.**
 - 3. Install standing and running trim with no more variation from a straight line than 1/8 inch in 96 inches.
- H. Stairs: Securely anchor carriages to supporting substrates. Install stairs with treads and risers no more than 1/8 inch from indicated position.
- I. Railings:
 - 1. General: Install rails with no more than 1/8 inch in 96-inch variation from a straight line.
 - 2. Stair Rails: Glue and dowel or pin balusters to treads and railings, and railings to newel posts.

3. Wall Rails: Support rails on indicated metal brackets securely fastened to wall framing.
- J. Casework: Install without distortion so doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.
1. Install casework with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.
 2. Maintain veneer sequence matching of casework with transparent finish.
 3. Attach casework to walls with mechanical fasteners. Do not use adhesives, so that casework may be removed and salvaged in the future.
- K. Countertops: Anchor securely by screwing through corner blocks of base casework or other supports into underside of countertop.
1. Align adjacent countertops and form seams to comply with manufacturer's written recommendations using adhesive in color to match countertop. Carefully dress joints smooth, remove surface scratches, and clean entire surface.
 2. Install countertops with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.
 3. Secure backsplashes to tops with concealed metal brackets at 16 inches and to walls with adhesive.
 4. Calk space between backsplash and wall with sealant specified in Section 079200 - JOINT SEALANTS.
- L. Touch up finishing work specified in this Section after installation of woodwork. Fill nail holes with matching filler where exposed.
- 3.3 ADJUSTING AND CLEANING
- A. Repair damaged and defective woodwork, where possible, to eliminate functional and visual defects; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.
 - B. Clean, lubricate, and adjust hardware.
 - C. Clean woodwork on exposed and semiexposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

END OF SECTION

SECTION 064200

PANELING

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Board paneling.
 - 2. Flush wood paneling.
 - 3. Resin paneling.
 - 4. Shop finishing work of paneling.
- B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council. Refer to Section 018110, SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 061000 - ROUGH CARPENTRY for wood furring, blocking, shims, and hanging strips required for installing woodwork and concealed within other construction before woodwork installation.
 - 2. Section 064020 - INTERIOR ARCHITECTURAL WOODWORK for trim at wood paneling.

1.3 DEFINITIONS

- A. Paneling includes wood furring, blocking, and shims for installing paneling, unless concealed within other construction before paneling installation.

1.4 SUBMITTALS

- A. Product Data: For each type of product specified, including cabinet hardware and accessories, and finishing materials and processes.
 - 1. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements.
- B. LEED Submittals:

1. Building Product Disclosure and Optimization, Environmental Product Declarations (EPD):
 - a. Option 1: For wood products, submit industry-wide EPDs.
 2. Building Product Disclosure and Optimization, Sourcing of Raw Materials:
 - a. General: For credit achievement calculation, submit location of products sourced (extracted, manufactured, and purchased), indicating number of miles from the project site.
 - b. Option 2, Leadership Extraction Practices:
 - 1) Wood Products: Wood products must be certified by the Forest Stewardship Council or USGBC-approved equivalent. Products meeting wood products criteria are valued at 100% of their cost for the purposes of credit achievement calculation.
 - 2) Recycled Content: Submit percentages by weight of postconsumer and preconsumer recycled content for products having recycled content. Include statement indicating costs for each product having recycled content.
 3. Low-Emitting Materials, General Emissions Evaluation: Building products must be tested and determined compliant in accordance with California Department of Public Health (CDPH) Standard Method v1.1–2010.
 - a. For wood composite materials, submit test results, including TVOC emissions.
 - b. For adhesives and sealants, submit test results, including TVOC emissions and VOC content.
 - c. For wet-applied products, submit volume used.
- C. Shop Drawings: Show location of paneling, large-scale details, attachment devices, and other components. Include dimensioned plans and elevations.
1. Show details full size.
 2. Show locations and sizes of furring and blocking, including concealed blocking specified in other Sections.
 3. For paneling produced from premanufactured sets, show finished panel sizes, set numbers, sequence numbers within sets, and method of cutting panels to produce indicated sizes.
 4. For paneling veneered in fabrication shop, show veneer leaves with dimensions, grain direction, exposed face, and identification numbers indicating the flitch and sequence within the flitch for each leaf.
- D. Samples for Initial Selection:
1. Shop-applied transparent finishes.
- E. Samples for Verification:
1. Lumber with or for transparent finish, not less than 5 inches wide by 12 inches long, for each species and cut, finished on 1 side and 1 edge.
 2. Veneer leaves representative of and selected from flitches to be used for transparent-finished paneling.

3. Veneer-faced panel products with or for transparent finish, 12 by 24 inches, for each species and cut. Include at least one face-veneer seam and finish as specified.

F. **Woodwork Quality Standard Compliance Certificates:** AWI Quality Certification Program certificates.

G. Qualification Data: For Installer and fabricator.

1.5 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate products similar to those required for this Project and whose products have a record of successful in-service performance. **Shop is a certified participant in AWI's Quality Certification Program.**

B. **Installer Qualifications: Certified participant in AWI's Quality Certification Program.**

C. Source Limitations: Engage a qualified woodworking firm to assume undivided responsibility for production of interior architectural woodwork with sequence-matched wood veneers.

D. Quality Standard: Unless otherwise indicated, comply with AWI's "Architectural Woodwork Quality Standards" for grades of interior architectural woodwork indicated for construction, finishes, installation, and other requirements.

1. **Provide AWI Quality Certification Program labels and certificates indicating that woodwork, including installation, complies with requirements of grades specified.**

E. Fire-Test-Response Characteristics: Where fire-retardant materials or products are indicated, provide materials and products with specified fire-test-response characteristics as determined by testing identical products per test method indicated by UL, ITS, or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify with appropriate markings of applicable testing and inspecting agency in the form of separable paper label or, where required by authorities having jurisdiction, imprint on surfaces of materials that will be concealed from view after installation.

F. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

G. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver paneling until painting and similar operations that could damage paneling have been completed in installation areas. If paneling must be stored in other than installation areas, store only in areas where environmental conditions comply with requirements specified in "Project Conditions" Article.

1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install paneling until building is enclosed, wet work is complete, and HVAC system is operating and will maintain temperature and relative humidity at occupancy levels during the remainder of the construction period.
- B. Field Measurements: Where paneling is indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
 - 1. Locate concealed framing, blocking, and reinforcements that support paneling by field measurements before being enclosed and indicate measurements on Shop Drawings.
 - 2. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating paneling without field measurements. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

1.8 COORDINATION

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

PART 2 - PRODUCTS

2.1 MATERIALS

- A. General: Provide materials that comply with requirements of AWI's quality standard for quality grade specified, unless otherwise indicated.
- B. Environmental Product Declarations (EPD): Industry-wide EPDs for wood products are available from the American Wood Council and Canadian Wood Council.
- C. Certified Wood: Materials shall be produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship."
 - 1. Salvaged and reclaimed wood is excluded from certified wood requirements.
- D. Recycled Content of Medium-Density Fiberboard and Particleboard: Provide products with an average recycled content so postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 percent.
- E. Wood Veneers and Lumber: Provide AWI Custom Grade materials and workmanship, unless otherwise indicated. For species not listed in the AWS comply with the following:
 - 1. Provide AWI Lumber Grade 1 and AWI Grade A Veneer, book-matched, minimum 6 inch face veneer width. Kiln dry to 6-8 percent moisture content. Components shall be free of defects and sapwood. Match adjacent pieces for color and grain pattern.
 - 2. Single-Source Requirement for Wood Veneers and Solids: Intent is to provide wood which matches as closely as possible throughout the project. Provide wood veneers and

solids from the same distributor, and from the same flitches and solids sources to the greatest extent possible.

F. Wood Species and Cut for Transparent Finish: As selected by the Architect.

1. Architect's control samples for transparent finish, veneer grain and figure characteristics are available for review at the office of the Architect.
2. Veneer Matching Requirements:
 - a. Matching Between Adjacent Veneer Leaves: Book match and architectural end match.
 - b. Matching Within Individual Panel Faces: Balance and Center Match.
 - c. Method of Matching Panels: Blueprint-matched panels and components.

G. Wood Species for Opaque Finish: Any closed-grain hardwood.

H. Composite Wood Products: Comply with the following:

1. Composite Wood, General: CARB II compliant or made with binder containing no added formaldehyde (NAF).
2. Medium-Density Fiberboard (MDF): ANSI A208.2, Grade MD.
3. Particleboard: ANSI A208.1, Grade M-2-Exterior Glue.
4. Softwood Plywood: DOC PS 1, Medium Density Overlay (MDO).
5. Veneer-Faced Panel Products (Hardwood Plywood): HPVA HP-1.
 - a. Resin impregnated paper backs are not permitted. Backs shall be of compatible hardwood species and cut. Contact adhesive is not permitted.

I. Resin Panel Material:

1. Provide one of the following polyethylene terephthalate glycol-modified (PETG) resin materials, or Architect approved equal:
 - a. 3form; Varia.
 - b. Armstrong World Industries; Infusions.
 - c. KnollTextiles; Imago.
 - d. Sheffield Plastics; Vivak.
2. Fire-Resistance: Panels shall comply with the following:
 - a. Smoke Density Rating: 3 to 33% per ASTM D 2843.
 - b. Combustion Rating: CC-1 rating per ASTM D 635.
 - c. Self-Ignition Temperature: 850°F per ASTM D 1929.
3. Fasteners: Provide fasteners as recommended by panel manufacturer.
4. Adhesives: Silicone as recommended by manufacturer.

J. Installation Adhesives and Wood Glues: Formulations approved for use indicated by adhesive manufacturer.

1. Low-Emitting Materials: Provide adhesives in compliance with the 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. VOC Content: Use installation adhesives that comply with the following limits:
 - a. Wood Glues: 30 g/L.
 - b. Contact Adhesives: Not permitted on the Project without Architect's prior approval.
3. Do not use adhesives that contain urea formaldehyde.
4. Methylene chloride and perchloroethylene may not be intentionally added to adhesives.

2.2 FIRE-RETARDANT-TREATED MATERIALS

- A. General: Where fire-retardant-treated materials are indicated, use materials that are acceptable to authorities having jurisdiction and that comply with requirements in this Article and with fire-test-response characteristics specified.
 1. Do not use treated materials that do not comply with requirements of referenced woodworking standard or that are warped, discolored, or otherwise defective.
 2. Use fire-retardant-treatment formulations that do not bleed through or otherwise adversely affect finishes. Do not use colorants to distinguish treated materials from untreated materials.
 3. Identify fire-retardant-treated materials with appropriate classification marking of UL, U.S. Testing, Timber Products Inspection, or another testing and inspecting agency acceptable to authorities having jurisdiction.
- B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Comply with performance requirements of AWPA C20 (lumber) and AWPA C27 (plywood). Use the following treatment type:
 1. Exterior Type: Organic-resin-based formulation thermally set in wood by kiln drying.
 2. Interior Type A: Low-hygroscopic formulation.
 3. Mill lumber after treatment, within limits set for wood removal that do not affect listed fire-test-response characteristics, using a woodworking plant certified by testing and inspecting agency.
 4. Mill lumber before treatment and implement special procedures during treatment and drying processes that prevent lumber from warping and developing discolorations from drying sticks or other causes, marring, and other defects affecting appearance of treated woodwork.
 5. Kiln-dry materials before and after treatment to levels required for untreated materials.
- C. Fire-Retardant Particleboard: Panels complying with the following requirements, made from softwood particles and fire-retardant chemicals mixed together at time of panel manufacture to achieve flame-spread index of 25 or less and smoke-developed index of 25 or less per ASTM E 84.
 1. Arauco NA; Duraflake FR.
 2. Or approved equal.
 3. For panels 3/4 inch thick and less, comply with ANSI A208.1 for Grade M-2 except for the following minimum properties: modulus of rupture, 1600 psi; modulus of elasticity, 300,000 psi; internal bond, 80 psi; and screw-holding capacity on face and edge, 250 and 225 lbf, respectively.

4. For panels 13/16 to 1-1/4 inches thick, comply with ANSI A208.1 for Grade M-1 except for the following minimum properties: modulus of rupture, 1300 psi; modulus of elasticity, 250,000 psi; linear expansion, 0.50 percent; and screw-holding capacity on face and edge, 250 and 175 lbf, respectively.

- D. Fire-Retardant Fiberboard: Medium-density fiberboard panels complying with ANSI A208.2, made from softwood fibers, synthetic resins, and fire-retardant chemicals mixed together at time of panel manufacture to achieve flame-spread index of 25 or less and smoke-developed index of 200 or less per ASTM E 84.

1. Roseburg.; Medite FR.
2. Or approved equal.

2.3 INSTALLATION MATERIALS

- A. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, kiln dried to less than 15 percent moisture content.
- B. Furring, Blocking, Shims, and Hanging Strips: Fire-retardant-treated softwood lumber, kiln dried to less than 15 percent moisture content.
- C. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide nonferrous-metal or hot-dip galvanized anchors and inserts on inside face of exterior walls and elsewhere as required for corrosion resistance. Provide toothed-steel or lead expansion sleeves for drilled-in-place anchors.

2.4 FABRICATION, GENERAL

- A. Paneling Grade: Provide Custom grade paneling complying with referenced quality standard.
- B. Wood Moisture Content: Comply with requirements of referenced quality standard for wood moisture content in relation to ambient relative humidity during fabrication and in installation areas.
- C. Sand fire-retardant-treated wood lightly to remove raised grain on exposed surfaces before fabrication.
- D. Arrange paneling in shop or other suitable space in proposed sequence for examination by Architect. Mark units with temporary sequence numbers to indicate position in proposed layout.
 1. Lay out one elevation at a time if approved by Architect.
 2. Notify Architect seven days in advance of the date and time when layout will be available for viewing.
 3. Provide lighting of similar type and level as that of final installation for viewing layout, unless otherwise approved by Architect.
 4. Rearrange paneling as directed by Architect until layout is approved.
 5. Do not trim end units and other nonmodular size units to less than modular size until after Architect's approval of layout. Indicate trimming by masking edges of units with nonmarking material.
 6. Obtain Architect's approval of layout before start of assembly. Mark units and Shop Drawings with assembly sequence numbers based on approved layout.

- E. Complete fabrication, including assembly and finishing, to maximum extent possible, before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.
 - 1. Notify Architect seven days in advance of the dates and times paneling fabrication will be complete.
 - 2. Trial fit assemblies at fabrication shop that cannot be shipped completely assembled. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting. Verify that various parts fit as intended and check measurements of assemblies against field measurements indicated on approved Shop Drawings before disassembling for shipment.
- F. Shop cut openings, to maximum extent possible, to receive hardware, appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

2.5 BOARD PANELING FOR TRANSPARENT FINISH

- A. Grade: Custom.
- B. Wood Species and Cut: As indicated on the Finish Schedule.
- C. Pattern: As indicated.
- D. Shop fabricate board paneling in lengths to provide pieces that are uninterrupted by joints. Machine edges of boards to provide joint profiles indicated.
- E. Shop fabricate board paneling from boards of standard random lengths, complying with applicable grading rules. Machine edges and ends of boards to provide joint profiles indicated.
- F. Preassemble board paneling into largest units that can be delivered into installation areas using permanent or temporary backing members as indicated. To maximum extent possible, fabricate units in sizes determined by field measurements of existing conditions and that will avoid fitting in the field; make provision for separate scribing pieces to be fitted to adjoining finished surfaces. Provide shop-prepared detachable pieces for forming joints with other units at Project site and with other types of architectural woodwork.

2.6 FLUSH WOOD PANELING FOR TRANSPARENT FINISH

- A. Grade: Custom.
- B. Wood Species and Cut: As indicated on the Finish Schedule.
 - 1. Lumber Trim and Edges: At paneling fabricator's option, trim and edges indicated as solid wood (except moldings) may be either lumber or veneered construction of same species and cut as panel faces and compatible with grain and color of panel faces.
- C. Matching of Adjacent Veneer Leaves: Book Slip match.
- D. Matching within Panel Face: Running Balance match.

- E. Panel-Matching Method: No matching is required between panels. Select and arrange panels for similarity of grain pattern and color between adjacent panels.
- F. Panel-Matching Method: Made-to-order, sequence-matched panels [Premanufactured panel sets used full width] [Premanufactured panel sets selectively reduced in width] [Made-to-order, blueprint-matched panels and components] within each separate area.
- G. Panel Core Construction: Hardwood veneer-core plywood.
- H. Exposed Panel Edges: Solid wood or wood veneer matching faces.
- I. Fire-Retardant-Treated Paneling: Provide panels consisting of wood-veneer and fire-retardant particleboard or fire-retardant, medium-density fiberboard. Panels shall have a flame-spread index of 75 or less and a smoke-developed index of 450 or less per ASTM E 84.
- J. Provide paneling of thickness shown or, if not shown, 3/4-inch minimum thickness. Assemble by gluing and concealed fastening.

2.7 SHOP FINISHING

- A. General: Comply with AWI/AWMAC/WI's "Architectural Woodwork Standards" for factory finishing.
 - 1. Finish architectural woodwork at fabrication shop as specified in this Section. Defer only final touchup, cleaning, and polishing until after installation.
- B. Preparation for Finishing: Comply with referenced quality standard for sanding, filling countersunk fasteners, sealing concealed surfaces, and similar preparations for finishing architectural woodwork, as applicable to each unit of work.
 - 1. Backpriming: Apply one coat of sealer or primer, compatible with finish coats, to concealed surfaces of woodwork. Apply two coats to back of paneling and to end-grain surfaces.
- C. Shop Priming: Shop apply the prime coat including backpriming, if any, for opaque-finished items specified to be field finished. Refer to Section 099000 - PAINTING AND COATING for material and application requirements.
- D. Transparent Finish: Comply with requirements indicated below for grade, finish system, staining, and sheen with sheen measured on 60-degree gloss meter per ASTM D 523:
 - 1. Grade: Same as item to be finished.
 - 2. AWS Finish System 5: Conversion varnish.
 - 3. Wash Coat for Stained Finish: Apply wash-coat sealer to woodwork made from closed-grain wood before staining and finishing.
 - 4. Staining: Match approved sample for color.
 - 5. Open Finish for Open-Grain Woods: Do not apply filler to open-grain woods.
 - 6. Sheen: Satin, 30-50 gloss units.
- E. Opaque Finish: Comply with requirements indicated below for grade, finish system, color, effect, and sheen, with sheen measured on 60-degree gloss meter per ASTM D 523.

1. Grade: Same as item to be finished.
2. AWS Finish System 5: Conversion varnish.
3. Color: As selected by Architect from manufacturer's full range.
4. Sheen: Satin, 30-50 gloss units.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Before installation, condition paneling to average prevailing humidity conditions in installation areas.
- B. Before installing paneling, examine shop-fabricated work for completion and complete work as required, including removal of packing and backpriming.

3.2 INSTALLATION

- A. Grade: Install paneling to comply with requirements for same grade specified in Part 2 for fabrication of type of paneling involved.
- B. Install paneling level, plumb, true, and straight with no distortions. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch in 96 inches. Install with no more than 1/16 inch in 96-inch vertical cup or bow and 1/8 inch in 96-inch horizontal variation from a true plane.
 1. For flush paneling with revealed joints, install with variations in reveal width, alignment of top and bottom edges, and flushness between adjacent panels not exceeding 1/32 inch.
- C. Scribe and cut paneling to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
- D. Anchor paneling to supporting substrate with concealed panel-hanger clips. Do not use face fastening unless covered by trim.
- E. Complete finishing work specified in this Section to extent not completed at shop or before installation of paneling. Fill nail holes with matching filler where exposed. Apply specified finish coats, including stains and paste fillers if any, to exposed surfaces where only sealer/prime coats are applied in shop.

3.3 ADJUSTING AND CLEANING

- A. Repair damaged and defective paneling, where possible, to eliminate functional and visual defects; where not possible to repair, replace paneling. Adjust for uniform appearance.
- B. Clean paneling on exposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

END OF SECTION

SECTION 066400

FRP PANELING

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Glass-fiber reinforced plastic (FRP) wall paneling and trim accessories.
- B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council. Refer to Section 018110, SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 061000 - ROUGH CARPENTRY for wood furring for installing plastic paneling.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. LEED Submittals:
 - 1. Low-Emitting Materials, General Emissions Evaluation: Building products must be tested and determined compliant in accordance with California Department of Public Health (CDPH) Standard Method v1.1–2010.
 - a. For adhesives and sealants, submit test results, including TVOC emissions and VOC content.
 - b. For wet-applied products, submit volume used.
- C. Samples for Verification: For plastic paneling and trim accessories, in manufacturer's standard sizes.

1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain plastic paneling and trim accessories from single manufacturer.

- B. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 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: 450 or less.

1.5 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install plastic paneling until spaces are enclosed and weathertight and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Crane Composites.
2. Marlite.
3. Nudo Products, Inc.

2.2 PLASTIC SHEET PANELING

- A. General: Gelcoat-finished, glass-fiber reinforced plastic (FRP) panels complying with ASTM D 5319.

1. Nominal Thickness: Not less than 0.075 inch.
2. Surface Finish: Smooth texture.
3. Color: As selected by Architect from manufacturer's full range.

2.3 ACCESSORIES

- A. Trim Accessories: Manufacturer's standard one-piece vinyl extrusions designed to retain and cover edges of panels. Provide division bars, inside corners, outside corners, and caps as needed to conceal edges.

1. Color: Match panels.

- B. Exposed Fasteners: Nylon drive rivets recommended by panel manufacturer.

- C. Concealed Mounting Splines: Continuous, H-shaped aluminum extrusions designed to fit into grooves routed in edges of factory-laminated panels and to be fastened to substrate.

- D. Adhesive: As recommended by plastic paneling manufacturer for substrate indicated.

1. Low-Emitting Materials: Provide adhesives in compliance with the 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. VOC Content: 50 g/L or less.
 - 3. Do not use adhesives that contain urea formaldehyde.
 - 4. Methylene chloride and perchloroethylene may not be intentionally added to adhesives.
- E. Sealant: Single-component, mildew-resistant, neutral-curing silicone sealant recommended by plastic paneling manufacturer and complying with requirements in Section 079200 - JOINT SEALANTS.
- 1. Low-Emitting Materials: Provide adhesives in compliance with the 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. VOC Content, Architectural Sealants: 250 g/L or less.
 - 3. Methylene chloride and perchloroethylene may not be intentionally added to sealants.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Remove wallpaper, vinyl wall covering, loose or soluble paint, and other materials that might interfere with adhesive bond.
- B. Prepare substrate by sanding high spots and filling low spots as needed to provide flat, even surface for panel installation.
- C. Clean substrates of substances that could impair bond of adhesive, including oil, grease, dirt, and dust.
- D. Condition panels by unpacking and placing in installation space before installation according to manufacturer's written recommendations.
- E. Lay out paneling before installing. Locate panel joints to provide equal panels at ends of walls not less than half the width of full panels and so that trimmed panels at corners are not less than 12 inches wide.
 - 1. Mark plumb lines on substrate at panel joint locations for accurate installation.
 - 2. Locate trim accessories to allow clearance at panel edges according to manufacturer's written instructions.

3.3 INSTALLATION

- A. Install plastic paneling according to manufacturer's written instructions.

- B. Install panels in a full spread of adhesive.
- C. Install trim accessories with adhesive.
- D. Fill grooves in trim accessories with sealant before installing panels and bed inside corner trim in a bead of sealant.
- E. Maintain uniform space between panels and wall fixtures. Fill space with sealant.
- F. Remove excess sealant and smears as paneling is installed. Clean with solvent recommended by sealant manufacturer and then wipe with clean dry cloths until no residue remains.

END OF SECTION

SECTION 070001

WATERPROOFING, DAMPPROOFING AND CAULKING

(Filed Sub-Bid Required)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

B. Time, Manner and Requirements for Submitting Sub-Bids:

1. Sub-bids for work under this Section shall be for the complete work and shall be filed in a sealed envelope with the _____ at a time and place as stipulated in the "NOTICE TO CONTRACTORS".

The following should appear on the upper left hand corner of the envelope:

NAME OF SUB-BIDDER: (Insert name of sub-bidder)

MASS. STATE PROJECT: ((Insert project number from top of page))

SUB-BID FOR SECTION: 070001 – WATERPROOFING, DAMPPROOFING
AND CAULKING.

2. Each sub-bid submitted for work under this Section shall be on forms furnished by the _____ as required by Section 44F of Chapter 149 of the General Laws, as amended. Sub-bid forms may be obtained at the office of the _____, or may be obtained by written or telephone request; telephone _____.
3. Sub-bids filed with the _____ shall be accompanied by BID BOND or CASH or CERTIFIED CHECK or TREASURER'S CHECK or CASHIER'S CHECK issued by a responsible bank or trust company payable to the _____ in the amount of five percent of the sub-bid. A sub-bid accompanied by any other form of bid deposit than those specified will be rejected.

C. Sub Sub-Bid Requirements: (None required under this Section.)

D. Reference Drawings: The Work of this Filed Sub-Bid is shown on the following Contract Drawings: *To be inserted with final documents*

1.2 DESCRIPTION OF WORK

A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. All Work of Section 071100 - BITUMINOUS DAMPPROOFING
2. All Work of Section 071300 - SHEET WATERPROOFING
3. All Work of Section 071610 - CRYSTALLINE WATERPROOFING
4. All Work of Section 072700 - AIR BARRIERS
5. All Work of Section 079200 - JOINT SEALANTS

END OF SECTION

SECTION 070002

ROOFING AND FLASHING

(Filed Sub-Bid Required)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

- B. Time, Manner and Requirements for Submitting Sub-Bids:

1. Sub-bids for work under this Section shall be for the complete work and shall be filed in a sealed envelope with the _____ at a time and place as stipulated in the "NOTICE TO CONTRACTORS".

The following should appear on the upper left hand corner of the envelope:

NAME OF SUB-BIDDER: (Insert name of sub-bidder)

MASS. STATE PROJECT: ((Insert project number from top of page))

SUB-BID FOR SECTION: 070002 – ROOFING AND FLASHING

2. Each sub-bid submitted for work under this Section shall be on forms furnished by the _____ as required by Section 44F of Chapter 149 of the General Laws, as amended. Sub-bid forms may be obtained at the office of the _____, or may be obtained by written or telephone request; telephone _____.
3. Sub-bids filed with the _____ shall be accompanied by BID BOND or CASH or CERTIFIED CHECK or TREASURER'S CHECK or CASHIER'S CHECK issued by a responsible bank or trust company payable to the _____ in the amount of five percent of the sub-bid. A sub-bid accompanied by any other form of bid deposit than those specified will be rejected.

- C. Sub Sub-Bid Requirements: (None required under this Section.)

- D. Reference Drawings: The Work of this Filed Sub-Bid is shown on the following Contract Drawings: *To be inserted with final documents.*

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. All Work of Section 075019 - PREPARATION FOR REROOFING

2. All Work of Section 075300 - EPDM ROOFING
3. All Work of Section 076200 - SHEET METAL FLASHING AND TRIM
4. All Work of Section 077100 - ROFF SPECIALTIES

END OF SECTION

SECTION 071100

BITUMINOUS DAMPPROOFING

(Part of Work of Section 070001 - WATERPROOFING, DAMPPROOFING AND CAULKING, Filed Sub-Bid Required)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Cold-applied, emulsified-asphalt dampproofing applied to the following surfaces:
 - a. Exterior, below-grade surfaces of concrete and masonry foundation walls without occupied space at interior, and not indicated to receive waterproofing.
 - b. **Back side of concrete and masonry retaining walls, below grade.**
- B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council. Refer to Section 018110, SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 071300 - SHEET WATERPROOFING for other waterproofing.
 - 2. Section 071610 - CRYSTALLINE WATERPROOFING for other waterproofing.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated. Include manufacturer recommendations for method of application, primer, number of coats, coverage or thickness, and protection course. Indicate special procedures and perimeter conditions requiring special attention.
- B. Material Certificates: For each product, signed by manufacturers.

1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain primary dampproofing materials and primers through one source from a single manufacturer. Provide secondary materials recommended by manufacturer of primary materials.

1.5 PROJECT CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit asphalt dampproofing to be performed according to manufacturers' written instructions.
- B. Ventilation: Provide adequate ventilation during application of dampproofing in enclosed spaces. Maintain ventilation until dampproofing has thoroughly cured.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Euclid Chemical Company.
 - 2. Henry Company.
 - 3. Karnak Corporation.
 - 4. Meadows, W. R., Inc.
 - 5. Sonneborn, Degussa Building Products.
 - 6. Tremco Inc.

2.2 BITUMINOUS DAMPPROOFING

- A. Cold-Applied, Emulsified-Asphalt Dampproofing, Brush and Spray Coats: ASTM D 1227, Type III, Class 1.

2.3 MISCELLANEOUS MATERIALS

- A. Emulsified-Asphalt Primer: ASTM D 1227, Type III, Class 1, except diluted with water as recommended by manufacturer.
- B. Asphalt-Coated Glass Fabric: ASTM D 1668, Type I.
- C. Mastics and related materials as recommended by manufacturer.
- D. Patching Compound: Manufacturer's fibered mastic of type recommended by dampproofing manufacturer.
- E. Protection Course: Multi-ply semi-rigid core composed of a mineral-fortified asphalt core formed between two outside layers of asphalt impregnated reinforced mats, manufactured in accordance with ASTM D 6506, 1/8 inch thick biodegradable hardboard.
- F. Drainage Board: Two-part prefabricated composite drain consisting of formed polystyrene or PVC dimpled core covered on one side with a polypropylene filter fabric, 1/4 inch thick.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, with Applicator present, for compliance with requirements for surface smoothness and other conditions affecting performance of work.
 - 1. Proceed with dampproofing application only after substrate construction and penetrating work have been completed and unsatisfactory conditions have been corrected.
 - 2. Verify substrate surfaces are durable and free of matter detrimental to adhesion or application of dampproofing system.

3.2 PREPARATION

- A. Protection of Other Work: Mask or otherwise protect adjoining exposed surfaces from being stained, spotted, or coated with dampproofing. Prevent dampproofing materials from entering and clogging weep holes and drains.
- B. Clean substrates of projections and substances detrimental to work; fill voids, seal joints, and apply bond breakers if any, as recommended by prime material manufacturer.
- C. Apply manufacturer approved patching compound for filling and patching tie holes, honeycombs, reveals, and other imperfections.

3.3 APPLICATION

- A. Comply with manufacturer's written recommendations unless more stringent requirements are indicated or required by Project conditions to ensure satisfactory performance of dampproofing.
 - 1. Apply additional coats if recommended by manufacturer or required to achieve coverages indicated.
 - 2. Allow each coat of dampproofing to cure 24 hours before applying subsequent coats.
 - 3. Apply from finished-grade line to top of footing, extend over top of footing, and down a minimum of 6 inches over outside face of footing.
 - 4. Extend 12 inches onto intersecting walls and footings, but do not extend onto surfaces exposed to view when Project is completed.
 - 5. Install flashings and corner protection stripping at internal and external corners, changes in plane, construction joints, cracks, and where shown as "reinforced," by embedding an 8-inch- wide strip of asphalt-coated glass fabric in a heavy coat of dampproofing. Dampproofing coat required for embedding fabric is in addition to other coats required.
- B. On Concrete Foundations: Apply two brush or spray coats at not less than 1.5 gal./100 sq. ft. for first coat and 1 gal./100 sq. ft.. for second coat.
- C. On Backs of Concrete and Masonry Retaining Walls: Apply one brush or spray coat at not less than 1.25 gal./100 sq. ft.

3.4 INSTALLATION OF PROTECTION COURSE

- A. Install protection course over completed-and-cured dampproofing. Butt joints of adjacent panels and adhere with mastic. Comply with dampproofing material manufacturer's written recommendations for attaching protection course. Support protection course with spot

application of trowel-grade mastic where not otherwise indicated. Place drainage panel directly over dampproofing, butt joints, place to encourage drainage downwards.

- B. Scribe and cut boards around projections, penetrations, and interruptions.

3.5 CLEANING

- A. Remove dampproofing materials from surfaces not intended to receive dampproofing.

END OF SECTION

SECTION 071300

SHEET WATERPROOFING

(Part of Work of Section 070001 - Waterproofing, Dampproofing and Caulking,
Filed Sub-Bid Required)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Post-applied, sheet waterproofing.
 - 2. Pre-applied, sheet waterproofing.
- B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council. Refer to Section 018110, SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 072100 - THERMAL INSULATION for insulation at foundations and under slabs.
 - 2. Section 079200 - JOINT SEALANTS for joint-sealant materials and installation.
 - 3. Section 079500 - EXPANSION CONTROL for expansion-joint systems.

1.3 PERFORMANCE REQUIREMENTS

- A. Provide waterproofing that prevents the passage of water.

1.4 SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include manufacturer's written instructions for evaluating, preparing, and treating substrate, technical data, and tested physical and performance properties of waterproofing.
- B. Shop Drawings: Show locations and extent of waterproofing. Include details for substrate joints and cracks, sheet flashings, penetrations, inside and outside corners, tie-ins with adjoining waterproofing, and other termination conditions.

- C. Samples: For the following products:
 - 1. 12-by-12-inch square of waterproofing and flashing sheet.
 - 2. 4-by-4-inch square of drainage panel.
- D. Installer Certificates: Signed by manufacturers certifying that installers comply with requirements.
- E. Sample Warranty: Copy of special waterproofing manufacturer's and Installer's warranty stating obligations, remedies, limitations, and exclusions before starting waterproofing.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer who is acceptable to waterproofing manufacturer to install manufacturer's products.
- B. Source Limitations: Obtain waterproofing materials, protection course, and molded-sheet drainage panels through one source from a single manufacturer.
- C. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01. Review requirements for waterproofing, including surface preparation specified under other Sections, substrate condition and pretreatment, minimum curing period, forecasted weather conditions, special details and sheet flashings, installation procedures, testing and inspection procedures, and protection and repairs.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver liquid materials to Project site in original packages with seals unbroken, labeled with manufacturer's name, product brand name and type, date of manufacture, and directions for storing and mixing with other components.
- B. Store liquid materials in their original undamaged packages in a clean, dry, protected location and within temperature range required by waterproofing manufacturer.
- C. Remove and replace liquid materials that cannot be applied within their stated shelf life.
- D. Store rolls according to manufacturer's written instructions.
- E. Protect stored materials from direct sunlight.

1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Apply waterproofing within the range of ambient and substrate temperatures recommended by waterproofing manufacturer. Do not apply waterproofing to a damp or wet substrate.
 - 1. Do not apply waterproofing in snow, rain, fog, or mist.
- B. Maintain adequate ventilation during preparation and application of waterproofing materials.

1.8 WARRANTY

- A. Special Manufacturer's Warranty: Written warranty, signed by waterproofing manufacturer agreeing to replace waterproofing material that does not comply with requirements or that does not remain watertight during specified warranty period.
1. Warranty does not include failure of waterproofing due to failure of substrate not prepared and treated according to requirements or formation of new joints and cracks in substrate exceeding 1/16 inch in width.
 2. Warranty Period: Five years after date of Substantial Completion.
 3. Warranty includes removing and reinstalling protection board, drainage panels, insulation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
1. Post-Applied Sheet Waterproofing:
 - a. Rubberized-Asphalt Sheet Waterproofing:
 - 1) American Hydrotech, Inc.; VM 60.
 - 2) Carlisle Corporation, Carlisle Coatings & Waterproofing Div.; MiraDRI 860/861.
 - 3) Cetco; Envirosheet.
 - 4) GCP Applied Technologies (formerly W.R. Grace); Bituthene 3000.
 - 5) Henry Company; WP 200
 - b. Composite HDPE/Bentonite Sheet Waterproofing:
 - 1) Tremco Inc.; Peraseal Membrane for vertical surfaces.
 2. Pre-Applied Sheet Waterproofing:
 - a. HDPE Sheet Waterproofing:
 - 1) GCP Applied Technologies (formerly W.R. Grace); Preprufe 160R Plus for vertical surfaces and Preprufe 300R Plus for horizontal surfaces.
 - 2) MiraPLY-H for horizontal and MiraPLY-V for vertical by Carlisle Coatings and Waterproofing.
 - b. Polypropylene Sheet Waterproofing:
 - 1) Henry Company; Blueskin PreSeal 320/435.
 - c. Composite HDPE/Bentonite Sheet Waterproofing:

- 1) Tremco Inc.; Peraseal LG Membrane for blindside conditions on retained earth or below slab and Peraseal GM for blindside conditions with hydrostatic water.

2.2 RUBBERIZED-ASPHALT SHEET WATERPROOFING

- A. Rubberized-Asphalt Sheet: 60-mil-thick, self-adhering sheet consisting of 56 mils of rubberized asphalt laminated to a 4-mil-thick, polyethylene film with release liner on adhesive side.
 1. Physical Properties: As follows, measured per standard test methods referenced:
 - a. Tensile Strength: 325 psi minimum; ASTM D 412, Die C, modified.
 - b. Ultimate Elongation: 300 percent minimum; ASTM D 412, Die C, modified.
 - c. Low-Temperature Flexibility: Pass at minus 20 deg F ASTM D 1970.
 - d. Crack Cycling: Unaffected after 100 cycles of 1/8-inch (movement; ASTM C 836.
 - e. Puncture Resistance: 50 lbf minimum; ASTM E 154.
 - f. Hydrostatic-Head Resistance: 200 feet (minimum; ASTM D 5385.
 - g. Water Absorption: 0.15 percent weight-gain maximum after 48-hour immersion at 70 deg F; ASTM D 570.
 - h. Vapor Permeance: 0.05 perms; ASTM E 96, Water Method.

2.3 COMPOSITE HDPE/BENTONITE SHEET WATERPROOFING

- A. HDPE/Bentonite Sheet for Vertical Applications: Dual-waterproofing, resealable, composite sheet membrane system composed of high-density polyethylene with a sodium-bentonite face
- B. Physical Properties: As follows, measured per standard test methods referenced:
 1. Puncture Resistance: 169 lbs.; ASTM E154.
 2. Tensile Strength: 4,000 psi; ASTM D412.
 3. Water Vapor Permeance: 0.03 perms; ASTM E96
 4. Percent Elongation: 700 percent; ASTM D638, Type 4 Dumbbell.
 5. Resistance to Hydrostatic Head: 150 feet: ASTM D751
 6. Warranted Crack-Bridging Capability: 1/8 inch.

2.4 HDPE SHEET WATERPROOFING

- A. HDPE Sheet for Vertical Applications: 32-mil-thick, uniform, flexible sheets consisting of 16-mil-thick, HDPE sheet coated with a pressure-sensitive rubber adhesive, a protective adhesive coating; release sheet not required.
- B. HDPE Sheet for Horizontal Applications: 46-mil-thick, uniform, flexible sheets consisting of 30-mil-thick, HDPE sheet coated with a pressure-sensitive rubber adhesive, a protective adhesive coating, a detackifying surface treatment, an uncoated self-adhering side lap strip, and a release liner.
- C. Physical Properties: As follows, measured per standard test methods referenced:
 1. Tensile Strength, Film: 4000 psi minimum; ASTM D 412.
 2. Lateral Water Migration Resistance: Pass at 231 ft. of hydrostatic head pressure; ASTM D 5385, modified.
 3. Low-Temperature Flexibility: Pass at minus 10 deg F; ASTM D 1970.

4. Peel Adhesion to Concrete: 5 lbf/in.; ASTM D 903, modified.
5. Lap Adhesion: 2.5 lbf/in.; ASTM D 1876, modified.
6. Hydrostatic-Head Resistance: 231 feet; ASTM D 5385, modified.
7. Vapor Permeance: 0.01 perms; ASTM E 96, Water Method.

2.5 POLYPROPYLENE SHEET WATERPROOFING

- A. Pre-applied fully bonded polypropylene sheet waterproofing membrane comprised of polypropylene film with a heat bonded dimple surfaced geotextile, used to form a mechanical and chemical bond to poured concrete to prevent water migration at the interface of the membrane and structural concrete; having the following typical properties:
 1. Resistance to Hydrostatic Head (ASTM D5385): 231 ft. (70.4m)
 2. Puncture Resistance (ASTM E154): [110 lbs (490 N)] [225 lbs (1000 N)]
 3. Lateral Migration Resistance (ASTM D5385 Modified): 231 ft. (70.4m)
 4. Lap Peel Adhesion (ASTM D1876): 6.9lbs/in (1200 N/m)
 5. Permeance (ASTM E96): <0.1 Perms
 6. Peel Adhesion to Concrete (ASTM D903): 5 lbs/in (875 N/m)

2.6 AUXILIARY MATERIALS

- A. General: Furnish auxiliary materials recommended by waterproofing manufacturer for intended use and compatible with sheet waterproofing.
 1. Furnish liquid-type auxiliary materials that comply with VOC limits of authorities having jurisdiction.
- B. Primer: Liquid primer recommended for substrate by manufacturer of sheet waterproofing material.
- C. Surface Conditioner: Liquid, waterborne surface conditioner recommended for substrate by manufacturer of sheet waterproofing material.
- D. Sheet Strips: Self-adhering, rubberized-asphalt composite sheet strips of same material and thickness as sheet waterproofing.
- E. Liquid Membrane: Elastomeric, two-component liquid, cold fluid applied, trowel grade or low viscosity.
- F. Substrate Patching Membrane: Low-viscosity, two-component, asphalt-modified coating.
- G. Mastic, Adhesives, and Tape: Liquid mastic and adhesives, and adhesive tapes recommended by waterproofing manufacturer.
 1. Detail Tape: Two-sided, pressure-sensitive, self-adhering reinforced tape, 4-1/2 inches wide, with a tack-free protective adhesive coating on one side and release film on self-adhering side.
- H. Metal Termination Bars: Aluminum bars, approximately 1 by 1/8 inch thick, predrilled at 9-inch centers.

- I. Protection Course: Fan-folded, extruded-polystyrene board insulation, unfaced, nominal thickness 3/8 inch.

2.7 MOLDED-SHEET DRAINAGE PANELS

- A. Nonwoven-Geotextile-Faced, Molded-Sheet Drainage Panel: Manufactured composite subsurface drainage panels consisting of a nonwoven, needle-punched geotextile facing with an apparent opening size not exceeding No. 70 (0.21-mm) sieve laminated to 1 side with a polymeric film bonded to the other side of a 3-dimensional (studded), nonbiodegradable, molded-plastic-sheet drainage core, with a vertical flow rate of 9 to 15 gpm per ft. (112 to 188 L/min. per m).
 1. Available Products: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. American Hydrotech, Inc.; Hydrodrain 420.
 - b. Carlisle Coatings & Waterproofing Inc.; CCW MiraDRAIN 6200 series.
 - c. GCP Applied Technologies (formerly W.R. Grace); Hydroduct 220 vertical, 660 horizontal.
 - d. Henry Company; DB 220 vertical, DB 650 horizontal.
 - e. Sika Sarnafil Inc.; Drainage Panel 900 series.
 - f. Tremco Inc. TREMDrain 1000 or TREMDrain 2000.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance.
 1. Verify that concrete has cured and aged for minimum time period recommended by waterproofing manufacturer.
 2. Verify that concrete is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D 4263.
 3. Verify that compacted subgrade and substrates are dry, smooth, and sound; ready to receive HDPE sheet.
 4. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 SURFACE PREPARATION

- A. Clean, prepare, and treat substrates according to manufacturer's written instructions. Provide clean, dust-free, and dry substrates for waterproofing application.
- B. Mask off adjoining surfaces not receiving waterproofing to prevent spillage and overspray affecting other construction.
- C. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.

- D. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and other voids.
- E. Prepare, fill, prime, and treat joints and cracks in substrates. Remove dust and dirt from joints and cracks according to ASTM D 4258.
- F. Bridge and cover isolation joints, expansion joints and discontinuous deck-to-wall and deck-to-deck joints with overlapping sheet strips.
 - 1. Invert and loosely lay first sheet strip over center of joint. Firmly adhere second sheet strip to first and overlap to substrate.
- G. Corners: Prepare, prime, and treat inside and outside corners according to ASTM D 6135.
 - 1. Install membrane strips centered over vertical inside corners. Install 3/4-inch fillets of liquid membrane on horizontal inside corners and as follows:
 - a. At footing-to-wall intersections, extend liquid membrane each direction from corner or install membrane strip centered over corner.
 - b. At plaza deck-to-wall intersections, extend liquid membrane or sheet strips onto deck waterproofing and to finished height of sheet flashing.
- H. Prepare, treat, and seal vertical and horizontal surfaces at terminations and penetrations through waterproofing and at drains and protrusions according to ASTM D 6135.

3.3 RUBBERIZED-ASPHALT SHEET APPLICATION

- A. Install self-adhering sheets according to waterproofing manufacturer's written instructions and recommendations in ASTM D 6135.
- B. Apply primer to substrates at required rate and allow to dry. Limit priming to areas that will be covered by sheet waterproofing in same day. Reprime areas exposed for more than 24 hours.
- C. Apply and firmly adhere sheets over area to receive waterproofing. Accurately align sheets and maintain uniform 2-1/2-inch-minimum lap widths and end laps. Overlap and seal seams and stagger end laps to ensure watertight installation.
 - 1. When ambient and substrate temperatures range between 25 and 40 deg F, install self-adhering, rubberized-asphalt sheets produced for low-temperature application. Do not use low-temperature sheets if ambient or substrate temperature is higher than 60 deg F .
- D. Horizontal Application: Apply sheets from low point to high point of decks to ensure that side laps shed water.
- E. Apply continuous sheets over sheet strips bridging substrate cracks, construction, and contraction joints.
- F. Seal exposed edges of sheets at terminations not concealed by metal counterflashings or ending in reglets with mastic or sealant.
- G. Install sheet waterproofing and auxiliary materials to tie into adjacent waterproofing as applicable.

- H. Repair tears, voids, and lapped seams in waterproofing not complying with requirements. Slit and flatten fishmouths and blisters. Patch with sheets extending 6 inches beyond repaired areas in all directions.
- I. Correct deficiencies in or remove sheet waterproofing that does not comply with requirements, repair substrates, reapply waterproofing, and repair sheet flashings.

3.4 HDPE SHEET APPLICATION

- A. Install HDPE sheets according to waterproofing manufacturer's written instructions.
- B. Vertical Applications: Install sheet membrane with HDPE face against substrate. Accurately align sheets and maintain uniform 3-inch-minimum lap widths and end laps. Overlap and seal seams and stagger and tape end laps to ensure watertight installation. Mechanically fasten to substrate.
 - 1. Securely fasten top termination of membrane with continuous metal termination bar anchored into substrate and cover with detailing tape.
- C. Horizontal Applications: Install sheet membrane with HDPE face against substrate. Accurately align sheets and maintain uniform 3-inch-minimum lap widths and end laps. Overlap and seal seams. Overlap, stagger, and seal end laps with detail tape to ensure watertight installation.
- D. Corners: Seal lapped terminations and cut edges of sheet waterproofing at inside and outside corners with detail tape.
- E. Seal penetrations through sheet waterproofing to provide watertight seal with detail tape patches or wraps and a liquid-membrane troweling.
- F. Install sheet waterproofing and auxiliary materials to produce a continuous watertight tie into adjacent waterproofing.
- G. Repair tears, voids, and lapped seams in waterproofing not complying with requirements. Tape perimeter of damaged or nonconforming area extending 6 inches beyond repaired areas in all directions. Apply a patch of sheet membrane and firmly secure with detail tape.
- H. Correct deficiencies in or remove waterproofing that does not comply with requirements, repair substrates, reapply waterproofing, and repair sheet flashings.

3.5 POLYPROPYLENE SHEET INSTALLATION

- A. Verify substrate is ready to receive the waterproofing in accordance with the Waterproofing Manufacturer's TDS and guide specification.
- B. Air and substrate temperature limitations:
 - 1. Do not perform Work when ambient (air) and substrate temperatures are below 32 °F (0 °C).
- C. Detailing/Flashing:
 - 1. Install detailing and flashings per Waterproofing Manufacturer's details.

D. Waterproofing Assembly Installation:

1. Vertical substrates:
 - a. Install waterproofing membrane with polypropylene film side facing existing substrate, dimpled surface geotextile side facing the installer.
 - b. Where vertical securement is required, select from the following methods:
 - 1) Tape:
 - a) Secure membrane with double sided tape.
 - 2) Mechanical attachment:
 - a) Secure membrane at selvedge with small, low profile, non-rusting, substrate appropriate fasteners to create a smooth and flat membrane seam.
 - c. Verify waterproofing is clean, dry and free from contaminants prior to subsequent membrane installations; wipe with damp cloth if necessary.
 - d. Overlap membrane seams two (2) inches.
 - e. Remove plastic release liner at selvedge and firmly press overlapping membrane into place to adhere membrane seams.
 - f. Seal membrane seams in accordance with Waterproofing Manufacturer details.
2. Horizontal substrates:
 - a. Install waterproofing membrane with polypropylene film side facing existing substrate, dimpled surface geotextile side facing the installer.
 - b. Extend pre-applied waterproofing twenty-four (24) inches beyond base slab to create a trafficable space and minimize membrane soiling or damage.
 - c. Verify waterproofing is clean, dry and free from contaminants prior to subsequent membrane installations; wipe with damp cloth if necessary.
 - d. Stagger end laps to avoid layer build up.
 - e. Overlap membrane seams two (2) inches.
 - f. Remove plastic release liner at selvedge and firmly press overlapping membrane into place to adhere membrane seams.
 - g. Seal membrane seams in accordance with Waterproofing Manufacturer details.

3.6 COMPOSITE HDPE/BENTONITE INSTALLATION

- A. Install composite HDPE/bentonite sheets according to waterproofing manufacturer's written instructions.
- B. Below Slab Installation:
 1. Bentonite-Side Up:
 - a. Install membrane sheets bentonite-side up with edges overlapped 3" minimum over stable, smoothed and compacted subgrade or mud slab; position membrane to stagger end laps 12"; securely fasten seams with staples every 8" on center.
 - b. Extend membrane upward 6" minimum within the formwork at bottom edges of mat slabs and wrapped footings to provide for proper tie-in to vertical membrane; install membrane in double layer continuous along bottom edges of slabs and wrapped footings extending 6" from edge in both directions.
 - c. Install membrane to wrap footings where shown on Drawings; carry membrane across top surfaces of unwrapped footings or mud slab to interior vertical faces of walls and columns and terminate as manufacturer recommends.
 - d. Waterproof penetrations in accord with manufacturers recommendations.
 - e. Verify membrane is protected from damage caused by rebar and support chairs.

- f. Protect exposed bentonite from moisture with temporary plastic sheets; remove plastic sheets before final covering.
- 2. Bentonite-Side Down:
 - a. Install polyethylene base sheets with edges lapped 5" over stable, smoothed and compacted subgrade or mud slab; trim base sheet away from penetrations and terminations.
 - b. Install membrane bentonite-side down over polyethylene base sheets with edges lapped 3" minimum; position membrane sheets to stagger end laps 12"; tape seams with reinforced seam tape closely following membrane placement and immediately secure by roll-pressing with hand-held metal seam roller.
 - c. Extend membrane upward 6" minimum within the formwork at bottom edges of mat slabs and wrapped footings; install a second layer of membrane, with the bentonite-side up, under the field membrane and extending upward within the formwork at bottom edges of mat slabs and wrapped footings to provide for proper tie-in to vertical membrane; membrane double layer continuous along bottom edges of slabs and wrapped footings shall extend 6" from edge in both directions.
 - d. Install membrane to wrap footings where shown on Drawings; carry membrane across top surfaces of unwrapped footings or mud slab to interior vertical faces of walls and columns and terminate as manufacturer recommends.
 - e. Waterproof penetrations in accord with manufacturer's recommendations.
 - f. Verify membrane is protected from damage caused by rebar and support chairs.
- 3. Backfilled Wall Installation:
 - a. Install membrane sheets in vertical or horizontal lifts with HDPE-side facing applicator to prepared surfaces conforming to manufacturer's requirements.
 - 1) Vertical installation: Securely fasten membrane 12" on center along top edge with sheet extending out onto footing surfaces 6" minimum, overlapping below-slab membrane 6"; install subsequent membrane sheets to overlap previous sheets 1-1/2" minimum; securely fasten membrane 24" on center through both sheets at overlaps; securely fasten 18" on center to tops of footing surfaces and horizontal shelves; apply seam tape to seam overlaps.
 - 2) Horizontal installation: Start membrane at lowest portion of wall; securely fasten membrane 24" on center along top edge with sheet extending out onto footing surfaces 6" minimum, overlapping under slab membrane 6"; install subsequent membrane sheets to overlap previous sheets minimum 1-1/2" in shingle fashion with staggered end laps; securely fasten membrane 24" on center through both sheets at overlaps; securely fasten 18" on center to tops of footing surfaces and horizontal shelves; apply seam tape to seam overlaps.
 - b. Waterproof penetrations in accord with manufacturer's recommendations.
- 4. Blindside Wall Installation:
 - a. Ensure that vertical surfaces to receive waterproofing system conform to manufacturer's requirements as applicable to the earth retaining system employed

prior to commencing installation; contact manufacturer for requirements of project conditions not provided for in installation manuals.

- b. Install waterproofing membrane starter-strip to vertical surfaces of earth retaining system with bentonite-side facing applicator prior to placement of concrete footings or foundation mat slab.
- c. Prepare all vertical inside corners that occur along the earth retaining system by fastening a minimum 12" wide strip of membrane pressed tight into corner with bentonite-side facing applicator; securely fasten along vertical edges 24" on center.
- d. Install membrane sheets oriented vertically with bentonite-side facing applicator; overlap membrane sheets 3" minimum for poured-in-place walls and 4" minimum for shotcrete/gunite walls; securely fasten membrane through both sheets at overlap areas with nails every 24" on center and staples every 3" on center.
- e. Verify which penetrations must be accessed after concrete placement for completion of waterproofing detail treatment and ensure that sufficient access to membrane is provided within a formed boxout; verify which penetrations will not be accessed after concrete placement for completion of waterproofing detail treatment and ensure that final detailing procedures are completed prior to erection of concrete formwork or shotcreting/guniting; waterproof penetrations in accord with manufacturer's current procedures; contact manufacturer for procedures at project conditions not provided for in installation manuals.
- f. Protect membrane system from excessive rain.
- g. Inspect and repair damages to membrane system immediately prior to erection of concrete formwork or shotcreting/guniting; ensure that concrete directly contacts membrane.
- h. Complete waterproofing details and terminations at gradeline coordinating with other trades.

5. Deck Installation:

- a. Install membrane with bentonite-side down against deck surfaces with edges overlapped minimum 1-1/2" in shingle fashion with staggered end laps; start installation at lowest point; tape seams with reinforced waterproofing seam tape closely following membrane placement and immediately secure by roll-pressing with hand-held metal seam roller.
- b. Waterproof penetrations, horizontal-to-vertical junctures and vertical terminations with liquid-applied elastomeric flashing carried out onto deck surfaces 12"; overlap cured elastomeric flashing 6" with membrane sheet and seal leading edge with reinforced waterproofing seam tape.
- c. Conduct flood-test of membrane installed to elevated horizontal surfaces by damming perimeter, stopping drains and covering with 2" of water for 24 hours; if leakage occurs, make repairs and repeat flood-test; when area is proven watertight, drain water and remove dams; obtain written authorization by manufacturer's representative prior to conducting flood-test.
- d. Ensure membrane is protected from damage caused by construction trades.

3.7 MOLDED-SHEET DRAINAGE-PANEL INSTALLATION

- A. Place and secure molded-sheet drainage panels, with geotextile facing away from wall or deck substrate, according to manufacturer's written instructions. Use adhesives or other methods that do not penetrate waterproofing. Lap edges and ends of geotextile to maintain continuity. Protect installed molded-sheet drainage panels during subsequent construction.

1. For vertical applications, install board insulation before installing drainage panels.

3.8 FIELD QUALITY CONTROL

- A. Flood Testing: Flood test each deck area for leaks, according to recommendations in ASTM D 5957, after completing waterproofing but before overlying construction is placed. Install temporary containment assemblies, plug or dam drains, and flood with potable water.
 1. Flood to an average depth of 2-1/2 inches with a minimum depth of 1 inch and not exceeding a depth of 4 inches. Maintain 2 inches of clearance from top of sheet flashings.
 2. Flood each area for 24 hours.
 3. After flood testing, repair leaks, repeat flood tests, and make further repairs until waterproofing installation is watertight.
 4. Engage an independent testing agency to observe flood testing and examine underside of decks and terminations for evidence of leaks during flood testing.

3.9 PROTECTION AND CLEANING

- A. Do not permit foot or vehicular traffic on unprotected membrane.
- B. Protect waterproofing from damage and wear during remainder of construction period.
- C. Protect installed insulation from damage due to ultraviolet light, harmful weather exposures, physical abuse, and other causes. Provide temporary coverings where insulation will be subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.
- D. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION

SECTION 071610

CRYSTALLINE WATERPROOFING

(Part of Work of Section 070001 - WATERPROOFING, DAMPPROOFING AND CAULKING, Filed Sub-Bid Required)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Crystalline waterproofing for the following applications.
 - a. Elevator pits.
 - b. Sump pits.
- B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council. Refer to Section 018110, SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 033000 - CAST-IN-PLACE CONCRETE for concrete substrate and finishing concrete walls and slabs to receive waterproofing.
 - 2. Section 042000 - UNIT MASONRY for preparing concrete unit masonry walls to receive waterproofing.
 - 3. Section 079200 - JOINT SEALANTS for elastomeric and preformed sealants in concrete and masonry walls and floors.

1.3 SUBMITTALS

- A. Product Data: Include manufacturer's installation instructions and general recommendations for waterproofing applications, substrate preparation, project specific construction details, and material descriptions and installation instructions for crystalline waterproofing.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: An employer of workers trained and approved by manufacturer.

- B. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01.

1.5 PROJECT CONDITIONS

- A. Weather Limitations: Proceed with application only when existing and forecasted weather conditions permit crystalline waterproofing to be performed according to manufacturer's written instructions and warranty requirements.
- B. Proceed with waterproofing work only after pipe sleeves, vents, curbs, inserts, drains, and other projections through the substrate to be waterproofed have been completed. Proceed only after concrete and masonry substrate defects, including honeycombs, voids, and cracks, have been repaired to provide a sound substrate free of forming materials, including reveal inserts.
- C. Ambient Conditions: Proceed with waterproofing work only if temperature is maintained at 40 deg F or above during work and cure period, and space is well ventilated and kept free of water.

1.6 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of crystalline waterproofing that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Failure to maintain watertight conditions within specified warranty period.
 - 2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Crystalline Waterproofing:
 - a. Anti-Hydro International, Inc.; Hydro Cap.
 - b. Conproco Corp.; Super Seal.
 - c. Tamms Industries, Inc.; Hey'Di K-11.
 - d. ThoRoc, Div. of ChemRex; Tegraproof.
 - e. Vandex International Ltd.; Vandex Super.
 - f. Xypex Chemical Corporation; Xypex. (Basis-of-Design)

2.2 MATERIALS

- A. Crystalline Waterproofing: A prepackaged, proprietary blend of Portland cement, specially treated sand, and active chemicals that, when mixed with water and applied, penetrates by capillary action into concrete or masonry and reacts chemically with free lime in the presence of water to develop crystalline growth within concrete or masonry capillaries to produce an

impervious, dense, waterproof concrete or masonry with properties meeting or exceeding the following criteria:

1. Permeability: 0 for water at 33 feet when tested according to CE CRD-C 48.
 2. Compressive Strength: Minimum 3000 psi when tested according to ASTM C 109/C 109M.
- B. Patching Compound: Cementitious waterproofing and repair mortar for filling and patching tie holes, honeycombs, reveals, and other imperfections; with properties meeting or exceeding the following criteria:
1. Compressive Strength: 7600 psi at 28 days when tested according to ASTM C 109/C 109M.
 2. Flexural Strength: 710 psi at 28 days when tested according to ASTM C 348.
 3. Shrinkage: Minus 0.093 percent at 28 days and plus 0.073 percent at 90 days when tested according to ASTM C 596.
- C. Plugging Compound: Cementitious compound with hydrophobic properties; resistant to water and moisture but vapor permeable for all standard applications (vertical, overhead and horizontal surfaces not exposed to vehicular traffic); with properties meeting or exceeding the following criteria:
1. Permeability: 30 feet when tested according to CE CRD-C 48.
 2. Compressive Strength: 6000 psi at 28 days when tested according to ASTM C 109/C 109M.
 3. Flexural Strength: 1000 psi at 28 days when tested according to ASTM C 348.
 4. Bond Strength: 300 psi at 14 days when tested according to ASTM C 321.
- D. Water: Potable.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Acceptance of Conditions: Examine substrates, with Applicator present, where waterproofing is to be applied.
1. Proceed with application only after unsatisfactory conditions have been corrected.
 2. Notify Architect in writing of active leaks or structural defects that would affect system performance.

3.2 PREPARATION

- A. Protect other work from damage from cleaning, preparation, and application of crystalline waterproofing. Provide temporary enclosure to confine spraying operation and to ensure adequate ambient temperatures and ventilation conditions for application.
- B. Stop active water leaks according to waterproofing manufacturer's written instructions.
- C. Repair damaged or unsatisfactory concrete or masonry according to manufacturer's written instructions.

- D. Surface Preparation: Comply with waterproofing manufacturer's written instructions to remove efflorescence, chalk, dust, dirt, mortar spatter, grease, oils, curing compounds, and form-release agents to ensure that waterproofing bonds to concrete or masonry surfaces.

1. Clean masonry surfaces according to ASTM D 4261.

- a. Lightweight Concrete Masonry: Etch with 10 percent muriatic (hydrochloric) acid solution or abrade surface by wire brushing. Remove acid residue until pH readings of water after rinse are not more than 1.0 pH lower or 2.0 pH higher than pH of water before rinse.
- b. Medium- and Normal-Weight Concrete Masonry: Sandblast or bushhammer to a depth of 1/16 inch.

2. Clean concrete surfaces according to ASTM D 4258.

- a. Scratch- and Float-Finished Concrete: Etch with 10 percent muriatic (hydrochloric) acid solution according to ASTM D 4260.
- b. Prepare smooth-formed and trowel-finished concrete by mechanical abrading or abrasive-blast cleaning according to ASTM D 4259.

3. Concrete Joints: Clean reveals according to waterproofing manufacturer's written instructions.

4. Cracks: Clean and fill cracks according to waterproofing manufacturer's written instructions.

3.3 APPLICATION

- A. General: Comply with waterproofing manufacturer's written instructions for application.

- 1. Dampen surface with water and maintain damp condition until applying waterproofing.
- 2. Apply waterproofing to negative-side surfaces.
- 3. Number of Coats: Two coats.
- 4. Dampen surface between coats.

- B. Final Coat Finish: Smooth

- C. Moist-cure waterproofing for three days immediately after application has set, followed by two days of air drying as recommended in writing by manufacturer.

- D. Waterproofing Treatment Extensions: Extend waterproofing treatment as follows:

- 1. Onto columns integral with treated walls.
- 2. Onto every substrate in areas indicated for treatment, including pipe trenches, pits, and sumps.

3.4 CLEANING AND PROTECTION

- A. Protect applied crystalline waterproofing from rapid drying, severe weather exposure, and water accumulation. Maintain completed Work in moist condition for not less than three days by procedures recommended in writing by waterproofing manufacturer. Protect waterproofing from temperatures below 36 deg F.

- B. Cleaning: Clean spillage and soiling from adjacent surfaces using appropriate cleaning agents and procedures.
- C. Protection: Take measures to protect completed crystalline waterproofing coating from damage after application.

3.5 FIELD QUALITY CONTROL

- A. Inspection: Engage manufacturer's representative to inspect completed application and to provide a written report that application complies with manufacturer's written instructions.

END OF SECTION

SECTION 072100

THERMAL INSULATION

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Rigid insulation under slabs-on-grade and at perimeter foundation walls.
 - 2. Rigid insulation at cavity walls.
 - 3. Glass-fiber blanket insulation.
 - 4. Mineral-wool blanket and board insulation.
 - 5. Spray polyurethane foam insulation.
 - 6. Spray-applied cellulose insulation at walls.
 - 7. Spray-applied cellulose insulation at ceilings.
 - 8. Vapor retarders.
- B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council. Refer to Section 018110 - SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 033000 - CAST-IN-PLACE CONCRETE for underslab vapor barrier.
 - 2. Section 072700 - AIR BARRIERS for air and vapor barrier membrane.
 - 3. Section 075300 - EPDM ROOFING for roofing insulation.
 - 4. Section 092110 - GYPSUM BOARD ASSEMBLIES for acoustic insulation in gypsum board assemblies.
 - 5. Division 22 - PLUMBING for plumbing insulation.
 - 6. Division 23 - HEATING, VENTILATING, AND AIR CONDITIONING for mechanical insulation.

1.3 SUBMITTALS

- A. Product Data: Manufacturer product data, installation instructions, performance criteria, and product limitations for each type of product indicated.
- B. LEED Submittals:

1. Building Product Disclosure and Optimization, Environmental Product Declarations (EPD):
 - a. Option 1: For insulation, submit industry-wide EPDs.
 2. Building Product Disclosure and Optimization, Sourcing of Raw Materials:
 - a. General: For credit achievement calculation, submit location of products sourced (extracted, manufactured, and purchased), indicating number of miles from the project site.
 - b. Option 1: For insulation, submit corporate sustainability reports (CSR).
 - c. Option 2, Leadership Extraction Practices:
 - 1) Recycled Content: For insulation, submit percentages by weight of postconsumer and preconsumer recycled content for products having recycled content. Include statement indicating costs for each product having recycled content.
 3. Building Product Disclosure and Optimization, Material Ingredients:
 - a. Option 1, Material Ingredient Reporting: For mineral wool blanket insulation, submit Declare product labels.
 4. Low-Emitting Materials, General Emissions Evaluation: Building products must be tested and determined compliant in accordance with California Department of Public Health (CDPH) Standard Method v1.1–2010, using the applicable exposure scenario.
 - a. For insulation, submit GreenGuard Gold certification.
 - b. For adhesives, submit test results, including TVOC emissions and VOC content.
 - c. For wet-applied products, submit volume used.
- C. Cavity Wall Insulation Certification: Submit manufacturer's certification that cavity wall insulation, as designed in the assemblies indicated on the Drawings, has been tested to meet the requirements of NFPA 285 and passed.
- D. Qualification Data: For Installer of spray-applied products and Testing Agency.
- 1.4 QUALITY ASSURANCE
- A. Source Limitations: Obtain each type of building insulation through one source from a single manufacturer.
 - B. Installer Qualifications: A qualified installer who has been trained by and is acceptable to spray polyurethane foam insulation manufacturer to install manufacturer's products.
 - C. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - D. Fire Test Performance for Insulation in Cavity Wall: Passes NFPA 285, Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components.

- E. Testing Agency Qualifications: An independent agency qualified as a "Certified Infrared Thermographer" per ASNT SNT-TC-1A guidelines, Level I certification minimum.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Protect insulation materials from physical damage and from deterioration by moisture, soiling, and other sources. Store in a dry and secure location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.
- B. Protect plastic and spray polyurethane foam insulation as follows:
 - 1. Do not expose to sunlight, except to extent necessary for period of installation and concealment.
 - 2. Protect against ignition at all times. Do not deliver materials to Project site before installation time.
 - 3. Complete installation and concealment of materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 FOUNDATION WALL AND UNDER SLAB INSULATION

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. DuPont (formerly Dow Chemical); Reduced GWP Styrofoam series (gray color).
 - 2. Sika Corporation; Sarnatherm XPS
 - 3. Owens Corning; Foamular NGX (Next Generation Extruded) series.
- B. Extruded-Polystyrene (XPS) Board Insulation: ASTM C 578, square edged of type, density, and compressive strength indicated below:
 - 1. For vertical applications, Type IV, 1.6-lb/cu. ft. minimum density and 25-psi minimum compressive strength.
 - 2. For horizontal applications, pedestrian traffic, Type VII, 2.2-lb/cu. ft. minimum density and 60-psi minimum compressive strength.
 - 3. For horizontal applications, vehicular traffic, Type V, 3-lb/cu. ft. minimum density and 100-psi minimum compressive strength.
 - 4. Thermal Resistivity (R-value): 5.0 per inch.
 - 5. Blowing Agent: Honeywell; Solstice Liquid Blowing Agent, low global warming potential (GWP) hydrofluoro-olefin (HFO), or approved equal.
 - a. Other insulation manufacturers may be considered, if they have adopted the HFO blowing agents by start of construction.
 - 6. Recycled Content: 20 percent min.
 - 7. FM Global Requirements: Provide FM Approved Class 1 thermal insulation materials.
- C. Adhesive for Bonding Insulation: Product with demonstrated capability to bond insulation securely to substrates indicated without damaging insulation and substrates.

2.2 CAVITY WALL INSULATION (NOT FOR USE BEHIND METAL WALL PANEL)

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. DuPont (formerly Dow Chemical); Reduced GWP Styrofoam series (gray color).
 2. Kingspan; Greenguard XPS LG series.
 3. Owens Corning; Foamular NGX (Next Generation Extruded) series.
- B. Extruded-Polystyrene (XPS) Board Insulation: ASTM C 578, Type X, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, and ASTM D 1621 compressive strength of 15 pounds per square inch minimum.
1. Thermal Resistivity (R-value): 5.0 per inch.
 2. Blowing Agent: Honeywell; Solstice Liquid Blowing Agent, low global warming potential (GWP) hydrofluoro-olefin (HFO), or approved equal.
 - a. Other insulation manufacturers may be considered, if they have adopted the HFO blowing agents by start of construction.
 3. Recycled Content: 20 percent min.
 4. **FM Global Requirements: Provide FM Approved Class 1 thermal insulation materials.**
- C. Adhesive for Bonding Insulation: Product with demonstrated capability to bond insulation securely to substrates indicated without damaging insulation and substrates.

2.3 CAVITY WALL INSULATION, POLYISOCYANURATE BOARD

- A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
1. Atlas Roofing Corp.
 2. Dow Chemical Company.
 3. Rmax Inc.
- B. Foil-Faced, Polyisocyanurate Board Insulation: ASTM C 1289, Type I, Class 1 or 2, with maximum flame-spread and smoke-developed indexes of 25 and 450, respectively, per ASTM E 84; 25-psi minimum compressive strength.
1. Fire Resistance: NFPA 286, for interior walls.
 2. Thermal Resistance: ASTM C 518, R-Value 6.5 per inch.
 3. Blowing Agent: Free from CFCs, HCFCs, or HFCs.
- C. Adhesive for Bonding Insulation: Product with demonstrated capability to bond insulation securely to substrates indicated without damaging insulation and substrates.
- D. Joint Tape: Provide manufacturer's recommended foil tape, as approved by the Architect.

2.4 CAVITY WALL INSULATION, MINERAL-WOOL BOARD

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Isolatek International.
 2. Owens Corning; Thermafiber.
 3. Rockwool (formerly Roxul).
- B. Unfaced, Mineral-Wool Board Insulation: ASTM C 612, Type IVB; with maximum flame-spread and smoke-developed indexes of 15 and zero, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics.
1. Nominal density of 4 lb/cu. ft. Types IA and IB, thermal resistivity of 4 deg F x h x sq. ft./Btu x in. at 75 deg F minimum.
 2. Fiber Color: Natural, except darkened where visible through joints in cladding.
 3. **NFPA 285 Assembly Fire Propagation Characteristics Testing Results: Passing.**
 4. Building Product Disclosure and Optimization, Environmental Product Declarations (EPD): Industry-wide EPD.
- C. Attachment to Substrate, Masonry Veneers: Manufacturer's recommended mechanical attachment clip or disk.
- D. Attachment to Substrate, Panel Veneers: Manufacturer's recommended adhesively attached, spindle-type insulation anchors.

2.5 BLANKET INSULATION, GLASS FIBER BLANKET

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. CertainTeed Corporation.
 2. Johns Manville.
 3. Knauf Insulation.
 4. Owens Corning.
- B. 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. GreenGuard certified as formaldehyde free and low chemical emissions.
- C. Glass-Fiber Blanket, Polypropylene-Scrim-Kraft Faced: ASTM C 665, Type II (nonreflective faced), Class A (faced surface with a flame-spread index of 25 or less); Category 1 (membrane is a vapor barrier). GreenGuard certified as formaldehyde free and low chemical emissions.
- D. Glass-Fiber Blanket, Kraft Faced: ASTM C 665, Type II (nonreflective faced), Class C (faced surface not rated for flame propagation); Category 1 (membrane is a vapor barrier). GreenGuard certified as formaldehyde free and low chemical emissions.
- E. Glass-Fiber Blanket, Foil Faced: ASTM C 665, Type III (reflective faced), Class B (faced surface with a flame-propagation resistance of 0.12 W/sq. cm); Category 1 (membrane is a vapor barrier), faced with foil scrim, foil-scrim kraft, or foil-scrim polyethylene. GreenGuard certified as formaldehyde free and low chemical emissions.

2.6 BLANKET INSULATION, MINERAL-WOOL BLANKET

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Owens Corning; Thermafiber UltraBatt FF.
 2. Isolatek International.
 3. Rockwool (formerly Roxul).
- B. Mineral-Wool Blanket, Unfaced: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers; 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. Recycled Content: 70 percent min.
 2. Building Product Disclosure and Optimization, Material Ingredients: Health Product Declaration (HPD) or Declare product labels.
 3. Low-Emitting Materials, General Emissions Evaluation: GreenGuard Gold certification, formaldehyde-free.
- C. Mineral-Wool Blanket, Reinforced-Foil Faced: ASTM C 665, Type III (reflective faced), Class A (faced surface with a flame-spread index of 25 or less per ASTM E 84); Category 1 (membrane is a vapor barrier), faced with foil scrim, foil-scrim kraft, or foil-scrim polyethylene. GreenGuard certified as formaldehyde free and low chemical emissions.

2.7 CLOSED-CELL SPRAY POLYURETHANE FOAM INSULATION

- A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
1. Accella Polyurethane Systems; Ecobay CC/CC Polar.
 2. BASF Corporation; WALLTITE.
 3. Corbond Corporation, a division of Johns Manville; Corbond III.
 4. Demilec (USA) LLC; Heatlok.
 5. DuPont; STYROFOAM Spray Polyurethane Foam (CM Series).
 6. Henry Company; PERMAX.
 7. NCFI, a Division of Barnhardt Mfg. Co.; InsulStar.
- B. Closed-Cell Polyurethane Foam Insulation: ASTM C 1029, Type I and II.
1. Minimum density of 1.5 lb/cu. ft., thermal resistivity of 6.2 deg F x h x sq. ft./Btu x in. at 75 deg F.
 2. Fire Resistance: ASTM E 84, Flame Spread 75 max., and Smoke Developed 450 max.
 3. Building Product Disclosure and Optimization, Environmental Product Declarations (EPD): Industry-wide EPD.
 4. Low-Emitting Materials, General Emissions Evaluation: GreenGuard Gold certification.

2.8 OPEN-CELL SPRAY POLYURETHANE FOAM INSULATION

- A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
1. Accella Polyurethane Systems; Bayseal OC.

2. BASF Corporation; ENERTITE.
3. Corbond Corporation, a division of Johns Manville; Corbond ocSPF.
4. Demilec (USA) LLC; Sealection 500.
5. **Henry Company; PERMAX 0.5 lb. Open Cell.**
6. Icynene Inc.; Icynene Classic LD-C-50.
7. NCFI, a Division of Barnhardt Mfg. Co.; Sealite.

B. Open-Cell Polyurethane Foam Insulation:

1. Minimum density of 0.4 lb/cu. ft., thermal resistivity of 3.6 deg F x h x sq. ft./Btu x in. at 75 deg F.
2. Fire Resistance: ASTM E 84, Flame Spread 75 max., and Smoke Developed 450 max.
3. Building Product Disclosure and Optimization, Environmental Product Declarations (EPD): Industry-wide EPD.
4. Low-Emitting Materials, General Emissions Evaluation: GreenGuard Gold certification.

2.9 SPRAYED-FOAM INSULATION, AT GAPS AND VOIDS

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

1. Dow Chemical; GreatStuff Pro.
2. ICP Adhesives and Sealants (formerly Fomo Products): Handi-Foam products.
3. Approved equal.

B. Sprayed-Foam Insulation: Water-cure closed cell polyurethane containing no urea-formaldehyde and no CFCs.

1. Minimum density of 0.4 lb/cu. ft., thermal resistivity of 4.0 deg F x h x sq. ft./Btu x in. at 75 deg F.
2. Fire Resistance: UL 723, Flame Spread 25 max., and Smoke Developed 50 max.
3. Building Product Disclosure and Optimization, Environmental Product Declarations (EPD): Industry-wide EPD.
4. Low-Emitting Materials, General Emissions Evaluation: GreenGuard Gold certification.

2.10 THERMAL AND IGNITION BARRIERS

A. Thermal Barrier for Foam Plastic Insulation at Occupied Spaces: Provide thermal barrier recommended by foam plastic manufacturer and tested with the specific product. Product shall have an active building code evaluation report that lists report number and effective dates of product acceptance.

B. Ignition Barrier for Foam Plastic Insulation at Attic and Crawl Spaces, **including Areas not Separated from Occupied Spaces by a Thermal Barrier**: Provide ignition barrier recommended by foam plastic manufacturer and tested with the specific product. Product shall have an active building code evaluation report that lists report number and effective dates of product acceptance.

2.11 SPRAY-APPLIED CELLULOSE INSULATION AT WALLS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. National Fiber; Cel-Pak.
2. Nu-Wool Cellulose Insulation.
3. US Greenfiber.

B. Spray-Applied Cellulosic Insulation: ASTM C 739 cellulose materials intended for dry dense pack installation, as follows:

1. Minimum density of 3.5 lb/cu. ft., thermal resistivity of 3.6 deg F x h x sq. ft./Btu x in. at 75 deg F.
2. Accessories: Non-woven, vapor-permeable netting, metal staples, and tape, as recommended by manufacturer for a complete assembly.

2.12 SPRAY-APPLIED THERMAL CELLULOSE INSULATION AT CEILINGS

A. Spray-Applied Cellulosic Insulation: ASTM C 739 cellulose materials intended for spray application at ceilings.

1. R-Value: R-3.7 per inch.
2. Thickness: 1-1/2 inches unless indicated otherwise on the Drawings.
3. Color: White, unless selected otherwise by the Architect.

B. Fire-Resistive Substrate: Where spray-applied insulation is intended for use over sprayed fire-resistive materials (SFRM) or intumescent fire-resistive materials (IFRM), provide evidence that the product and SFRM/IFRM system has been tested in accordance with UL 263 or ASTM E119.

2.13 VAPOR RETARDERS

A. Polyethylene Vapor Retarders: ASTM D 4397, 6 mils thick, with maximum permeance rating of 0.06 perm.

B. Vapor-Retarder Tape: Pressure-sensitive tape of type recommended by vapor-retarder manufacturer for sealing joints and penetrations in vapor retarder.

2.14 AUXILIARY INSULATING MATERIALS

A. Adhesive for Bonding Insulation: Product with demonstrated capability to bond insulation securely to substrates indicated without damaging insulation and substrates.

1. Low-Emitting Materials: Provide interior adhesives in compliance with the 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. Do not use adhesives that contain urea formaldehyde.
3. Methylene chloride and perchloroethylene may not be intentionally added to adhesives.

B. Masonry and Concrete Fasteners:

1. Hardened nails, pneumatically-driven fasteners or other anchors recommended by insulation manufacturer, sufficient to penetrate substrate and permanently retain insulation.

2. Self-adhering insulation stick pins: Galvanized steel plate welded to projecting steel spindle; capable of holding insulation thicknesses indicated securely in position indicated with self-locking galvanized steel washer in place. Backseal fastener penetrations.
- C. Tape: Adhesive tape recommended by insulation manufacturer, to tape joints and tears in faced insulation.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements of Sections in which substrates and related work are specified and for other conditions affecting performance.
1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

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

3.3 INSTALLATION, GENERAL

- A. Comply with insulation manufacturer's written instructions applicable to products and application indicated.
- B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed at any time to ice, rain, and snow.
- C. Extend insulation in thickness indicated to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.
- D. Spray Polyurethane Foam: Comply with recommendations of the American Chemistry Council, "Health and Safety Product Stewardship Workbook for High-Pressure Application of Spray Polyurethane Foam (SPF)."
1. Spray Polyurethane Foam: Spray insulation no greater than 1-1/2 inch thickness per layer. Allow each layer to fully cure before spraying additional thickness.
 2. Contain and fully ventilate the area being sprayed with negative air machines, venting directly to the exterior. Do not operate permanent building HVAC system during installation. Continue ventilation during curing process.
 3. Install spray polyurethane foam insulation with uniform full thickness and with density which will not displace adjacent materials.
 4. Do not apply insulation until installation of pipes, ducts, conduits, wiring, and electrical outlets in walls is completed and windows, electrical boxes, and other items not indicated to receive insulation are masked. After insulation is applied, make flush with face of studs by using method recommended by insulation manufacturer.

- E. Miscellaneous Voids: Install spray polyurethane foam insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation.
 - 1. Cure insulation with continuous natural or mechanical ventilation.
 - 2. Remove and dispose of over-spray.

3.4 INSTALLATION OF BELOW-GRADE INSULATION

- A. On vertical surfaces, set rigid insulation units in adhesive applied according to manufacturer's written instructions. Use adhesive recommended by insulation manufacturer.
 - 1. If not otherwise indicated, extend insulation a minimum of 48 inches below exterior grade line.
- B. On horizontal surfaces, loosely lay rigid insulation units according to manufacturer's written instructions. Stagger end joints and tightly abut insulation units.

3.5 INSTALLATION OF CAVITY-WALL INSULATION

- A. On units of foam-plastic board insulation, install pads of adhesive spaced approximately 24 inches o.c. both ways on inside face, and as recommended by manufacturer. Fit courses of insulation between wall ties (if applicable) and other obstructions, with edges butted tightly in both directions. Press units firmly against inside substrates indicated. Fill gaps with compatible insulating material.
- B. Install mineral wool board cavity insulation per manufacturer's instructions. Fit insulation with edges butted tightly in both directions. Do not compress insulation. Maintain cavity width of dimension indicated between insulation and cladding material.
 - 1. Masonry Veneers: Secure with clips installed over masonry anchors. Provide at least 6 clips per mineral wool board.
 - 2. Panel Veneers: Secure with adhesively attached, spindle-type insulation anchors. Space anchors according to insulation manufacturer's written instructions.

3.6 INSTALLATION OF INSULATION FOR FRAMED CONSTRUCTION

- A. Glass-Fiber or Mineral-Wool 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. Maintain 3-inch clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.
- B. Spray-Applied Insulation: Apply spray-applied insulation according to manufacturer's written instructions. Do not apply insulation until installation of pipes, ducts, conduits, wiring, and electrical outlets in walls is completed and windows, electrical boxes, and other items not indicated to receive insulation are masked. After insulation is applied, make flush with face of studs by using method recommended by insulation manufacturer.

3.7 INSTALLATION OF VAPOR RETARDERS

- A. Place vapor retarders on side of construction indicated on Drawings. Extend vapor retarders to extremities of areas to protect from vapor transmission. Secure vapor retarders in place with adhesives or other anchorage system as indicated. Extend vapor retarders to cover miscellaneous voids in insulated substrates, including those filled with loose-fiber insulation.
- B. Seal vertical joints in vapor retarders over framing by lapping no fewer than two studs.
 - 1. Attach vapor retarders to framing at top, end, and bottom edges; at perimeter of wall openings; and at lap joints.
 - 2. Seal overlapping joints in vapor retarders with vapor-retarder tape according to vapor-retarder manufacturer's written instructions. Seal butt joints with vapor-retarder tape. Locate all joints over framing members or other solid substrates.
- C. Seal joints caused by pipes, conduits, electrical boxes, and similar items penetrating vapor retarders with vapor-retarder tape to create an airtight seal between penetrating objects and vapor retarders.
- D. Repair tears or punctures in vapor retarders immediately before concealment by other work. Cover with vapor-retarder tape or another layer of vapor retarders.

3.8 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections indicated below and prepare test reports.
- B. Infrared Camera Survey: Perform an infrared camera scan of walls, floors, and ceilings to determine where insulation and air barrier are not continuous, after insulation has been installed, but prior to plaster patching or new gypsum board installation.
 - 1. Provide complete digital report with images of test results with recommendations for repairs.
- C. Repair or replace work where test results and inspections indicate that it does not comply with specified requirements.
- D. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.9 PROTECTION

- A. Protect installed insulation and vapor retarders 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

SECTION 072600

UNDERSLAB VAPOR RETARDERS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Vapor retarders under slabs-on-grade.
- B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council. Refer to Section 018110, SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 033000 - CAST-IN-PLACE CONCRETE.

1.3 SUBMITTALS

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

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Protect materials from physical damage and from deterioration by 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.

PART 2 - PRODUCTS

2.1 VAPOR RETARDER

- A. Basis-of-Design: Stego Wrap Vapor Retarder by Stego Industries LLC, or Perminator by W.R. Meadows, or Viper VaporCheck II 15 mil by ISI Building Products. Vapor retarder shall have the following qualities:
 - 1. Permeance of less than 0.01 perms per ASTM F 1249 or ASTM E 96.

2. ASTM E 1745 Class A, with the permeance requirement modified to not exceed 0.01 perms both before and after conditioning.
3. Thickness: 15 mils.

B. Accessories:

1. Seam Tape: Permeance less than 0.3 perms per ASTM F 1249 or ASTM E 96.
2. Vapor Proofing Mastic: Permeance less than 0.3 perms per ASTM F 1249 or ASTM E 96.
3. Pipe Boots: Construct pipe boots from vapor retarder material, pressure sensitive tape and/or mastic per manufacturer's instructions.

2.2 VAPOR RETARDER

- A. Integrally Bonded Vapor Protection: A 0.5mm (0.021 in) nominal thickness composite sheet membrane comprising 0.4 mm (0.016 in.) of polyolefin film, and layers of specially formulated synthetic adhesive layers. The membrane shall form an integral and permanent bond to poured concrete to prevent vapor migration at the interface of the membrane and structural concrete.

1. Basis-of-Design: GCP Applied Technologies (formerly W.R. Grace); Florprufe 120.

- B. Physical Properties for Membrane: Provide a Class A vapor rearder exceeding the requirements as defined by ASTM E 1745.

Property	Typical Value	Test Method
Thickness (nominal)	0.5mm (0.021 in)	ASTM D3767 Method A
Water Vapor Permeance	0.03 perms	ASTM E96 Method B
Tensile Strength	65 lb./in	ASTM E154
Elongation	300%	ASTM D412
Puncture Resistance	3300 grams	ASTM D1709
Peel Adhesion to Concrete	>4 lb./in	ASTM D903

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements of Sections in which substrates and related work are specified and for other conditions affecting performance.

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

3.2 PREPARATION

- A. Clean substrates of substances harmful to vapor retarders, including removing projections capable of puncturing vapor retarders.

3.3 INSTALLATION, GENERAL

- A. Comply with manufacturer's written instructions.

3.4 PROTECTION

- A. Protect installed vapor retarders from damage due to harmful weather exposures, physical abuse, and other causes.

END OF SECTION

SECTION 072700

AIR BARRIERS

(Part of Work of Section 070001 - Waterproofing, Dampproofing and Caulking,
Filed Sub-Bid Required)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS, which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. Self-adhering, vapor-retarding, modified bituminous sheet air barrier.
2. Self-adhering, vapor-permeable, modified bituminous sheet air barrier.
3. Fluid-applied, vapor-retarding membrane air barrier.
4. Fluid-applied, vapor-permeable membrane air barrier
5. Transition strips to adjacent and penetrating materials.

- B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council. Refer to Section 018110, SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.

- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:

1. Section 042000 - UNIT MASONRY for substrate for air and vapor barrier system.
2. Section 061600 - SHEATHING for sheathing substrate for air and vapor barrier system.
3. Section 075210 - SBS MODIFIED BITUMINOUS MEMBRANE ROOFING for connection to roof air and vapor barrier.
4. Section 075300 - EPDM ROOFING for roof air and vapor barrier.
5. Section 075400 - THERMOPLASTIC MEMBRANE ROOFING for roof air and vapor barrier.
6. Section 079200 - JOINT SEALANTS for joint sealant requirements.

1.3 DEFINITIONS

- A. Air Barrier Assembly: The collection of air barrier materials and auxiliary materials applied to an opaque wall or soffit, including joints and junctions to abutting construction, to control air movement through the wall.

1.4 PERFORMANCE REQUIREMENTS

- A. General: Air barrier shall be capable of performing as a continuous vapor-retarding air barrier and as a liquid-water drainage plane flashed to discharge to the exterior incidental condensation or water penetration. Air barrier assemblies shall be capable of accommodating substrate movement and of sealing substrate expansion and control joints, construction material changes, penetrations, and transitions at perimeter conditions without deterioration and air leakage exceeding specified limits.
- B. Air Barrier Assembly Air Leakage: Not to exceed 0.03 cfm/sq. ft. of surface area at 1.57 lbf/sq. ft., ASTM E 2357.
- C. Fire Test Performance: Passes NFPA 285, Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components.

1.5 PRECONSTRUCTION TESTING

- A. Mockup Testing: Air barrier assemblies shall comply with performance requirements indicated, as evidenced by reports based on mockup testing by a qualified testing agency.
 - 1. The Owner may engage a qualified testing agency.
 - 2. Quantitative Air Leakage Testing: Testing of the mockup for air leakage will be conducted not to exceed the test pressure differential, positive and negative, indicated in "Performance Requirements" Article for air barrier assembly air leakage when tested according to ASTM E 783.
 - 3. Notify Architect and the Owner a minimum of seven days in advance of the dates and times when mockup testing will take place.

1.6 SUBMITTALS

- A. Product Data: For each type of product indicated.
 - 1. Include manufacturer's written instructions for evaluating, preparing, and treating substrate; technical data; and tested physical and performance properties of air barrier.
- B. LEED Submittals:
 - 1. Building Product Disclosure and Optimization, Material Ingredients:
 - a. Option 1, Material Ingredient Reporting: For air barriers, submit Declare product labels.
- C. Shop Drawings: Show locations and extent of air barrier. Include details for substrate joints and cracks, counterflashing strip, penetrations, inside and outside corners, terminations, and tie-ins with adjoining construction.
 - 1. Include details of interfaces with other materials that form part of air barrier.
 - 2. Include details of mockups.

- D. Product Certificates: For air barriers, certifying compatibility of air barrier and accessory materials with Project materials that connect to or that come in contact with air barrier; signed by product manufacturer.
- E. Air Barrier Certification: Submit manufacturer's certification that air barrier, as designed in the assemblies indicated on the Drawings, has been tested to meet the requirements of NFPA 285 and passed.
- F. Qualification Data: For Applicator.
- G. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for air barriers.

1.7 QUALITY ASSURANCE

- A. Applicator Qualifications: A firm experienced in applying air barrier materials similar in material, design, and extent to those indicated for this Project, whose work has resulted in applications with a record of successful in-service performance.
- B. Mockups: Before beginning installation of air barrier, build mockups of exterior wall assembly 150 sq. ft., incorporating backup wall construction, external cladding, window, door frame and sill, insulation, and flashing to demonstrate surface preparation, crack and joint treatment, and sealing of gaps, terminations, and penetrations of air barrier membrane.
 - 1. Coordinate construction of mockup to permit inspection by Owner's testing agency of air barrier before external insulation and cladding is installed.
 - 2. Include junction with roofing membrane, building corner condition, and foundation wall intersection.
 - 3. If the Architect determines mockups do not comply with requirements, reconstruct mockups and apply air barrier until mockups are approved.
 - 4. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.
- C. Preinstallation Conference: Conduct conference at Project site.
 - 1. Include installers of other construction connecting to air barrier, such as roofing, waterproofing, architectural precast concrete, masonry, joint sealants, windows, glazed curtain walls, and door frames.
 - 2. Review air barrier requirements including surface preparation, substrate condition and pretreatment, minimum substrate curing period, forecasted weather conditions, special details and sheet flashings, mockups, installation procedures, sequence of installation, testing and inspecting procedures, and protection and repairs.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Store liquid materials in their original undamaged packages in a clean, dry, protected location and within temperature range required by air barrier manufacturer.
- B. Remove and replace liquid materials that cannot be applied within their stated shelf life.
- C. Store rolls according to manufacturer's written instructions.

- D. Protect stored materials from direct sunlight.

1.9 PROJECT CONDITIONS

- A. Environmental Limitations: Apply air barrier within the range of ambient and substrate temperatures recommended by air barrier manufacturer. Protect substrates from environmental conditions that affect performance of air barrier. Do not apply air barrier to a damp or wet substrate or during snow, rain, fog, or mist.

PART 2 - PRODUCTS

2.1 SELF-ADHERING SHEET MEMBRANE AIR BARRIERS, FIRE-RATED TYPES

- A. Self-Adhering, Vapor-Retarding Aluminum-Faced Sheet: Rubberized asphalt laminated to cross-laminated polyethylene film with aluminum facing on one side, with release liner on adhesive side, and formulated for application with primer that complies with VOC limits of authorities having jurisdiction.

- 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Carlisle Coatings & Waterproofing; CCW 705FR-A.
 - b. GCP Applied Technologies (formerly W.R. Grace); Perm-A-Barrier Aluminum Wall Membranes.
 - c. Henry Co.; Metal Clad Membrane.
- 2. Thickness: 40 mils minimum.
- 3. Physical and Performance Properties:
 - a. Vapor Permeance: Not more than 0.1 perm, ASTM E 96, Water Method.
 - b. Air Permeance: Not to exceed 0.004 cfm/sq. ft. of surface area at 1.57-lbf/sq. ft. pressure difference; ASTM E 2178.
 - c. Fastener Sealability: No water leaking through fastener penetration after 24 hours; ASTM D 1970.
 - d. Fire Test Performance: Passes NFPA 285, Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components.
- 4. Building Product Disclosure and Optimization, Material Ingredients: Declare product label.

- B. Self-Adhering, Vapor-Permeable Sheet:

- 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Carlisle Fire Resist 705 VP.
 - b. GCP Applied Technologies (formerly W.R. Grace); Perm-A-Barrier VPS.
 - c. Henry Co.; Blueskin VP 160.
- 2. Thickness: 40 mils minimum.
- 3. Physical and Performance Properties:

- a. Fire Test Performance: Passes NFPA 285, Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components.

4. Building Product Disclosure and Optimization, Material Ingredients: Declare product label.

2.2 SELF-ADHERING SHEET MEMBRANE AIR BARRIERS

- A. Self-Adhering, Vapor-Retarding Modified Bituminous Sheet: Rubberized asphalt laminated to cross-laminated polyethylene film with release liner on adhesive side and formulated for application with primer that complies with VOC limits of authorities having jurisdiction.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Carlisle Coatings & Waterproofing; CCW-705.
 - b. GCP Applied Technologies (formerly W.R. Grace); Perm-A-Barrier.
 - c. Henry Co.; Blueskin SA.
 - d. Rubber Polymer Corporation; Rub-R-Wall SA.
 - e. Tremco, Inc.; ExoAir 110.
 - f. W.R. Meadows; SealTight Air-Shield.
2. Thickness: 40 mils minimum.
3. Physical and Performance Properties:
 - a. Membrane Air Permeance: Not to exceed 0.004 cfm/sq. ft. of surface area at 1.57-lbf/sq. ft. pressure difference; ASTM E 2178.
 - b. Tensile Strength: 250 psi minimum; ASTM D 412, Die C, modified.
 - c. Ultimate Elongation: 200 percent minimum; ASTM D 412, Die C, modified.
 - d. Low-Temperature Flexibility: Pass at minus 20 deg F, ASTM D 1970.
 - e. Crack Cycling: Unaffected after 100 cycles of 1/8-inch movement; ASTM C 836.
 - f. Puncture Resistance: 40 lbf minimum; ASTM E 154.
 - g. Water Absorption: 0.15 percent weight-gain maximum after 48-hour immersion at 70 deg F; ASTM D 570.
 - h. Vapor Permeance: 0.05 perms, ASTM E 96, Water Method.
4. Building Product Disclosure and Optimization, Material Ingredients: Declare product label.

- B. Self-Adhering, Vapor-Permeable Sheet:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - a. GCP Applied Technologies (formerly W.R. Grace); Perm-A-Barrier VPS.
 - b. Henry Co.; Blueskin VP 160.
2. Thickness: 23 mils minimum.
3. Physical and Performance Properties:
 - a. Membrane Air Permeance: Not to exceed 0.004 cfm/sq. ft. of surface area at 1.57-lbf/sq. ft. pressure difference; ASTM E 2178.
 - b. Membrane Vapor Permeance: Not less than 10 perms; ASTM E 96.

4. Building Product Disclosure and Optimization, Material Ingredients: Declare product label.

2.3 FLUID-APPLIED MEMBRANE AIR BARRIERS, FIRE-RATED TYPES

- A. Fluid-Applied, Vapor-Retarding Membrane Air Barrier: Elastomeric, modified bituminous, or synthetic polymer membrane.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Carlisle Coatings & Waterproofing; Fire Resist Barritech NP.
 - b. GCP Applied Technologies (formerly W.R. Grace); Perm-A-Barrier NPL 10.
 - c. Henry Co.; Air Bloc 16MR or 17MR.
 - d. Tremco; ExoAir 130.
 - e. W.R. Meadows; Air-Shield LSR.
2. Physical and Performance Properties:
 - a. Vapor Permeance: Not more than 0.1 perm, ASTM E 96, Water Method.
 - b. Air Permeance: Not to exceed 0.004 cfm/sq. ft. of surface area at 1.57-lbf/sq. ft. pressure difference; ASTM E 2178.
 - c. Fastener Sealability: No water leaking through fastener penetration after 24 hours; ASTM D 1970.
 - d. Fire Test Performance: Passes NFPA 285, Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components.

3. Building Product Disclosure and Optimization, Material Ingredients: Declare product label.

- B. Fluid-Applied, Vapor-Permeable Membrane Air Barrier: Elastomeric, modified bituminous, or synthetic polymer membrane.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Carlisle Coatings & Waterproofing; Barritech VP.
 - b. GCP Applied Technologies (formerly W.R. Grace); Perm-A-Barrier VPL.
 - c. Henry Co.; Air Bloc 17MR.
 - d. Tremco; ExoAir 230.
 - e. W.R. Meadows; Air-Shield LMP.
2. Physical and Performance Properties:
 - a. Membrane Air Permeance: Not to exceed 0.004 cfm/ sq. ft. of surface area at 1.57-lbf/sq. ft. pressure difference; ASTM E 2178.
 - b. Membrane Vapor Permeance: Not less than 10 perms; ASTM E 96.
 - c. Fire Test Performance: Passes NFPA 285, Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components.

2.4 FLUID-APPLIED MEMBRANE AIR BARRIERS

A. Fluid-Applied, Vapor-Retarding Membrane Air Barrier: Elastomeric, modified bituminous, or synthetic polymer membrane.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

a. Elastomeric Modified Bituminous Membrane:

- 1) Carlisle Coatings & Waterproofing; Barriseal.
- 2) Henry Co.; Air Bloc 06.
- 3) Tremco Incorporated; ExoAir 120.
- 4) W.R. Meadows; Air-Shield LM.

b. Synthetic Polymer Membrane:

- 1) GCP Applied Technologies (formerly W.R. Grace); Perm-A-Barrier Liquid.
- 2) Henry Co.; Air Bloc 21, 21S, 21FR, or 32MR.
- 3) Rubber Polymer Corporation; Rub-R-Wall Airtight.

2. Physical and Performance Properties:

- a. Membrane Air Permeance: Not to exceed 0.004 cfm x sq. ft. of surface area at 1.57-lbf/sq. ft. pressure difference; ASTM E 2178.
- b. Membrane Vapor Permeance: Not to exceed 0.1 perm; ASTM E 96.

B. Fluid-Applied, Vapor-Permeable Membrane Air Barrier: Elastomeric, modified bituminous or synthetic polymer membrane.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

- a. Carlisle Coatings & Waterproofing; Barritech VP.
- b. GCP Applied Technologies (formerly W.R. Grace); Perm-A-Barrier VP.
- c. Henry Co.; Air Bloc 07, 31MR, or 33MR.

2. Physical and Performance Properties:

- a. Membrane Air Permeance: Not to exceed 0.004 cfm/ sq. ft. of surface area at 1.57-lbf/sq. ft. pressure difference; ASTM E 2178.
- b. Membrane Vapor Permeance: Not less than 10 perms; ASTM E 96.

2.5 AUXILIARY MATERIALS

A. General: Auxiliary materials recommended by air barrier manufacturer for intended use and compatible with air barrier. Liquid-type auxiliary materials shall comply with VOC limits of authorities having jurisdiction.

B. Primer: Liquid waterborne or solvent-borne primer recommended for substrate by manufacturer of air barrier material.

- C. Counterflashing Strip: Modified bituminous 40-mil-thick, self-adhering sheet consisting of 32 mils of rubberized asphalt laminated to an 8-mil-thick, crosslaminated polyethylene film with release liner backing.
- D. Butyl Strip at Termination with EPDM or TPO Roofing Membrane: Vapor-retarding, 30- to 40-mil-thick, self-adhering; polyethylene-film-reinforced top surface laminated to layer of butyl adhesive, with release liner backing.
- E. Modified Bituminous Strip To Cover Cracks and Joints and Terminate Air Barrier to Compatible Roofing Membrane: Vapor-retarding, 40-mil-thick, smooth-surfaced, self-adhering; consisting of 36 mils of rubberized asphalt laminated to a 4-mil- polyethylene film with release liner backing.
- F. Termination Mastic: Cold fluid-applied elastomeric liquid; trowel grade.
- G. Substrate Patching Membrane: Manufacturer's standard trowel-grade substrate filler.
- H. Adhesive and Tape: Air barrier manufacturer's standard adhesive and pressure-sensitive adhesive tape.
- I. Stainless-Steel Sheet: ASTM A 240/A 240M, Type 304, 0.0187 inch thick, and Series 300 stainless-steel fasteners.
- J. Sprayed Polyurethane Foam Sealant to Fill Gaps at Penetrations and Openings: one- or two-component, foamed-in-place, polyurethane foam sealant, 1.5 to 2.0 lb/cu. ft. density; flame spread index of 25 or less according to ASTM E 162; with primer and noncorrosive substrate cleaner recommended by foam sealant manufacturer.
- K. Modified Bituminous Transition Strip to Seal Air Barrier Terminations with Glazing Systems: Vapor-retarding, 40-mil-thick, smooth-surfaced, self-adhering; consisting of 36 mils of rubberized asphalt laminated to a 4-mil-thick polyethylene or aluminum film with release liner backing.
- L. Preformed Silicone-Sealant Extrusion to Seal Air Barrier Terminations with Glazing Systems: Manufacturer's standard system consisting of cured low-modulus silicone extrusion, sized to fit opening widths, with a single-component, neutral-curing, Class 100/50 (low-modulus) silicone sealant for bonding extrusions to substrates.
 - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Dow Corning Corporation; 123 Silicone Seal.
 - b. Elbex Corp: Transition Silicone Sheeting.
 - c. GE Silicone; UltraSpan US1100.
 - d. Tremco; approved equal.
- M. Joint Sealant: ASTM C 920, single-component, neutral-curing silicone; Class 100/50 (low-modulus), Grade NS, Use NT related to exposure, and, as applicable to joint substrates indicated, Use O. Comply with Section 079200 - JOINT SEALANTS.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance.
 - 1. Verify that substrates are sound and free of oil, grease, dirt, excess mortar, or other contaminants.
 - 2. Verify that concrete has cured and aged for minimum time period recommended by air barrier manufacturer.
 - 3. Verify that concrete is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D 4263.
 - 4. Verify that masonry joints are flush and completely filled with mortar.
 - 5. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 SURFACE PREPARATION

- A. Clean, prepare, and treat substrate according to manufacturer's written instructions. Provide clean, dust-free, and dry substrate for air barrier application.
- B. Mask off adjoining surfaces not covered by air barrier to prevent spillage and overspray affecting other construction.
- C. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.
- D. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and other voids in concrete with substrate-patching membrane.
- E. Remove excess mortar from masonry ties, shelf angles, and other obstructions.
- F. Prepare, fill, prime, and treat joints and cracks in substrates. Remove dust and dirt from joints and cracks according to ASTM D 4258.
 - 1. Install modified bituminous strips and center over treated construction and contraction joints and cracks exceeding a width of 1/16 inch.
- G. Bridge and cover isolation joints expansion joints and discontinuous deck-to-wall and deck-to-deck joints with overlapping modified bituminous strips.
- H. At changes in substrate plane, apply sealant or termination mastic beads at sharp corners and edges to form a smooth transition from one plane to another.
- I. Cover gaps in substrate plane and form a smooth transition from one substrate plane to another with stainless-steel sheet mechanically fastened to structural framing to provide continuous support for air barrier.

3.3 JOINT TREATMENT IN PREPARATION FOR INSTALLATION OF FLUID-APPLIED MEMBRANE

- A. Concrete and Masonry: Prepare, treat, rout, and fill joints and cracks in substrate according to ASTM C 1193 and air barrier manufacturer's written instructions. Remove dust and dirt from joints and cracks complying with ASTM D 4258 before coating surfaces.
 - 1. Prime substrate and apply a single thickness of preparation coat strip extending a minimum of 3 inches along each side of joints and cracks. Apply a double thickness of air barrier membrane and embed a joint reinforcing strip in preparation coat.
- B. Gypsum Sheathing: Fill joints greater than 1/4 inch with sealant according to ASTM C 1193 and with air barrier manufacturer's written instructions. Apply first layer of fluid air barrier membrane at joints. Tape joints with joint reinforcing strip after first layer is dry. Apply a second layer of fluid air barrier membrane over joint reinforcing strip.

3.4 TRANSITION STRIP INSTALLATION

- A. Install strips, transition strips, and auxiliary materials according to air barrier manufacturer's written instructions to form a seal with adjacent construction and maintain a continuous air barrier.
 - 1. Coordinate the installation of air barrier with installation of roofing membrane and base flashing to ensure continuity of air barrier with roofing membrane.
 - 2. Install butyl or modified bituminous strip on roofing membrane or base flashing so that a minimum of 3 inches of coverage is achieved over both substrates.
- B. Apply primer to substrates at required rate and allow to dry. Limit priming to areas that will be covered by air barrier sheet in same day. Reprime areas exposed for more than 24 hours.
 - 1. Prime glass-fiber-surfaced gypsum sheathing with number of prime coats needed to achieve required bond, with adequate drying time between coats.
- C. Connect and seal exterior wall air barrier membrane continuously to roofing membrane air barrier, concrete below-grade structures, floor-to floor construction, exterior glazing and window systems, glazed curtain-wall systems, storefront systems, exterior louvers, exterior door framing, and other construction used in exterior wall openings, using accessory materials.
- D. At end of each working day, seal top edge of strips and transition strips to substrate with termination mastic.
- E. Apply joint sealants forming part of air barrier assembly within manufacturer's recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.
- F. Wall Openings: Prime concealed perimeter frame surfaces of windows, curtain walls, storefronts, and doors. Apply transition strip so that a minimum of 3 inches of coverage is achieved over both substrates. Maintain 3 inches of full contact over firm bearing to perimeter frames with not less than 1 inch of full contact.
 - 1. Transition Strip: Roll firmly to enhance adhesion.

2. Elastomeric Flashing Sheet: Apply adhesive to wall, frame, and flashing sheet. Install flashing sheet and termination bars, fastened at 6 inches o.c. Apply lap sealant over exposed edges and on cavity side of flashing sheet.
 3. Preformed Silicone-Sealant Extrusion: Set in full bed of silicone sealant applied to walls, frame, and membrane.
- G. Fill gaps in perimeter frame surfaces of windows, curtain walls, storefronts, and doors, and miscellaneous penetrations of air barrier membrane with foam sealant.
- H. Seal strips and transition strips around masonry reinforcing or ties and penetrations with termination mastic.
- I. Seal top of through-wall flashings to air barrier with an additional 6-inch-wide, modified bituminous strip.
- J. Seal exposed edges of strips at seams, cuts, penetrations, and terminations not concealed by metal counterflashings or ending in reglets with termination mastic.
- K. Repair punctures, voids, and deficient lapped seams in strips and transition strips. Slit and flatten fishmouths and blisters. Patch with transition strips extending 6 inches beyond repaired areas in strip direction.
- 3.5 INSTALLATION OF SELF-ADHERING SHEET MEMBRANE
- A. Install modified bituminous sheets according to air barrier manufacturer's written instructions and according to recommendations in ASTM D 6135.
1. When ambient and substrate temperatures range between 25 and 40 deg F, install self-adhering, modified bituminous air barrier sheets produced for low-temperature application. Do not use low-temperature sheets if ambient or substrate temperature is higher than 60 deg F.
- B. Corners: Prepare, prime, and treat inside and outside corners according to ASTM D 6135.
1. Install modified bituminous strips centered over vertical inside corners. Install 3/4-inch fillets of termination mastic on horizontal inside corners.
- C. Prepare, treat, and seal vertical and horizontal surfaces at terminations and penetrations with termination mastic and according to ASTM D 6135.
- D. Apply primer to substrates at required rate and allow to dry. Limit priming to areas that will be covered by air barrier sheet in same day. Reprime areas exposed for more than 24 hours.
1. Prime glass-fiber-surfaced gypsum sheathing with number of prime coats needed to achieve required bond, with adequate drying time between coats.
- E. Apply and firmly adhere modified bituminous sheets horizontally or vertically over area to receive air barrier sheets. Accurately align sheets and maintain a uniform 2-1/2-inch-minimum lap widths and end laps. Overlap and seal seams and stagger end laps to ensure airtight installation.

1. Apply sheets in a shingled manner to shed water without interception by any exposed sheet edges.
 2. Roll sheets firmly to enhance adhesion to substrate.
 3. Apply termination mastic on any horizontal, field-cut or non-factory edges.
- F. Apply continuous modified bituminous sheets over modified bituminous strips bridging substrate cracks, construction, and contraction joints.
- G. Seal top of non-metallic through-wall flashings to air barrier sheet with an additional 6-inch- wide strip.
- H. Seal exposed edges of metallic sheets at seams, cuts, penetrations, and terminations not concealed by metal counterflashings or ending in reglets with termination mastic.
- I. Install air barrier sheets and auxiliary materials to form a seal with adjacent construction and to maintain a continuous air barrier.
1. Coordinate the installation of air barrier with installation of roofing membrane and base flashing to ensure continuity of air barrier with roofing membrane.
 2. Install compatible strip on roofing membrane or base flashing so that a minimum of 3 inches of coverage is achieved over both substrates.
- J. Connect and seal exterior wall air barrier membrane continuously to roofing membrane air barrier, concrete below-grade structures, floor-to floor construction, exterior glazing and window systems, glazed curtain-wall systems, storefront systems, exterior louvers, exterior door framing, and other construction used in exterior wall openings using accessory materials.
- K. Wall Openings: Prime concealed perimeter frame surfaces of windows, curtain walls, storefronts, and doors. Apply membrane specified below so that a minimum of 3 inches of coverage is achieved over both substrates. Maintain 3 inches of full contact over firm bearing to perimeter frames with not less than 1 inch of full contact.
1. Modified Bituminous Transition Strip: Roll firmly to enhance adhesion.
 2. Elastomeric Flashing Sheet: Apply adhesive to wall, frame, and flashing sheet. Install flashing sheet and termination bars, fastened at 6 inches o.c. Apply lap sealant over exposed edges and on cavity side of flashing sheet.
 3. Preformed Silicone-Sealant Extrusion: Set in full bed of silicone sealant applied to walls, frame, and membrane.
- L. Fill gaps in perimeter frame surfaces of windows, curtain walls, storefronts, doors, and miscellaneous penetrations of air barrier membrane with foam sealant.
- M. At end or each working day, seal top edge of membrane to substrate with termination mastic.
- N. Apply joint sealants forming part of air barrier assembly within manufacturer's recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.
- O. Repair punctures, voids, and deficient lapped seams in air barrier. Slit and flatten fishmouths and blisters. Patch with air barrier sheet extending 6 inches beyond repaired areas in all directions.

- P. Do not cover air barrier until it has been tested and inspected by Owner's testing agency.
- Q. Correct deficiencies in or remove air barrier that does not comply with requirements; repair substrates and reapply air barrier components.

3.6 INSTALLATION OF FLUID-APPLIED MEMBRANE AIR BARRIER

- A. Apply air barrier membrane to form a seal with strips and transition strips and to achieve a continuous air barrier according to air barrier manufacturer's written instructions.
- B. Apply air barrier membrane within manufacturer's recommended application temperature ranges.
- C. Apply primer to substrates at required rate and allow to dry. Limit priming to areas that will be covered by air barrier sheet in same day. Reprime areas exposed for more than 24 hours.
 - 1. Prime glass-fiber-surfaced gypsum sheathing with number of prime coats needed to achieve required bond, with adequate drying time between coats.
- D. Apply a continuous unbroken air barrier to substrates according to the following minimum thickness. Apply membrane in full contact around protrusions such as masonry ties.
 - 1. Vapor-Retarding Membrane Air Barrier: 60-mil dry film thickness.
 - 2. Vapor-Permeable Membrane Air Barrier: 120-mil wet film thickness.
- E. Apply strip and transition strip a minimum of 1 inch onto cured air membrane or strip and transition strip over cured air membrane overlapping 3 inches onto each surface according to air barrier manufacturer's written instructions.
- F. Do not cover air barrier until it has been tested and inspected by Owner's testing agency.
- G. Correct deficiencies in or remove air barrier that does not comply with requirements; repair substrates and reapply air barrier components.

3.7 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections and prepare test reports.
- B. Inspections: Air barrier materials and installation are subject to inspection for compliance with requirements. Inspections may include the following:
 - 1. Continuity of air barrier system has been achieved throughout the building envelope with no gaps or holes.
 - 2. Continuous structural support of air barrier system has been provided.
 - 3. Masonry and concrete surfaces are smooth, clean, and free of cavities, protrusions, and mortar droppings.
 - 4. Site conditions for application temperature and dryness of substrates have been maintained.
 - 5. Maximum exposure time of materials to UV deterioration has not been exceeded.
 - 6. Surfaces have been primed.

7. Laps in sheet materials have complied with the minimum requirements and have been shingled in the correct direction (or mastic applied on exposed edges), with no fishmouths.
8. Termination mastic has been applied on cut edges.
9. Air barrier has been firmly adhered to substrate.
10. Compatible materials have been used.
11. Transitions at changes in direction and structural support at gaps have been provided.
12. Connections between assemblies (membrane and sealants) have complied with requirements for cleanliness, preparation, and priming of surfaces, structural support, integrity, and continuity of seal.
13. All penetrations have been sealed.

C. Tests:

1. Qualitative Testing: Air barrier assemblies will be tested for evidence of air leakage according to ASTM E 1186.
2. Quantitative Air Leakage Testing: Testing not to exceed the test pressure differential, positive and negative, indicated in "Performance Requirements" Article for air barrier assembly air leakage according to ASTM E 783.

D. Remove and replace deficient air barrier components and retest as specified above.

3.8 CLEANING AND PROTECTION

- A. Protect air barrier system from damage during application and remainder of construction period, according to manufacturer's written instructions.
1. Protect air barrier from exposure to UV light and harmful weather exposure as required by manufacturer. Remove and replace air barrier exposed to these conditions for more than 30 days.
 2. Protect air barrier from contact with creosote, uncured coal-tar products, TPO, EPDM, flexible PVC membranes, and sealants not approved by air barrier manufacturer.
- B. Clean spills, stains, and soiling from adjacent construction that would be exposed in the completed work using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION

SECTION 074200

METAL WALL PANELS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Metal-faced composite wall panels and attachment systems.
- B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council. Refer to Section 018110, SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 054000 - COLD-FORMED METAL FRAMING for secondary support framing supporting metal wall panels.
 - 2. Section 072100 - THERMAL INSULATION for insulation behind metal wall panels.
 - 3. Section 077700 - WALL CLADDING SUPPORT SYSTEM.
 - 4. Section 076200 - SHEET METAL FLASHING AND TRIM for copings, flashings, and other sheet metal work not part of metal wall panel assemblies.
 - 5. Section 079200 - JOINT SEALANTS for field-applied sealants not otherwise specified in this Section.

1.3 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design metal wall panel assembly, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. General: Provide metal wall panel assemblies that comply with performance requirements specified as determined by testing manufacturers' standard assemblies similar to those indicated for this Project, by a qualified testing and inspecting agency.
- C. Structural Performance: Provide metal wall panel assemblies capable of withstanding the effects of gravity loads and loads and stresses within limits and under conditions indicated, based on testing according to ASTM E 1592 and ASTM E 330 as applicable.

1. Wind Loads: As required by Code.
 2. Deflection Limits: Engineer metal wall panel assemblies to withstand test pressures with deflection no greater than 1/180 of the span and no evidence of material failure, structural distress, or permanent deformation exceeding 0.2 percent of the clear span, at code required loading.
- D. Fire Test Performance: Passes NFPA 285, Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components.
- E. Thermal Movements for Metal Wall Panels: Provide wall panel assemblies that allow for noiseless thermal movements resulting from the following range in ambient temperatures and that prevent buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects:
1. Ambient Temperature Range: Minus 20 to plus 180 deg F.
- F. Seismic Performance: Metal wall panels shall withstand the effects of earthquake motions determined according to Code.
1. Component Importance Factor: 1.0 [1.5].
- 1.4 SUBMITTALS
- A. Product Data: For each type of product.
1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of panel and accessory.
- B. LEED Submittal:
1. Building Product Disclosure and Optimization, Environmental Product Declarations (EPD):
 - a. Option 1: For composite metal panel, submit industry-wide (generic) EPDs or product specific Type III EPDs.
 2. Building Product Disclosure and Optimization, Material Ingredients:
 - a. Option 1, Material Ingredient Reporting: For factory-applied metal finishes, submit Declare product labels.
- C. Shop Drawings: Show fabrication and installation layouts of metal wall panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details. Distinguish between factory- and field-assembled work.
1. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer licensed in the Commonwealth of Massachusetts responsible for their preparation. All costs for professional engineering shall be included in the bid price for the Work of this Section.

- D. Delegated-Design Submittal: For metal wall panel assembly indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- E. Exterior Wall Certification: Submit manufacturer's certification that exterior wall panels, as designed in the assemblies indicated on the Drawings, has been tested to meet the requirements of NFPA 285 and passed.
- F. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below.
 - 1. Metal Panels: 12 inches long by actual panel width. Include fasteners, closures, and other metal wall panel accessories. Include 4-way joint for panels.
 - 2. Exposed Sealants: For each type and color of joint sealant required. Install joint sealants in 1/2-inch-wide joints formed between two 6-inch-long strips of material matching the appearance of metal wall panels adjacent to joint sealants.
- G. Qualifications: Qualifications of professional engineer and qualifications of installer as specified.

1.5 QUALITY ASSURANCE

- A. Engineering Responsibility: Preparation of Shop Drawings, design calculations, and other structural data by a qualified professional engineer.
- B. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in the state the project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of panels that are similar to those indicated for this Project in material, design, and extent.
- C. Installer Qualifications: An employer of workers trained and approved by manufacturer.
 - 1. Installer's responsibilities include fabricating and installing metal wall panel assemblies and providing professional engineering services needed to assume engineering responsibility.
- D. Fabricator Qualifications: Certified by metal wall panel manufacturer to fabricate and install manufacturer's wall panel system.
- E. Source Limitations: Obtain each type of metal wall panel through one source from a single manufacturer.
- F. Fire Test Performance for Exterior Wall: Passes NFPA 285, Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components.
- G. Preconstruction Compatibility and Adhesion Testing: Submit to joint-sealant manufacturers, for testing indicated below, samples of materials that will contact or affect joint sealants.
 - 1. Use manufacturer's standard test methods to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.

- H. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01. Review methods and procedures related to metal wall panel assemblies including, but not limited to, the following:
 - 1. Meet with The Owner, Architect, Owner's insurer if applicable, testing and inspecting agency representative, metal wall panel Installer, metal wall panel manufacturer's representative, structural-support Installer, and installers whose work interfaces with or affects metal wall panels including installers of doors, windows, and louvers.
 - 2. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - 3. Review methods and procedures related to metal wall panel installation, including manufacturer's written instructions.
 - 4. Examine support conditions for compliance with requirements, including alignment between and attachment to structural members.
 - 5. Review flashings, special siding details, wall penetrations, openings, and condition of other construction that will affect metal wall panels.
 - 6. Review governing regulations and requirements for insurance, certificates, and testing and inspecting if applicable.
 - 7. Review temporary protection requirements for metal wall panel assembly during and after installation.
 - 8. Review wall panel observation and repair procedures after metal wall panel installation.
 - 9. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.
- I. Mockups: Provide mock-ups as specified in Section 014330 - MOCK-UPS, coordinate with other trades as required.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver components, sheets, metal wall panels, and other manufactured items so as not to be damaged or deformed. Package metal wall panels for protection during transportation and handling.
- B. Unload, store, and erect metal wall panels in a manner to prevent bending, warping, twisting, and surface damage.
- C. Stack metal wall panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal wall panels to ensure dryness, with positive slope for drainage of water. Do not store metal wall panels in contact with other materials that might cause staining, denting, or other surface damage.
- D. Store metal-faced composite wall panels vertically, covered with suitable weathertight and ventilated covering. Store metal-faced composite wall panels to ensure dryness, with positive slope for drainage of water. Do not store metal-faced composite wall panels in contact with other materials that might cause staining, denting, or other surface damage. Do not allow storage space to exceed 120 deg F.
- E. Protect strippable protective covering on metal wall panels from exposure to sunlight and high humidity, except to extent necessary for period of metal wall panel installation.

1.7 PROJECT CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal wall panels to be performed according to manufacturers' written instructions and warranty requirements.
- B. Field Measurements: Verify locations of structural members and wall opening dimensions by field measurements before metal wall panel fabrication and indicate measurements on Shop Drawings.
 - 1. Established Dimensions: Where field measurements cannot be made without delaying the Work, either establish framing and opening dimensions and proceed with fabricating metal wall panels without field measurements, or allow for field trimming of panels. Coordinate wall construction to ensure that actual building dimensions, locations of structural members, and openings correspond to established dimensions.

1.8 COORDINATION

- A. Coordinate metal wall panel assemblies with rain drainage work, flashing, trim, and construction of girts, studs, soffits, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.9 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal wall panel assemblies that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures, including rupturing, cracking, or puncturing.
 - b. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 - 2. Warranty Period: Two years from date of Substantial Completion.
- B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal wall panels 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: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 METAL-FACED COMPOSITE WALL PANELS

- A. General: Provide factory-formed and -assembled metal-faced composite wall panels fabricated from two metal facings bonded, using no glues or adhesives, to solid extruded thermoplastic core; formed into profile for installation method indicated. Include attachment system components and accessories required for weathertight system.
- B. Aluminum Composite Material Panels: Formed with 0.020-inch- (0.50-mm-) thick, aluminum sheet facings.
 - 1. Acceptable Products: Subject to compliance with requirements, provide one of the following products:
 - a. 3A Composites USA, Inc.; Alucobond Plus (Basis of Design, product specific Type III EPD).
 - b. Arconic, Inc.; Reynobond FR.
 - c. Alpolic Materials, a division of Mitsubishi; Alpolic/pe Alpolic/fr.
 - d. Alucoil North America; Alucoil FR.
 - e. Firestone Building Products, LLC; UNA-FAB Series 1500, with fire-rated core.
 - 2. Panel Thickness: 0.157 inch (4 mm).
 - 3. Building Product Disclosure and Optimization, Environmental Product Declarations (EPD): Type III EPD.
 - 4. Fire-Retardant Core: Noncombustible, with the following surface burning characteristics as determined by testing identical products per ASTM E 84 by UL or another testing and inspection agency acceptable to authorities having jurisdiction.
 - a. Flame-Spread Index: 25 or less.
 - b. Smoke- Development Index: 450 or less.
- C. Attachment Assembly Components: Formed from extruded aluminum.
 - 1. Include manufacturer's standard perimeter extrusions, panel stiffeners, panel clips and anchor channels.
- D. Attachment Assembly: Manufacturer's standard rainscreen system.

2.2 ACCESSORIES

- A. Wall Panel Accessories: Provide components required for a complete metal wall panel assembly including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal wall panels, unless otherwise indicated.
- B. Trim: Formed from 0.0179-inch-thick, zinc-coated (galvanized) steel sheet or aluminum-zinc alloy-coated steel sheet prepainted with coil coating. Provide flashing and trim as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, bases, drips, sills, jambs, corners, endwalls, framed openings, rakes, fasciae, parapet caps, soffits, reveals, and fillers. Finish flashing and trim with same finish system as adjacent metal wall panels.

2.3 METAL FRAMING

- A. Steel Sheet Components, General: Complying with ASTM C 645 requirements for metal and with ASTM A 653, G60, hot-dip galvanized zinc coating.
- B. Z-Shaped Furring: With slotted or nonslotted web, face flange of 1-1/4 inches wall attachment flange of 7/8 inch, minimum bare metal thickness of 0.0179 inch and depth required to fit insulation thickness indicated.
- C. Rainscreen System: Provide system that has been tested in accordance with AAMA 508 (Pressure Equalized Rain Screen Wall Cladding Test) – Standard Test Method for Water Penetration of Exterior Vented Rainscreen Panel System. The test requires a minimum airflow of 1 CFM / SF of weather wall area through the vented rainscreen system to replicate severe storm and imperfection in air/vapor barrier system. While maintaining 1 CFM/SF airflow, the system must be able to pressure equalize and sustain zero pressure difference between the interior and exterior wall cavity without any water penetration.
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Universe Systems, Division of Universe Corporation.
 - b. LYMO Architectural Panel Systems Inc.
 - c. POHL Inc. of America.
 - d. Centria Architectural Systems.
 - e. Metal Sales & Service, Inc.
 - 2. Rout and return wall panel system with dry joints for rainscreen assembly; as approved by the Architect.
- D. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

2.4 FABRICATION

- A. General: Fabricate and finish metal wall panels and accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.
 - 1. Form panel lines, breaks, and angles to be sharp and true, with surfaces free from warp and buckle.
 - 2. Fabricate wall panels with panel stiffeners as required to maintain fabrication tolerances and to withstand design loads.
- B. Metal-Faced Composite Wall Panels: Factory form panels. Trim and square edges of sheets with no displacement of face sheets or protrusion of core material.
 - 1. Fabricate panels with panel stiffeners, as required to comply with deflection limits, attached to back of panels with structural silicone sealant or bond tape.
 - 2. Fabricate panels with sharply cut edges, with no displacement of face sheets or protrusion of core material.

3. Dimensional Tolerances:

- a. Length: Plus 0.125 inch.
- b. Width: Plus 0.188 inch.
- c. Thickness: Plus or minus 0.008 inch.
- d. Panel Bow: 0.8 percent maximum of panel length or width.
- e. Squareness: 0.2 inch maximum.
- f. Surfaces: Free from warp or buckle with no rises and falls across the panel (local pumps and depressions) and maximum 0.062 inch (1.6 mm) bow or warp in concave or convex direction, measured perpendicular to normal plane.

C. Sheet Metal Accessories: Fabricate trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to the design, dimensions, metal, and other characteristics of item indicated.

- 1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
- 2. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
- 3. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
- 4. Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant to comply with SMACNA standards.
- 5. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
- 6. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended by metal wall panel manufacturer.
 - a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal wall panel manufacturer for application but not less than thickness of metal being secured.

2.5 FINISHES, GENERAL

- 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: 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.
- D. High-Performance Organic Finish (2-Coat Fluoropolymer): AA-C12C40R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: conversion coating; Organic Coating: manufacturer's standard 2-coat, thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color coat, with color coat 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. Available Products: Sherwin-Williams Coil Coatings; Valspar Fluoropon Pure; or approved equal.
2. Building Product Disclosure and Optimization, Material Ingredients: Declare product label.
3. Non-metallic Color and Gloss: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal wall panel supports, and other conditions affecting performance of work.
 1. Examine primary and secondary wall framing to verify that girts, angles, channels, studs, and other structural panel support members and anchorage have been installed within alignment tolerances required by metal wall panel manufacturer.
 2. Examine solid wall sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal wall panel manufacturer.
 3. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.
- B. Examine roughing-in for components and systems penetrating metal wall panels to verify actual locations of penetrations relative to seam locations of metal wall panels before metal wall panel installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean substrates of substances harmful to insulation, including removing projections capable of interfering with insulation attachment.
- B. Miscellaneous Framing: Install subgirts, base angles, sills, furring, and other miscellaneous wall panel support members and anchorage according to ASTM C 754 and metal wall panel manufacturer's written recommendations.

3.3 METAL WALL PANEL INSTALLATION, GENERAL

- A. General: Install metal wall panels in orientation, sizes, and locations indicated on Drawings. Install panels perpendicular to girts and subgirts, unless otherwise indicated. Anchor metal wall panels and other components of the Work securely in place, with provisions for thermal and structural movement.
 1. Field cutting of metal wall panels by torch is not permitted.
 2. Shim or otherwise plumb substrates receiving metal wall panels.

3. Rigidly fasten base end of metal wall panels and allow eave end free movement due to thermal expansion and contraction. Predrill panels.
 4. Flash and seal metal wall panels with weather closures at eaves, rakes, and at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until weather barrier and flashings that will be concealed by metal wall panels are installed.
 5. Install screw fasteners in predrilled holes.
 6. Locate and space fastenings in uniform vertical and horizontal alignment.
 7. Install flashing and trim as metal wall panel work proceeds.
 8. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
 9. Apply elastomeric sealant continuously between metal base channel (sill angle) and concrete, and elsewhere as indicated or, if not indicated, as necessary for waterproofing.
 10. Align bottom of metal wall panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.
 11. Provide weatherproof escutcheons for pipe and conduit penetrating exterior walls.
- B. Fasteners, Aluminum Panels: Use aluminum or stainless-steel fasteners for surfaces exposed to the exterior and aluminum or galvanized steel fasteners for surfaces exposed to the interior.
- C. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating, by applying rubberized-asphalt underlayment to each contact surface, or by other permanent separation as recommended by metal wall panel manufacturer.

3.4 WALL PANEL INSTALLATION

- A. General: Install attachment system required to support wall panels and to provide a complete weathertight wall system, including subgirts, perimeter extrusions, tracks, drainage channels, panel clips, and anchor channels.
1. Include attachment to supports, panel-to-panel joinery, panel-to-dissimilar-material joinery, and panel-system joint seals.
 2. Do not begin installation until weather barrier and flashings that will be concealed by metal panels are installed.
- B. Track-Support Installation: Provide manufacturer's standard horizontal and vertical tracks that provide support and complete secondary drainage system, draining to the exterior at horizontal joints. Install support system at locations, spacings, and with fasteners recommended by manufacturer. Attach panels to wall by interlocking tracks with perimeter extrusions attached to wall panels. Fully engage integral gaskets and leave horizontal and vertical joints with open reveal.
1. Attach routed-and-turned flanges of wall panels to perimeter extrusions with manufacturer's standard fasteners.

3.5 ACCESSORY INSTALLATION

- A. General: Install accessories with positive anchorage to building and weathertight mounting and provide for thermal expansion. Coordinate installation with flashings and other components.

1. Install components required for a complete metal wall panel assembly including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.
- B. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.
 1. Install exposed flashing and trim that is without excessive oil canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof and weather-resistant performance.
 2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped or bayonet-type expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).

3.6 ERECTION TOLERANCES

- A. Installation Tolerances: Shim and align metal wall panel units within installed tolerance of 1/4 inch in 20 feet nonaccumulative, on level, plumb, and location lines as indicated and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

3.7 CLEANING AND PROTECTION

- A. Remove temporary protective coverings and strippable films, if any, as metal wall panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal wall panel installation, clean finished surfaces as recommended by metal wall panel manufacturer. Maintain in a clean condition during construction.
- B. After metal wall panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.
- C. Replace metal wall panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

SECTION 075019

PREPARATION FOR REROOFING

(Part of Work of Section 070002 - ROOFING AND FLASHING, Filed Sub-Bid Required)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Roof tear-off.
 - 2. Partial roof tear-off.
 - 3. Temporary roofing membrane.
 - 4. Roof re-cover preparation.
 - 5. Removal of base flashings.
- B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council. Refer to Section 018110, SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.
- C. Related Work: The following items are not included in this Section and will be performed under the designated Sections:
 - 1. Section 061000 - ROUGH CARPENTRY for blocking, cants, nailers and miscellaneous wood materials.
 - 2. Section 075100 – COLD-PROCESS BUILT-UP ROOFING for new roofing materials.
 - 3. Section 076200 - SHEET METAL FLASHING AND TRIM for new flashing materials.
 - 4. Section 230001 - HEATING, VENTILATING, AND AIR CONDITIONING for HVAC equipment removal and reinstallation.
 - 5. Section 260001 - ELECTRICAL for electrical equipment disconnection and reconnection.

1.3 MATERIALS OWNERSHIP

- A. Except for items or materials indicated to be reused, reinstalled, or otherwise indicated to remain Owner's property, demolished materials shall become Contractor's property and shall be removed from Project site.

1.4 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. Existing Membrane Roofing System: Roofing membrane, roof insulation, surfacing, and components and accessories between deck and top surface of roofing system.
- C. Roof Re-Cover Preparation: Existing roofing membrane that is to remain and be prepared for reuse.
- D. Roof Tear-Off: Removal of existing membrane roofing system from deck.
- E. Partial Roof Tear-Off: Removal of a portion of existing membrane roofing system from deck or removal of selected components and accessories from existing membrane roofing system.
- F. Remove: Detach items from existing construction and legally dispose of them off-site unless indicated to be removed and reinstalled.
- G. Existing to Remain: Existing items of construction that are not indicated to be removed.

1.5 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Temporary Roofing: Include Product Data and description of temporary roofing system. If temporary roof will remain in place, submit surface preparation requirements needed to receive permanent roof, and submit a letter from roofing membrane manufacturer stating acceptance of the temporary membrane and that its inclusion will not adversely affect the roofing system's resistance to fire and wind.
- C. Fastener pull-out test report.
- D. Photographs or Videotape: Show existing conditions of adjoining construction and site improvements, including exterior and interior finish surfaces, that might be misconstrued as having been damaged by reroofing operations. Submit before Work begins.
- E. Qualification Data: For Installer.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: Installer of new membrane roofing system [approved by warrantor of existing roofing system to work on existing roofing].
- B. Regulatory Requirements: Comply with governing EPA notification regulations before beginning membrane roofing removal. Comply with hauling and disposal regulations of authorities having jurisdiction.
- C. Reroofing Conference: Conduct conference at Project site. Comply with requirements in Division 01. Review methods and procedures related to roofing system including, but not limited to, the following:

1. Meet with the Owner, Architect, the Owner's insurer if applicable, testing and inspecting agency representative, roofing Installer, roofing system manufacturer's representative, deck Installer, and installers whose work interfaces with or affects reroofing including installers of roof accessories and roof-mounted equipment.
2. Review methods and procedures related to roofing system tear-off and replacement, including manufacturer's written instructions.
3. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
4. Examine existing roof drains and roof drainage during each stage of reroofing, and roof drain plugging and plug removal requirements.
5. Examine existing deck substrate conditions and base flashing substrate for reuse.
6. Review existing deck removal procedures and Owner notifications.
7. Review structural loading limitations of roof deck during reroofing.
8. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect reroofing.
9. Review HVAC shutdown and sealing of air intakes.
10. Review shutdown of fire-suppression, -protection, and -alarm and -detection systems.
11. Review procedures for asbestos removal and discovery of asbestos-containing materials.
12. Review existing conditions that may require notification of Architect before proceeding.
13. Review governing regulations and requirements for insurance and certificates if applicable.
14. Review temporary protection requirements for existing roofing system that is to remain during and after installation.

1.7 PROJECT CONDITIONS

- A. Owner will occupy portions of building immediately below reroofing area. Conduct reroofing so Owner's operations will not be disrupted. Provide Owner with not less than 72 hours' notice of activities that may affect Owner's operations.
 1. Provide temporary protection, including dust and noise control, of existing building affected by reroofing procedures.
 2. Coordinate work activities daily with Owner so Owner can place additional protective dust or water leakage covers over sensitive equipment or furnishings, shut down HVAC and fire-alarm or -detection equipment if needed, and evacuate occupants from below the work area.
 3. Before working over structurally impaired areas of deck, notify Owner to evacuate occupants from below the affected area. Verify that occupants below the work area have been evacuated before proceeding with work over the impaired deck area.
- B. Protect building to be reroofed, adjacent buildings, walkways, site improvements, exterior plantings, and landscaping from damage or soiling from reroofing operations.
- C. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities.
- D. Conditions existing at time of inspection for bidding will be maintained by Owner as far as practical.
- E. 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.

- F. Hazardous Materials: It is not expected that hazardous materials such as asbestos-containing materials will be encountered in the Work.
 - 1. Hazardous materials will be removed by Owner before start of the Work. Existing roof will be left no less watertight than before removal.
 - 2. If materials suspected of containing hazardous materials are encountered, do not disturb; immediately notify Architect. Hazardous materials will be removed by Owner under a separate contract.

1.8 WARRANTY

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

PART 2 - PRODUCTS

2.1 INFILL MATERIALS

- A. Use infill materials matching existing membrane roofing system materials unless otherwise indicated. Infill materials are specified in the following Sections:
 - 1. Section 075100 – COLD-PROCESS BUILT-UP ROOFING.

2.2 TEMPORARY ROOFING MATERIALS

- A. Design and selection of materials for temporary roofing are responsibilities of Contractor.

2.3 RECOVER BOARDS

- A. Recover Board: ASTM C 1177/C 1177M, glass-mat, water-resistant gypsum substrate, 1/2 inch thick.
- B. Fasteners: Factory-coated steel fasteners and metal or plastic plates listed in FM Approval's "Approval Guide," designed for fastening recover boards to deck.

2.4 AUXILIARY REROOFING MATERIALS

- A. General: Auxiliary reroofing preparation materials recommended by roofing system manufacturer for intended use and compatible with components of [existing and] new membrane roofing system.
- B. Base Sheet Fasteners: Capped head, factory-coated steel fasteners, listed in FM Approval's "Approval Guide."
- C. Metal Flashing Sheet: Metal flashing sheet is specified in Section 076200 - SHEET METAL FLASHING AND TRIM.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Protect existing membrane roofing system that is indicated not to be reroofed.
- B. Coordinate with Owner to shut down air-intake equipment in the vicinity of the Work. Cover air-intake louvers before proceeding with reroofing work that could affect indoor air quality or activate smoke detectors in the ductwork.
 - 1. If necessary to deactivate all or a portion of fire-detection system, provide a fire watch during work and for 2 hours after restart of fire-detection system.
- C. During removal operations, have sufficient and suitable materials on-site to facilitate rapid installation of temporary protection in the event of unexpected rain.
- D. Maintain roof drains in functioning condition to ensure roof drainage at end of each workday. Prevent debris from entering or blocking roof drains and conductors. Use roof-drain plugs specifically designed for this purpose. Remove roof-drain plugs at end of each workday, when no work is taking place, or when rain is forecast.
 - 1. If roof drains are temporarily blocked or unserviceable due to roofing system removal or partial installation of new membrane roofing system, provide alternative drainage method to remove water and eliminate ponding. Do not permit water to enter into or under existing membrane roofing system components that are to remain.
- E. Verify that rooftop utilities and service piping have been shut off before beginning the Work.

3.2 ROOF TEAR-OFF

- A. General: Notify the Architect and Owner each day of extent of roof tear-off proposed for that day and obtain authorization to proceed.
- B. Remove aggregate, pavers and accessories from roofing membrane.
 - 1. Store and protect pavers and accessories for reuse. Discard cracked pavers.
- C. Roof Tear-Off: Remove existing roofing membrane and other membrane roofing system components down to the deck.
- D. Partial Roof Tear-Off: Remove existing roofing membrane and immediately check for presence of moisture by visually observing boards and roof insulation that will remain.
 - 1. Coordinate with Owner's inspector to schedule times for tests and inspections immediately after membrane removal.
 - 2. Remove wet or damp boards and roof insulation. Removal will be paid for by adjusting the Contract Sum according to unit prices included in the Contract Documents.

3.3 DECK PREPARATION

- A. Inspect deck after tear-off of membrane roofing system.

- B. Concrete Deck: Verify that concrete substrate is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D 4263 or by pouring 1 pint of hot roofing asphalt on deck at start of each day's work and at start of each roof area or plane. Do not proceed with roofing work if moisture condenses under the plastic sheet or if asphalt test sample foams or can be easily and cleanly stripped after cooling.
- C. If deck surface is not suitable for receiving new roofing or if structural integrity of deck is suspect, immediately notify Architect. Do not proceed with installation until directed by Architect.
- D. Replace deck as indicated on Drawings. Replacement deck is specified in the following Sections:
 - 1. Section 033000 - CAST-IN-PLACE CONCRETE.
 - 2. Section 053100 - STEEL DECKING.

3.4 INFILL MATERIALS INSTALLATION

- A. Immediately after removal of selected portions of existing membrane roofing system, and inspection and repair, if needed, of deck, fill in the tear-off areas to match existing membrane roofing system construction.
 - 1. Installation of infill materials is specified in Division 07 Section as indicated in Part 2.
 - 2. Install new roofing membrane patch over roof infill area. If new roofing membrane is installed the same day tear-off is made, roofing membrane patch is not required.

3.5 TEMPORARY ROOFING MEMBRANE

- A. Install approved temporary roofing membrane over area to be reroofed.
- B. Remove temporary roofing membrane before installing new roofing membrane.

3.6 EXISTING BASE FLASHINGS

- A. Remove existing base flashings around parapets, curbs, walls, and penetrations.
 - 1. Clean substrates of contaminants such as asphalt, sheet materials, dirt, and debris.
- B. Do not damage metal counterflashings that are to remain. Replace metal counterflashings damaged during removal with counterflashings specified in Section 076200 - SHEET METAL FLASHING AND TRIM.

3.7 FASTENER PULL-OUT TESTING

- A. Retain independent testing and inspecting agency to conduct fastener pull-out tests according to SPRI FX-1, and submit test report to Owner, Architect, and roofing membrane manufacturer before installing new membrane roofing system.
 - 1. Obtain Owner, Architect, and roofing membrane manufacturer's approval to proceed with specified fastening pattern. Roofing membrane manufacturer may furnish revised fastening pattern commensurate with pull-out test results.

3.8 RECOVER BOARD INSTALLATION

- A. Install recover boards over [roof insulation] [roofing membrane] with long joints in continuous straight lines and end joints staggered between rows. Loosely butt recover boards together and fasten to deck.
 - 1. Tape joints of recover boards if required by roofing membrane manufacturer.
 - 2. Fasten recover boards to resist wind-uplift pressure at corners, perimeter, and field of roof specified in Division 07 Section as indicated in Part 2.
 - 3. Install additional fasteners near board corners and edges as necessary to conform boards to substrate and to adjacent boards.

3.9 DISPOSAL

- A. Collect demolished materials and place in containers. Promptly dispose of demolished materials. Do not allow demolished materials to accumulate on-site.
 - 1. 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

SECTION 075300

EPDM ROOFING

(Part of Work of Section 070002 - Roofing and Flashing, Filed Sub-Bid Required)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Adhered membrane roofing system.
 - 2. Cover board.
 - 3. Roof insulation.
 - 4. Substrate Board (thermal barrier).
 - 5. Vapor retarder.
 - 6. Flashing for equipment mounted on roofing and roofing penetrations.
- B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council. Refer to Section 018110, SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.
- C. Items To Be Installed Only: Install the following items as furnished by the designated Sections:
 - 1. Section 220001 - PLUMBING:
 - a. Roof drains.
 - 2. Section 230001 - HEATING, VENTILATING, AND AIR CONDITIONING:
 - a. Roof curbs for HVAC equipment.
- D. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 061000 - ROUGH CARPENTRY for wood nailers, curbs, and blocking.
 - 2. Section 076200 - SHEET METAL FLASHING AND TRIM for metal roof penetration flashings, flashings, and counterflashings.
 - 3. Section 079200 - JOINT SEALANTS for sealants.
 - 4. Division 22 - PLUMBING for roof drains.

5. Division 23 - HEATING, VENTILATING, AND AIR CONDITIONING for roof curbs for HVAC equipment.

1.3 DEFINITIONS

- A. Roofing Terminology: Refer to ASTM D 1079 and glossary of NRCA's "The NRCA Roofing and Waterproofing Manual" for definition of terms related to roofing work in this Section.

1.4 PERFORMANCE REQUIREMENTS

- A. General: Provide installed roofing membrane and base flashings that remain watertight; do not permit the passage of water; and resist specified uplift pressures, thermally induced movement, and exposure to weather without failure.
1. Accelerated Weathering: Roofing system shall withstand 2000 hours of exposure when tested according to ASTM G 152, ASTM G 154, or ASTM G 155.
 2. Impact Resistance: Roofing system shall resist impact damage when tested according to ASTM D 3746 or ASTM D 4272.
- B. Material Compatibility: Provide roofing materials that are compatible with one another under conditions of service and application required, as demonstrated by roofing manufacturer based on testing and field experience.
- C. Roofing System Design: Roofing system shall be designed to withstand loads indicated on Drawings, but not less than loads required by Code.
- D. FM Global Listing: Roofing, base flashings, and component materials shall comply with requirements in FM Global 4450 or FM Global 4470 as part of a roofing system, and shall be listed in FM Global's "RoofNav" for Class 1 or noncombustible construction, as applicable. Identify materials with FM Global markings.
1. Fire/Windstorm Classification: Class 1A-90 [Class 1A-60] [Class 1A-75] [Class 1A-105] [Class 1A-120] <Insert class>.
 2. Hail-Resistance Rating: MH [SH].
- E. Flashings: Provide base flashings, perimeter flashings, detail flashings and component materials that comply with requirements and recommendations in FMG 1-49 Loss Prevention Data Sheet for Perimeter Flashings; FMG 1-29 Loss Prevention Data Sheet for Above Deck Roof Components; NRCA Roofing and Waterproofing Manual (Fifth Edition) for Construction Details and SMACNA Architectural Sheet Metal Manual (Seventh Edition) for Construction Details, as applicable.
- F. Energy Performance: Provide roofing system with Solar Reflectance Index (SRI) not less than the following when calculated according to ASTM E 1980 based on testing identical products by a qualified testing agency:
1. Low-sloped roof (less than or equal 2:12) - 82 minimum (initial): 64 (3-year aged).
 2. Steep-sloped roof (greater than 2:12) - 39 minimum (initial); 32 (3-year aged).
- G. Energy Star Listing: Roofing system shall be listed on the DOE's ENERGY STAR "Roof Products Qualified Product List" for low-slope roof products.

- H. Exterior Fire-Test Exposure: ASTM E 108 or UL 790, Class A; for application and roof slopes indicated; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1.5 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. LEED Submittals:
 - 1. Product test reports indicating that roof materials comply with Solar Reflectance Index requirement.
 - 2. For adhesives and sealants used inside the weatherproofing system, documentation including printed statement of VOC content.
 - 3. For adhesives and sealants used inside the weatherproofing system, documentation indicating that products comply with the testing and product requirements of the California Department of Public Health's (formerly, the California Department of Health Services') "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- C. Shop Drawings: For roofing system. Include plans, elevations, sections, details, and attachments to other Work.
 - 1. Base flashings and membrane terminations.
 - 2. Tapered insulation, including slopes.
 - 3. Insulation fastening patterns.
- D. Qualification Data: From Installer and manufacturer stating that the roof installer is acceptable to the manufacturer to install the specified system.
- E. Manufacturer Certificates: Signed by roofing manufacturer certifying that roofing system complies with requirements specified in "Performance Requirements" Article.
- F. Product Test Reports: For components of roofing system, tests performed by manufacturer and witnessed by a qualified testing agency.
- G. Inspection Report: Copy of roofing system manufacturer's inspection report of completed roofing installation.
- H. Maintenance Data: For roofing system to include in maintenance manuals.

1.6 QUALITY ASSURANCE

- A. Source Limitations: Obtain components for roofing system from or approved by roofing system manufacturer.
- B. Roofing Inspector: Owner may engage a full-time roofing inspector during installation of the deck, insulation assembly, membrane, flashing and other appurtenances, and when a survey of the roof and roof drains is conducted. Cooperate with Owner's roofing inspector and allow unlimited access to roofing during construction.

- C. Roofing Signage: At entry points to roof, provide signage-listing type of roofing system, manufacturer, date installed, and holder of the warranty.
- D. Preinstallation Conference: Conduct conference at Project site. Comply with requirements in Division 01. Review methods and procedures related to roofing system including, but not limited to, the following:
 - 1. Meet with the Owner, Architect, Owner's insurer if applicable; testing and inspecting agency representative; roofing Installer; roofing system manufacturer's representative; deck 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 installation, including manufacturer's written instructions.
 - 3. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - 4. Examine deck substrate conditions and finishes for compliance with requirements, including flatness and fastening.
 - 5. Review structural loading limitations of roof deck during and after roofing.
 - 6. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect roofing system.
 - 7. Review governing regulations and requirements for insurance and certificates if applicable.
 - 8. Review temporary protection requirements for roofing system during and after installation.
 - 9. Review roof observation and repair procedures after roofing installation.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, and directions for storing and mixing with other components.
- B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid material from direct sunlight.
 - 1. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.
- C. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.
- D. Handle and store roofing materials and place equipment in a manner to avoid permanent deflection of deck.

1.8 PROJECT CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to manufacturer's written instructions and warranty requirements.

1.9 WARRANTY

- A. Roofing Contractor's Warranty: The roofing subcontractor shall supply Owner with a minimum two-year workmanship warranty for each roof. In the event any work related to the roofing, flashing, or metalwork is found to be defective within two years of substantial completion, the roofing contractor shall remove and replace such at no additional cost to the Owner. The roofing subcontractor's warranty obligation shall run directly to the Owner, and a copy the roofing signed warranty shall be sent to the roofing system's manufacturer.
1. The duration of the Roofing Contractor's two-year warranty shall run concurrent with the roofing system's manufacturer's 20-year warranty.
- B. Roofing Systems Manufacturer's Warranty: The roofing manufacturer shall guarantee roof areas to be in a watertight condition, for a period of 20 years, from the date of final acceptance of the roofing system. The warranty shall be a 20-year no dollar limit (NDL), non-prorated total system labor and material warranty, for wind speed as required by Code or as indicated on the Drawings. Total system warranty shall include all roofing materials, related components and accessories including, but not limited to the substrate board, vapor retarder, insulation board, cover board, roofing membrane, membrane flashings, fasteners, adhesives, metal roof copings, metal roof edges and termination metals and roof drain assemblies. The manufacturer shall repair defects in materials and workmanship as promptly after observation as weather and site conditions permit.

PART 2 - PRODUCTS

2.1 EPDM ROOFING MEMBRANE

- A. EPDM Roofing Membrane: ASTM D 4637, Type I, nonreinforced uniform, flexible sheet made from EPDM, and as follows:
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
- a. Carlisle SynTec Incorporated.
 - b. Firestone Building Products Company.
 - c. Johns Manville International, Inc.
 - d. Mule-Hide Products Co., Inc.
 - e. Versico Inc.
2. Thickness: 60 mils (1.5 mm) nominal.
3. Exposed Face Color: White.

2.2 AUXILIARY MATERIALS

- A. General: Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with membrane roofing.
1. Liquid-type auxiliary materials shall meet VOC limits of authorities having jurisdiction.
2. Adhesives and sealants that are not on the exterior side of weather barrier shall comply with the following limits for VOC content:

- a. Plastic Foam Adhesives: 50 g/L.
 - b. Gypsum Board and Panel Adhesives: 50 g/L.
 - c. Multipurpose Construction Adhesives: 70 g/L.
 - d. Fiberglass Adhesives: 80 g/L.
 - e. Single-Ply Roof Membrane Adhesives: 250 g/L.
 - f. Single-Ply Roof Membrane Sealants: 450 g/L.
 - g. Nonmembrane Roof Sealants: 300 g/L.
 - h. Sealant Primers for Nonporous Substrates: 250 g/L.
 - i. Sealant Primers for Porous Substrates: 775 g/L.
 - j. Other Adhesives and Sealants: 250 g/L.
3. Adhesives and sealants that are not on the exterior side of weather barrier shall comply with the testing and product requirements of the California Department of Public Health's (formerly, the California Department of Health Services) "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- B. Sheet Flashing: 60-mil-thick EPDM, partially cured or cured, according to application.
- C. Epichlorohydrin Sheet at Areas Requiring Grease Resistance: 60-mil-thick, unreinforced flexible sheet with the following typical properties as determined per ASTM test method indicated:
1. Tensile Strength: 1500 psi; ASTM D 412.
 2. Ultimate Elongation: 200 percent; ASTM D 412.
 3. Tear Resistance: 150 lbf/in; ASTM D 412.
 4. Brittleness Temperature: Minus 20 deg F ASTM D 746.
 5. Resistance to Ozone Aging: No cracks after 168 hours' exposure of 50 percent elongated sample at 104 deg F and 100-pphm ozone; ASTM D 1149.
 6. Resistance to Oil Aging: 15 percent maximum mass change after 168 hours' immersion in diesel fuel No. 2 at 158 deg F; ASTM D 471.
- D. Bonding Adhesive: Manufacturer's standard bonding adhesive.
- E. Seaming Material: Manufacturer's standard synthetic-rubber polymer primer and 3-inch- wide minimum with cover strip or 6-inch-wide, butyl splice tape with release film.
- F. Lap Sealant: Manufacturer's standard single-component sealant, color to match roofing membrane.
- G. Water Cutoff Mastic: Manufacturer's standard butyl mastic sealant.
- H. Metal Termination Bars: Manufacturer's standard predrilled stainless-steel or aluminum bars, approximately 1 by 1/8 inch thick; with anchors.
- I. Fasteners: Factory-coated steel fasteners and metal or plastic plates meeting corrosion-resistance provisions in FMG 4470, designed for fastening membrane to substrate, and acceptable to membrane roofing system manufacturer.
- J. Miscellaneous Accessories: Provide pourable sealers, preformed cone and vent sheet flashings, preformed inside and outside corner sheet flashings, T-joint covers, in-seam sealants, termination reglets, cover strips, and other accessories.

2.3 VAPOR RETARDER

- A. Self-Adhering Sheet Vapor Retarder: ASTM D 1970, minimum 40-mil- thick film laminated to layer of rubberized asphalt adhesive; maximum permeance rating of 0.1 perm; cold-applied, with slip-resisting surface and release paper backing. Provide primer when recommended by vapor-retarder manufacturer.
- B. Self-Adhering Vapor Permeable Sheet Membrane (for CLT decking applications): ASTM D 1970, minimum 19-mil- thick laminated and reinforced membrane with release film. Provide primer when recommended by membrane manufacturer.
 - 1. Water Vapor Permeance (ASTM E96): 33 perms.
- C. Reinforced Fire-Retardant Vapor Retarder: 3-ply polyethylene and non-woven cord grid equal to Griffolyn TX-1200FR with prefabricated Griffolyn pipe boots, mastic-type Griffolyn Fab Tape at seams, and self-adhesive Griff-Tape at punctures by Reef Industries, Inc.
- D. Loose-Laid Sheet Vapor Retarder: Minimum 10 mil polyethylene sheet with maximum permeance rating of 0.1 perm.
 - 1. Tape: Pressure-sensitive tape of type recommended by vapor-retarder manufacturer for sealing joints and penetrations in vapor retarder.

2.4 ROOF INSULATION

- A. General: Provide preformed roof insulation boards that comply with requirements and referenced standards, selected from manufacturer's standard sizes and of thicknesses indicated.
- B. Extruded-Polystyrene Board Insulation: ASTM C 578, Type IV, 1.6-lb/cu. ft. minimum density, square edged and acceptable to roofing system manufacturer.
 - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - a. DiversiFoam Products.
 - b. Dow Chemical Company.
 - c. Pactiv/Greenguard
 - d. Owens Corning.
- C. Polyisocyanurate Board Insulation: ASTM C 1289, Type II, felt or glass-fiber mat facer on both major surfaces.
 - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Atlas Roofing Corporation.
 - b. Carlisle SynTec Incorporated.
 - c. Firestone Building Products Company.
 - d. GAF Materials Corp.
 - e. GenFlex Roofing Systems.
 - f. Johns Manville International Inc.

- D. Tapered Insulation: Provide factory-tapered insulation boards fabricated to slope of 1/4 inch per 12 inches unless otherwise indicated.
- E. Provide preformed saddles, crickets, tapered edge strips, and other insulation shapes where indicated for sloping to drain. Fabricate to slopes indicated.

2.5 INSULATION ACCESSORIES

- A. General: Furnish roof insulation accessories recommended by insulation manufacturer for intended use and compatible with membrane roofing.
- B. Fasteners: Factory-coated steel fasteners and metal or plastic plates meeting corrosion-resistance provisions in FMG 4470, designed for fastening roof insulation to substrate, and acceptable to roofing system manufacturer.
- C. Cold Fluid-Applied Adhesive: Manufacturer's standard cold fluid-applied adhesive formulated to adhere roof insulation to substrate.
 - 1. Cover Board Adhesive: Manufacturer's cold fluid-applied adhesive formulated to adhere cover board to insulation substrate.
- D. Cover Board: Provide the following, as required by roofing manufacturer to comply with performance requirements and provide specified warranty.
 - 1. Cover Board: ASTM C 1278/C 1278M, cellulosic-fiber reinforced, water-resistant gypsum substrate, 1/2 or 5/8 inch thick.
- E. Substrate Board (Thermal Barrier): ASTM C 1177/C 1177M, glass-mat, water-resistant gypsum substrate, Type X, 5/8 inch (16 mm) thick, factory primed.

2.6 WALKWAYS

- A. Flexible Walkways: Factory-formed, nonporous, heavy-duty, solid-rubber, slip-resisting, surface-textured walkway pads or rolls approximately 3/16 inch thick, and acceptable to membrane roofing system manufacturer.

2.7 ELECTRIC BREACH DETECTION SYSTEM COMPONENTS

- A. Testing Source:
 - 1. Acceptable Sources: Employ electrical conduction methods from one of the following, as approved by waterproofing system manufacturer:
 - a. Detec Systems
 - a. Honza Group, Inc.
 - b. International Leak Detection Ltd.
 - c. Leak Detection USA
 - 2. Basis of Design: Specifications are based on the following system. Subject to compliance with Project requirements and approval by waterproofing manufacturer, equivalent systems from acceptable sources will be approved:

- a. International Leak Detection Ltd, "Electric Field Vector Mapping (EFVM)".
- B. Electric Breach Detection, General: Provide permanent network of testing loops, as required to test entire waterproofing assembly.
- C. Conductor Network Materials:
 - 1. Conductor Wire: Braided polyethylene interwoven with a minimum of six strands of stainless steel wire. Tensile strength of wire shall be no less than 180 lbs.
 - 2. Accessory Materials: Connectors and other materials as needed for complete loop or network.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with the following requirements and other conditions affecting performance of roofing system:
 - 1. Verify that roof openings and penetrations are in place and set and braced and that roof drains are securely clamped in place.
 - 2. Verify that wood blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.
 - 3. Verify that surface plane flatness and fastening of steel roof deck comply with requirements in Section 053100 - STEEL DECKING.
 - 4. Verify that minimum concrete drying period recommended by roofing system manufacturer has passed.
 - 5. Verify that concrete substrate is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D 4263.
 - 6. Verify that concrete curing compounds that will impair adhesion of roofing components to roof deck have been removed.
 - 7. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing installation according to roofing system manufacturer's written instructions. Remove sharp projections.
- B. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.
- C. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at the end of the workday or when rain is forecast. Remove and discard temporary seals before beginning work on adjoining roofing.

3.3 SUBSTRATE BOARD INSTALLATION

- A. Install substrate board with long joints in continuous straight lines, perpendicular to roof slopes with end joints staggered between rows. Tightly butt substrate boards together.

1. Fasten substrate board to top flanges of steel deck to resist uplift pressure at corners, perimeter, and field of roof according to roofing system manufacturers' written instructions and as required to comply with performance requirements.
2. Fasten substrate board to top flanges of steel deck according to recommendations in FM Global's "RoofNav" and FM Global Loss Prevention Data Sheet 1-29 for specified Windstorm Resistance Classification.

3.4 VAPOR-RETARDER INSTALLATION

- A. Self-Adhering Sheet Vapor Retarder: Prime substrate if required by manufacturer. Install self-adhering sheet vapor retarder over area to receive vapor retarder, side, and end lapping each sheet a minimum of 3-1/2 inches and 6 inches, respectively. Seal laps by rolling.
- B. Vapor Retarder: Loosely lay polyethylene-film vapor retarder over area to receive vapor retarder, side, and end lapping each sheet a minimum of 2 inches and 6 inches, respectively. Continuously seal side and end laps with tape.
- C. Completely seal vapor retarder at side laps, end laps, terminations, obstructions, and penetrations to prevent air movement into roofing system.

3.5 INSULATION AND COVERBOARD INSTALLATION

- A. Coordinate installing membrane roofing system components so insulation is not exposed to precipitation or left exposed at the end of the workday.
- B. Comply with membrane roofing system manufacturer's written instructions for installing roof insulation.
- C. Install tapered insulation under area of roofing to conform to slopes indicated.
- D. Install one or more layers of insulation under area of roofing to achieve required thickness. Install 2 or more layers with joints of each succeeding layer staggered from joints of previous layer a minimum of 6 inches in each direction.
- E. Trim surface of insulation where necessary at roof drains so completed surface is flush and does not restrict flow of water.
- F. Install insulation with long joints of insulation in a continuous straight line with end joints staggered between rows, abutting edges and ends between boards. Fill gaps exceeding 1/4 inch with insulation.
 1. Cut and fit insulation within 1/4 inch of nailers, projections, and penetrations.
- G. Mechanically Fastened Insulation: Install each layer of insulation and secure to deck using mechanical fasteners specifically designed and sized for fastening specified board-type roof insulation to deck type.
 1. Fasten insulation to resist uplift pressure at corners, perimeter, and field of roof.
 2. Fasten insulation according to requirements in FMG's "Approval Guide" for specified Windstorm Resistance Classification.
 3. For insulation applied in multiple layers, loose-lay first layer and mechanically fasten top layer.

- H. Mechanically Fastened Cover Boards: Install cover boards over insulation with long joints in continuous straight lines with end joints staggered between rows. Offset joints of insulation below a minimum of 6 inches in each direction. Loosely butt cover boards together and mechanically fasten to roof deck.
 - 1. Mechanically fasten cover boards, unless otherwise indicated.
 - 2. Fasten insulation to resist uplift pressure at corners, perimeter, and field of roof.
 - 3. Fasten insulation according to requirements in FMG's "Approval Guide" for specified Windstorm Resistance Classification.
- I. Adhered Cover Boards: Install cover boards over mechanically-fastened insulation with long joints in continuous straight lines with end joints staggered between rows. Offset joints of insulation below a minimum of 6 inches in each direction. Adhere cover boards to mechanically-fastened insulation in ribbons of bead-applied adhesive or full-spread adhesive, as required to comply with performance and warranty requirements.
 - 1. Locations for Adhered Cover Board Installation: Provide under green roof areas and elsewhere, where indicated.
 - 2. Adhere cover boards to resist uplift pressure at corners, perimeter, and field of roof.
 - 3. Adhere cover boards according to requirements in FMG's "Approval Guide" for specified Windstorm Resistance Classification.

3.6 ADHERED ROOFING MEMBRANE INSTALLATION

- A. Install roofing membrane over area to receive roofing according to membrane roofing system manufacturer's written instructions. Unroll roofing membrane and allow to relax before installing.
- B. Start installation of roofing membrane in presence of membrane roofing system manufacturer's technical personnel.
- C. Accurately align roofing membrane and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.
- D. Bonding Adhesive: Apply bonding adhesive to substrate and underside of roofing membrane at rate required by manufacturer and allow to partially dry before installing roofing membrane. Do not apply bonding adhesive to splice area of roofing membrane.
- E. Mechanically or adhesively fasten roofing membrane securely at terminations, penetrations, and perimeter of roofing.
- F. Apply roofing membrane with side laps shingled with slope of roof deck where possible.
- G. Tape Seam Installation: Clean and prime both faces of splice areas, apply splice tape, and firmly roll side and end laps of overlapping roofing membranes according to manufacturer's written instructions to ensure a watertight seam installation. Apply lap sealant and seal exposed edges of roofing membrane terminations.
- H. Repair tears, voids, and lapped seams in roofing that does not meet requirements.
- I. Spread sealant or mastic bed over deck drain flange at deck drains and securely seal roofing membrane in place with clamping ring.

- J. Apply epichlorohydrin sheet over roofing membrane at locations indicated.

3.7 BASE FLASHING INSTALLATION

- A. Install sheet flashings and preformed flashing accessories and adhere to substrates according to membrane roofing system manufacturer's written instructions.
- B. Apply bonding adhesive to substrate and underside of sheet flashing at required rate and allow to partially dry. Do not apply bonding adhesive to seam area of flashing.
- C. Flash penetrations and field-formed inside and outside corners with cured or uncured sheet flashing.
- D. Clean splice areas, apply splicing cement, and firmly roll side and end laps of overlapping sheets to ensure a watertight seam installation. Apply lap sealant and seal exposed edges of sheet flashing terminations.
- E. Terminate and seal top of sheet flashings.

3.8 WALKWAY INSTALLATION

- A. Flexible Walkways: Install walkway products in locations indicated. Adhere walkway products to substrate with compatible adhesive according to roofing system manufacturer's written instructions.

3.9 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will **engage** a qualified independent testing and inspecting agency to perform roof tests and inspections and to prepare test reports.
- B. Manufacturer's Technical Representative: Engage a qualified manufacturer's technical representative to perform roof tests and inspections and to prepare test reports.
- C. Final Roof Inspection: Engage roofing system manufacturer's technical personnel to inspect roofing installation on completion and submit report to Architect.

- 1. Notify Architect and the Owner 48 hours in advance of date and time of inspection.

- D. **Electric Breach Detection: Confirm integrity of installed roofing membrane by testing membrane for holes, open seams and capillary defects that will allow water intrusion.**

- 1. **Electric Breach Detection Procedure:**

- a. **Conduct testing after installing membrane and before placing pavers, test to verify membrane is watertight.**
 - b. **Schedule testing to best meet project demands and construction schedule with ample time to allow for repairs of defects and consequential retesting.**
 - c. **If breaches are found, conduct retest after repairs to membrane have been completed.**
 - d. **Conduct third and final test after paver placement to verify that no damage has been done to the membrane during installation of pavers.**

2. Testing Procedure:

- a. Attach EFVM impulse generator to conductor wire and ground or building structure creating a potential circuit. The circuit will complete if water finds a path to ground by way of a breach in membrane.
- b. Create a continuous conducting "plate" above the membrane by wetting some or all of the test area with water. Test only areas that are wetted.
- c. Deliver a one second long 40 volt potential electrical impulse to the conductor wire at an average rate of one impulse every two or three seconds.
- d. Detect the presence or absence of electrical flow across the surface of the membrane by systematically contacting the wet field with two noninvasive probes and reading the potentiometer linked between them.

3. Results of Testing:

- a. If, after a systematic search, no concentration of electrical flow is found, the installed membrane in that area tested is determined to be free of breaches, seam and capillary defects and will be considered waterproof at that time.
 - b. If concentrations of electrical flow are found, trace and identify all contact points and therefore any breaches in the membrane. Document on a drawing and provide a written report, immediately if possible, showing the exact location of breaches found in the installed membrane in the area tested.
 - c. Retest repaired defects.
 - d. Record each day's test results with a written description and photographs of all breaches and any corrections made and a schematic CAD drawing and provide three copies of the report at the completion of the roofing work.
4. Engage an independent testing agency to observe testing and examine underside of decks and terminations for evidence of leaks during testing.
5. When all areas have been tested, submit Final Report stating that the waterproofing system is "totally waterproof" consistent with warranty requirements of the roofing system manufacturer.

- E. Repair or remove and replace components of membrane roofing system where test results or inspections indicate that they do not comply with specified requirements.
- F. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.10 PROTECTING AND CLEANING

- A. Protect membrane roofing system from damage and wear during remainder of construction period. When remaining construction will not affect or endanger roofing, inspect roofing for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and the Owner.
- B. Correct deficiencies in or remove membrane roofing system that does not comply with requirements, repair substrates, and repair or reinstall membrane roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.

- C. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION

SECTION 076200

SHEET METAL FLASHING AND TRIM

(Part of Work of Section 070002 - ROOFING AND FLASHING, Filed Sub-Bid Required)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Sheet metal flashing and trim for the following applications:
 - a. Through-wall flashing.
 - b. Formed wall flashing and trim.
 - c. Formed low-slope roof flashing and trim.
- B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council. Refer to Section 018110, SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.
- C. Items To Be Furnished Only: Furnish the following items for installation by the designated Sections
 - 1. Section 042000 - UNIT MASONRY:
 - a. Through-wall flashings.
- D. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 042000 - UNIT MASONRY for through-wall flashings in masonry.
 - 2. Section 061000 - ROUGH CARPENTRY for wood nailers, curbs, and blocking.
 - 3. Section 072700 - AIR BARRIERS for perimeter terminations at air and vapor barrier assembly.
 - 4. Section 074200 - METAL WALL PANELS for factory-formed metal wall panels and flashing and trim not part of sheet metal flashing and trim.
 - 5. Section 075300 - EPDM ROOFING for installing sheet metal flashing and trim integral with roofing membrane.
 - 6. Section 079200 - JOINT SEALANTS for field-applied sheet metal flashing and trim sealants.

7. Section 079500 - EXPANSION CONTROL for manufactured sheet metal expansion-joint covers.

1.3 PERFORMANCE REQUIREMENTS

- A. General: Install sheet metal flashing and trim to withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failing, rattling, leaking, and fastener disengagement.
- B. Fabricate and install roof edge flashing and copings capable of resisting Wind Zone forces required by Code according to recommendations in FMG Loss Prevention Data Sheet 1-49.
- C. Thermal Movements: Provide sheet metal flashing and trim that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing 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 sheet metal and trim thermal movements. 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.
- D. Water Infiltration: Provide sheet metal flashing and trim that do not allow water infiltration to building interior.
- E. Interface with Other Systems:
 1. Do not proceed with installation of flashing and sheet metal until completion of curb and substrate construction, cants, blocking, reglets and other construction required to receive flashing.
 2. Coordinate flashing with other Work for correct sequencing of items comprising entire membrane or system of roofing or waterproofing and rain drainage.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. LEED Submittals:
 1. Building Product Disclosure and Optimization, Material Ingredients:
 - a. Option 1, Material Ingredient Reporting: For factory-applied metal finishes, submit Declare product labels.
- C. Shop Drawings: Show layouts of sheet metal flashing and trim, including plans and elevations. Distinguish between shop- and field-assembled work. Include the following:
 1. Identify 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 fastening, joining, supporting, and anchoring sheet metal flashing and trim, including fasteners, clips, cleats, and attachments to adjoining work.
4. Details of expansion-joint covers, including showing direction of expansion and contraction.

D. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below:

1. Sheet Metal Flashing: 12 inches long. Include fasteners, cleats, clips, closures, and other attachments.
2. Trim: 12 inches long. Include fasteners and other exposed accessories.
3. Accessories: Full-size Sample.

1.5 QUALITY ASSURANCE

- A. Sheet Metal Flashing and Trim Standard: Comply with SMACNA's "Architectural Sheet Metal Manual." Conform to dimensions and profiles shown unless more stringent requirements are indicated.
- B. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01.
1. Meet with the Owner, Architect and Owner's insurer if applicable, Installer, and installers whose work interfaces with or affects sheet metal flashing and trim including installers of roofing materials, roof accessories, unit skylights, and roof-mounted equipment.
 2. Review methods and procedures related to sheet metal flashing and trim.
 3. Examine substrate conditions for compliance with requirements, including flatness and attachment to structural members.
 4. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver sheet metal flashing materials and fabrications undamaged. Protect sheet metal flashing and trim materials and fabrications during transportation and handling.
- B. Unload, store, and install sheet metal flashing materials and fabrications in a manner to prevent bending, warping, twisting, and surface damage.
- C. Stack materials on platforms or pallets, covered with suitable weathertight and ventilated covering. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage.

1.7 COORDINATION

- A. Coordinate installation of sheet metal flashing and trim with interfacing and adjoining construction to provide a leakproof, secure, and noncorrosive installation.

PART 2 - PRODUCTS

2.1 SHEET METALS

- A. Aluminum Sheet: ASTM B 209, Alloy 3003, 3004, 3105, or 5005. Thickness as specified in this Section. Temper suitable for forming and structural performance required, but not less than H14, finished as follows:

1. High-Performance Organic Finish (3-Coat Fluoropolymer): AA-C12C40R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: conversion coating; Organic Coating: manufacturer's standard 3-coat, thermocured system consisting of specially formulated inhibitive primer, fluoropolymer color coat, and clear fluoropolymer topcoat, with both color coat and clear topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with AAMA 2605 and with coating and resin manufacturers' written instructions.

a. Color and Gloss: As selected by Architect from manufacturer's full range.

2. High-Performance Organic Finish (2-Coat Fluoropolymer): AA-C12C40R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: conversion coating; Organic Coating: manufacturer's standard 2-coat, thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color coat, with color coat 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.

a. Available Products: Sherwin-Williams Coil Coatings; Valspar Fluropon Pure; or approved equal.

- 1) Building Product Disclosure and Optimization, Material Ingredients: Declare product label.

b. Color and Gloss: As selected by Architect from manufacturer's full range.

3. Class I, Clear Anodic Finish: AA-M12C22A41 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 611.

- B. Stainless-Steel Sheet: ASTM A 240/A 240M, Type 304, with No. 2D dull, cold-rolled finish. Thickness as specified in this Section.

2.2 UNDERLAYMENT MATERIALS

- A. Felts: ASTM D 226, Type II (No. 30), asphalt-saturated organic felt, nonperforated.
- B. Slip Sheet: Rosin-sized paper, minimum 3 lb/100 sq. ft.

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.

- B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads.
 - 1. Exposed Fasteners: Heads matching color of sheet metal by means of plastic caps or factory-applied coating.
 - 2. Fasteners for Flashing and Trim: Blind fasteners or self-drilling screws, gasketed, with hex washer head.
 - 3. Blind Fasteners: High-strength aluminum or stainless-steel rivets.
- C. Solder for Stainless Steel: ASTM B 32, Grade Sn60, with acid flux of type recommended by stainless-steel sheet manufacturer.
- D. Sealing Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealing tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape.
- E. Elastomeric Sealant: ASTM C 920, elastomeric polyurethane polymer sealant; 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. Isolation Coating: ASTM D 1187, cold-applied asphalt emulsion, VOC compliant, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.
- H. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.

2.4 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, metal, and other characteristics of item indicated. Shop fabricate items where practicable. Obtain field measurements for accurate fit before shop fabrication.
- B. 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.
- C. Fabricate 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.
 - 1. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength. Provide 2 in. min. end dams at terminations (riveted and sealed watertight).
 - 2. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
 - 3. Soldered Seams in Stainless Steel: Prefabricated inside and outside corners and 2 in. min. end dams at terminations (riveted and soldered watertight).
- D. Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant to comply with SMACNA recommendations.

- E. Expansion Provisions: Where lapped or bayonet-type expansion provisions in the Work cannot be used, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with elastomeric sealant concealed within joints.
- F. Conceal fasteners and expansion provisions where possible on exposed-to-view sheet metal flashing and trim, unless otherwise indicated.
- G. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.
 - 1. Thickness: As recommended by SMACNA's "Architectural Sheet Metal Manual" for application but not less than thickness of metal being secured.

2.5 LOW-SLOPE ROOF SHEET METAL FABRICATIONS

- A. Roof Edge Flashing (Gravel Stop) and Fascia Caps: Fabricate in minimum 96-inch-long, but not exceeding 10-foot-long, sections. Furnish with 6-inch-wide joint cover plates.
 - 1. Joint Style: Butt, with 12-inch-wide concealed backup plate.
 - 2. Fabricate from the following material:
 - a. Aluminum: 0.050 inch (1.27 mm) thick.
- B. Copings: Fabricate in minimum 96-inch-long, but not exceeding 10-foot-long, sections. Fabricate joint plates of same thickness as copings. Furnish with continuous cleats to support edge of external leg and drill elongated holes for fasteners on interior leg. Miter corners, seal, and solder or weld watertight.
 - 1. Joint Style: Butt, with 12-inch-wide concealed backup plate.
 - 2. Fabricate copings from the following material:
 - a. Aluminum: 0.050 inch (1.27 mm) thick.
- C. Roof and Roof to Wall Transition Expansion-Joint Cover: Fabricate from the following material:
 - 1. Stainless Steel: 0.025 inch (0.64 mm) thick.
- D. Base Flashing: Fabricate from the following material:
 - 1. Stainless Steel: 0.019 inch (0.48 mm) thick.
- E. Counterflashing: Fabricate from the following material:
 - 1. Stainless Steel: 0.019 inch (0.48 mm) thick.
- F. Roof-Penetration Flashing: Fabricate from the following material:
 - 1. Stainless Steel: 0.019 inch (0.48 mm) thick.
- G. Roof-Drain Flashing: Fabricate from the following material:
 - 1. Stainless Steel: 0.016 inch (0.40 mm) thick.

- H. Splash Pans: Fabricate from the following material:

1. Stainless Steel: 0.025 inch thick.

2.6 WALL SHEET METAL FABRICATIONS

- A. Through-Wall Flashing, Typical: Fabricate continuous flashings in minimum 96-inch-long, but not exceeding 12 foot long, sections, under copings, at shelf angles, and where indicated. Fabricate discontinuous lintel, sill, and similar flashings to extend 6 inches beyond each side of wall openings. Form with 2-inch-high end dams. Fabricate from the following material:

1. Stainless Steel: 0.016 inch (0.40 mm) thick.

- B. Through-Wall Flashing, in Masonry: Through-wall flashing in masonry is specified in Section 042000 – UNIT MASONRY.

2.7 FINISHES

- 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: 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.

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 work.
1. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
 2. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 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. Unless otherwise indicated, install sheet metal flashing and trim to comply with performance requirements, manufacturer installation instructions, and SMACNA "Architectural Sheet Metal Manual". Anchor units work of work securely in place by methods indicated, providing for thermal expansion of metal units; conceal

fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints and seams that will be permanently watertight and weatherproof.

1. Torch cutting of sheet metal flashing and trim is not permitted.
- 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 fabricator or manufacturers of dissimilar metals.
1. Coat side of stainless-steel sheet metal flashing and trim with isolation 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 or install a course of polyethylene underlayment.
 3. Bed flanges in thick coat of asphalt roofing cement where required for waterproof performance.
- C. Install exposed sheet metal flashing and trim without excessive oil canning, buckling, and tool marks.
- D. Install sheet metal flashing and trim true to line and levels indicated. Provide uniform, neat seams with minimum exposure of solder, welds, and elastomeric sealant.
- E. 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.
1. Space cleats not more than 12 inches apart. Anchor each cleat with two fasteners. Bend tabs over fasteners.
- F. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped or bayonet-type expansion provisions cannot be used or would not be sufficiently watertight, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with elastomeric sealant concealed within joints.
- G. Fasteners: Use fasteners of sizes that will penetrate substrate not less than 1-1/4 inches for nails and not less than 3/4 inch for wood screws.
1. Aluminum: Use aluminum or stainless steel fasteners.
 2. Stainless Steel: Use stainless-steel fasteners.
- H. Seal joints with elastomeric sealant 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 either way. Adjust setting proportionately for installation at higher ambient temperatures. Do not install sealant-type joints at temperatures below 40 deg F.
 2. Prepare joints and apply sealants to comply with requirements in Section 079200 - JOINT SEALANTS.

- I. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Prein edges of sheets to be soldered to a width of 1-1/2 inches except where pretinned surface would show in finished Work.
 - 1. Do not solder aluminum sheet.
 - 2. Stainless-Steel Soldering: Prein edges of uncoated sheets to be soldered using solder recommended for stainless steel and phosphoric acid flux. Promptly wash off acid flux residue from metal after soldering.
 - 3. Do not use open-flame torches for soldering. Heat surfaces to receive solder and flow solder into joints. Fill joints completely. Completely remove flux and spatter from exposed surfaces.
- J. Aluminum Flashing: Rivet or weld joints in uncoated aluminum where necessary for strength.

3.3 ROOF FLASHING INSTALLATION

- A. General: Install sheet metal roof flashing and trim to comply with performance requirements, sheet metal manufacturer's written installation instructions,] 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.
- 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 (100 mm) 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 elastomeric sealant.
 - 1. Secure in a waterproof manner by means of snap-in installation and sealant.
- D. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Install flashing as follows:
 - 1. Seal with elastomeric sealant and clamp flashing to pipes penetrating roof except for flashing on vent piping.

3.4 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 in Masonry: Installation of through-wall flashing in masonry is specified in Section 042000 - UNIT MASONRY.

3.5 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 and sealants.
- C. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed. On completion of installation, clean finished surfaces, including removing unused fasteners, metal filings, pop rivet stems, and pieces of flashing. Maintain in a clean condition during construction.
- D. 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

SECTION 077100

ROOF SPECIALTIES

(Part of Work of Section 070002 - ROOFING AND FLASHING, Filed Sub-Bid Required)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Roof-edge drainage systems.
- B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council. Refer to Section 018110, SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 061000 - ROUGH CARPENTRY for wood nailers, curbs, and blocking.
 - 2. Section 079200 - JOINT SEALANTS for sealants.

1.3 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. 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.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

- B. Shop Drawings: For roof specialties. Include plans, elevations, expansion-joint locations, keyed details, and attachments to other work. Distinguish between plant- and field-assembled work. Include the following:
 - 1. Details for expansion and contraction; locations of expansion joints, including direction of expansion and contraction.
 - 2. Pattern of seams and layout of fasteners, cleats, clips, and other attachments.
 - 3. Details of termination points and assemblies, including fixed points.
 - 4. Details of special conditions.
- C. Samples for Verification: For roof-edge drainage systems made from 12-inch lengths of full-size components including fasteners, cover joints, accessories, and attachments.

1.5 QUALITY ASSURANCE

- A. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.
 - 1. Build mockup of typical roof edge, including gutter and downspout approximately 10 feet long, including supporting construction, seams, attachments, and accessories.
 - 2. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.
- B. 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.

1.6 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.

PART 2 - PRODUCTS

2.1 EXPOSED METALS

- A. Aluminum Sheet: ASTM B 209, Alloy 3003, 3004, 3105, or 5005. Thickness as specified in this Section. Temper suitable for forming and structural performance required, but not less than H14, finished as follows:
 - 1. High-Performance Organic Finish: AA-C12C42R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: acid-chromate-fluoride-phosphate conversion

coating; Organic Coating: as specified below). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

- a. Fluoropolymer 3-Coat System: Manufacturer's standard 3-coat, thermocured system consisting of specially formulated inhibitive primer, fluoropolymer color coat, and clear fluoropolymer topcoat, with both color coat and clear topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight, with a minimum total dry film thickness of 1.5 mil; complying with AAMA 2605.

- 1) Color: As selected by Architect from manufacturer's full range.

- B. Copper Sheet: ASTM B 370, cold-rolled copper sheet, H00 or H01 temper.

- 1. Non-Patinated Exposed Finish: Mill.

- C. Zinc Alloy Sheet/Coils:

- 1. Titanium Zinc Alloy whose base is electrolytic high grade fine zinc (DIN EN1179) with a 99.995 % Zn degree of purity and alloying additives of + 0.1% copper and + 0.1% titanium in accordance with DIN EN 988.

- a. Pre-Weathered: pickling process (no phosphating)

- 1) Blue-Gray

- 2. Pre-Weathered Roofing: Backside coated zinc by manufacturer.

2.2 CONCEALED METALS

- A. Stainless-Steel Sheet: ASTM A 240/A 240M or ASTM A 666, Type 304.

2.3 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 Copper Sheet: Copper, hardware bronze, or passivated Series 300 stainless steel.
 - 3. Fasteners for Zinc-Coated Copper Sheet: Series 300 stainless steel.

- C. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D 1187.

- D. Solder for Copper: ASTM B 32, Grade Sn50, 50 percent tin and 50 percent lead.

2.4 ROOF-EDGE DRAINAGE SYSTEMS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. ATAS International, Inc.
 - 2. Berger Building Products, Inc.
 - 3. Cheney Flashing Company.
 - 4. Hickman Company, W. P.
 - 5. Merchant & Evans, Inc.
 - 6. Metal-Era, Inc.
 - 7. Metal-Fab Manufacturing, LLC.
 - 8. MM Systems Corporation.
- B. Gutters: Manufactured in uniform section lengths not exceeding 12 feet, with matching corner units, ends, outlet tubes, and other accessories. Elevate back edge at least 1 inch above front edge. Furnish flat-stock gutter straps, gutter brackets, expansion joints, and expansion-joint covers fabricated from same metal as gutters.
 - 1. Fabricate from the following exposed metal:
 - a. Aluminum: 0.050 inch (1.27 mm) thick.
 - 2. Gutter Profile: As indicated according to SMACNA's "Architectural Sheet Metal Manual."
 - 3. Corners: Factory mitered and soldered.
 - 4. Gutter Supports: As indicated with finish matching the gutters.
 - 5. Gutter Accessories: Bronze wire ball downspout strainer,
- C. Downspouts: Plain round complete with mitered elbows, manufactured from the following exposed metal. Furnish with metal hangers, from same material as downspouts, and anchors.
 - 1. Aluminum: 0.040 inch (1.02 mm) thick.
- D. Conductor Heads: Manufactured conductor heads, each with flanged back and stiffened top edge and of dimensions and shape indicated, complete with outlet tube that nests into upper end of downspout.
 - 1. Fabricate from the following exposed metal:
 - a. Aluminum: 0.040 inch (1.02 mm) thick.

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 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 metal 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.
- 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 that will penetrate wood blocking or sheathing not less than 1-1/4 inches for nails and not less than 3/4 inch for wood screws.
- E. 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
- 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. Tin edges of uncoated copper sheets using solder for copper. 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.

3.3 ROOF-EDGE DRAINAGE-SYSTEM INSTALLATION

- A. General: Install components to produce a complete roof-edge drainage system according to manufacturer's written instructions. Coordinate installation of roof perimeter flashing with installation of roof-edge drainage system.
- B. Gutters: Join and seal gutter lengths. Allow for thermal expansion. Attach gutters to firmly anchored gutter supports spaced not more than 24 inches apart. Attach ends with rivets and solder to make watertight. Slope to downspouts.
 - 1. Install gutter with expansion joints at locations indicated but not exceeding 50 feet apart. Install expansion joint caps.
- C. Downspouts: Join sections with manufacturer's standard telescoping joints. Provide hangers with fasteners designed to hold downspouts securely to walls and 1 inch away from walls; locate fasteners at top and bottom and at approximately 60 inches o.c.
 - 1. Provide elbows at base of downspout to direct water away from building.
- D. Conductor Heads: Anchor securely to wall with elevation of conductor top edge 1 inch below gutter discharge.

3.4 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 and sealants.
- C. Remove temporary protective coverings and strippable films as roof specialties are installed. 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.
- D. Replace roof specialties that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

END OF SECTION

SECTION 077200

ROOF ACCESSORIES

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Smoke evacuation hatch, automatic operation.
- B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council. Refer to Section 018110, SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 055000 - METAL FABRICATIONS for metal vertical ladders, ships' ladders, and stairs for access to roof hatches, and from roof to roof.
 - 2. Section 061000 - ROUGH CARPENTRY for wood cants and wood nailers
 - 3. Section 076200 - SHEET METAL FLASHING AND TRIM for shop- and field-fabricated metal flashing and counterflashing, roof expansion-joint covers, and miscellaneous sheet metal trim and accessories.
 - 4. Division 23 - HEATING, VENTILATING, AND AIR CONDITIONING for roof-mounted ventilators.
 - 5. Division 26 - ELECTRICAL for power supply and final connections for automatically operated heat and smoke vents.

1.3 SUBMITTALS

- A. Product Data: For each type of roof accessory indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Shop Drawings: Show fabrication and installation details for roof accessories. Show layouts of roof accessories including plans and elevations. Indicate dimensions, weights, loadings, required clearances, method of field assembly, and components. Include plans, elevations, sections, details, and attachments to other work.

1.4 QUALITY ASSURANCE

- A. Sheet Metal Standard: Comply with SMACNA's "Architectural Sheet Metal Manual" details for fabrication of units, including flanges and cap flashing to coordinate with type of roofing indicated.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Pack, handle, and ship roof accessories properly labeled in heavy-duty packaging to prevent damage.

1.6 PROJECT CONDITIONS

- A. Field Measurements: Verify required openings for each type of roof accessory by field measurements before fabrication and indicate measurements on Shop Drawings.

1.7 COORDINATION

- A. Coordinate layout and installation of roof accessories with roofing membrane and base flashing and interfacing and adjoining construction to provide a leakproof, weathertight, secure, and noncorrosive installation.

PART 2 - PRODUCTS

2.1 HEAT AND SMOKE VENTS

- A. Hatch-Type Heat and Smoke Vents: Manufacturer's standard, with double-walled insulated curbs, welded or mechanically fastened and sealed corner joints, integral condensation gutter, and cap flashing. Fabricate with insulated double-walled lid and continuous weathertight perimeter lid gaskets, and equip with automatic self-lifting mechanisms and UL-listed fire-suppression system smoke-detection system.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Babcock-Davis; a Ciera Products Inc. Company.
 - b. Bilco Company (The).
 - c. Nystrom, Inc.
 - 2. Type and Size: As shown on drawings.
 - 3. Loads: Minimum 40-lbf/sq. ft. external live load and internal uplift load.
 - a. When release is actuated, lid shall open against 10-lb/sq. ft. snow or wind load and lock in position.
 - 4. Heat and Smoke Vent Standard: Provide units that have been tested and listed to comply with UL 793 and NFPA 204.
 - a. Operation during Power Failure: Provide automatic opening action at power failure and automatic closure when power is restored.

5. Curb, Framing, and Lid Material: Zinc-coated (galvanized or Aluminum-zinc alloy-coated steel sheet, 0.079 inch thick.
 - a. Finish: Baked enamel or powder coat.
 - b. Fire resistance of Lids: UL Class A rating.
6. Construction:
 - a. Insulation: Manufacturer standard board.
 - b. Hatch Lid: Opaque, insulated, and double walled, with manufacturer's standard metal liner of same material and finish as outer metal lid.
 - c. Exterior Curb Liner: Manufacturer's standard, of same material and finish as metal curb.
 - d. Fabricate curbs to minimum height of 12 inches unless otherwise indicated.
 - e. Sloping Roofs: Where slope or roof deck exceeds 1:48, fabricate curb with perimeter curb height that is constant tapered to accommodate roof slope so that top surfaces of perimeter curb are level. Equip hatch with water diverter or cricket on side that obstructs water flow.
7. Hardware: Manufacturer's standard, corrosion resistant or hot-dip galvanized; with hinges, hold-open devices, and independent manual-release devices for inside and outside operation of lids.
8. Fall protection screens: 4" x 4" fully welded screen – Factory installed, tested to comply with OSHA 1926.502c
 - a. Steel wire: 0.163" diameter wire.

2.2 MISCELLANEOUS MATERIALS

- A. Wood Nailers: Softwood lumber, pressure treated with waterborne preservatives for aboveground use, complying with AWPA C2; not less than 1-1/2 inches thick.
- B. Isolation Coating: ASTM D 1187, cold-applied asphalt emulsion, VOC compliant, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.
- C. Fasteners: Same metal as metals being fastened, or nonmagnetic stainless steel or other noncorrosive metal as recommended by roof accessory manufacturer. Match finish of exposed fasteners with finish of material being fastened. Provide nonremovable fastener heads to exterior exposed fasteners.
- D. Gaskets: Manufacturer's standard tubular or fingered design of neoprene, EPDM, or PVC; or flat design of foam rubber, sponge neoprene, or cork.
- E. Elastomeric Sealant: ASTM C 920, polyurethane sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

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 work.
 - 1. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored and is ready to receive roof accessories.
 - 2. Verify dimensions of roof openings for roof accessories.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Install roof accessories according to manufacturer's written instructions. Anchor roof accessories securely in place and capable of resisting forces specified. Use fasteners, separators, sealants, and other miscellaneous items as required for completing roof accessory installation. Install roof accessories to resist exposure to weather without failing, rattling, leaking, and fastener disengagement.
- B. Install roof accessories to fit substrates and to result in watertight performance.
- C. 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 manufacturer.
 - 1. Coat concealed side of uncoated aluminum roof accessories with isolation coating where in contact with wood, ferrous metal, or cementitious construction.
 - 2. Underlayment: Where installing exposed-to-view components of roof accessories directly on cementitious or wood substrates, install a course of felt underlayment and cover with a slip-sheet, or install a course of polyethylene underlayment.
 - 3. Bed flanges in thick coat of asphalt roofing cement where required by roof accessory manufacturers for waterproof performance.
- D. Install roof accessories level, plumb, true to line and elevation, and without warping, jogs in alignment, excessive oil canning, buckling, or tool marks.
- E. Heat and Smoke Vent Installation:
 - 1. Check for proper operation. Adjust operating mechanism as required. Clean and lubricate joints and hardware.
- F. Seal joints with elastomeric sealant as required by manufacturer of roof accessories.

3.3 TOUCH UP

- A. Touch up factory-primed surfaces with compatible primer ready for field painting in accordance with Section 099000 - PAINTING AND COATING.

- B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION

SECTION 077700

WALL CLADDING SUPPORT SYSTEM

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Non-combustible thermally-broken continuous insulation and cladding support system at exterior.
- B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council. Refer to Section 018110, SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 054000 – COLD-FORMED METAL FRAMING for exterior wall framing.
 - 2. Section 072000 - THERMAL INSULATION for insulation.
 - 3. Section 074200 – METAL WALL PANELS for exterior cladding.

1.3 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design support system and framing, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. Structural Performance: Provide support system and framing capable of withstanding design loads within limits and under conditions indicated.
 - 1. Design Loads: As required by code and not less than indicated on the Structural Drawings.

1.4 SUBMITTALS

- A. Product Data: For each product.
- B. Shop Drawings: Show layout, spacings, sizes, thicknesses, and types; and fastening and anchorage details, including mechanical fasteners. Show opening framing, supplemental

WALL CLADDING SUPPORT SYSTEM

framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.

- C. Delegated-Design Submittal: For framing indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- D. Qualification Data: For professional engineer.

1.5 QUALITY ASSURANCE

- A. Engineering Responsibility: Preparation of Shop Drawings, design calculations, and other structural data by a qualified professional engineer.
- B. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in the jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of framing that are similar to those indicated for this Project in material, design, and extent.
- C. Mock-Up: Provide labor and materials for mock-ups specified in Section 014000 – QUALITY REQUIREMENTS.
- D. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01.

PART 2 - PRODUCTS

2.1 COMPOSITE FRAMING SUPPORT

- A. Non-Combustible, Thermally Broken Continuous Insulation and Cladding Support System: Coordinated with exterior insulation, engineered to support exterior cladding dead loads and project specific wind loads, and without thru-insulation thermal bridging other than brackets and/or fasteners. Acceptable systems are limited to the following:
 - 1. Stand-Off PV Bracket by ExoTec Mfg.
 - 2. KnightWall MFI-System.
 - 3. Alpha VCI or HCI Sub-Framing System by ECO Cladding.

2.2 ACCESSORIES

- A. Fasteners: Corrosion-resistant, self-tapping and self-drilling screws, bolts, nuts, and other fasteners as recommended by panel support system manufacturer for project application.
- B. Sealants: Provide sealants as recommended by exterior wall panel manufacturer for openings within wall panels and perimeter conditions.
 - 1. Refer to Section 079200 – JOINT SEALANTS for requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas of this work, and project conditions with installer present for compliance with requirements for installation tolerances, substrates, wall panel support conditions, and other conditions affecting performance of this Work.
- B. Examine structural wall framing to ensure that angles, channels, studs, and other structural support members have been installed within alignment tolerances required by continuous insulation wall panel support system manufacturer.
- C. Verify that water resistive barrier has been installed over exterior sheathing to control air infiltration or water penetration as indicated for project.
- D. Examine rough-in for components and systems penetrating wall panel support system to coordinate actual locations of penetrations relative to exterior wall panel joint locations prior to installation.
- E. Proceed with installation only after exterior walls have been properly prepared and unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean surfaces thoroughly prior to installation. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION, GENERAL

- A. Install wall panel support system in accordance with manufacturer's installation instructions, approved submittals, and in proper relationship to adjacent construction.
- B. Install wall panel support system in compliance with exterior wall panel orientation, sizes, and locations as indicated on Drawings.

3.4 TOLERANCES

- A. Shim and align wall panel units with installed tolerances of 1/4 inch in 20 feet, non-cumulative, on level, plumb, and location lines as indicated.

3.5 PROTECTION

- A. Protect installed products from damage until date of Substantial Completion.

END OF SECTION

SECTION 078100

APPLIED FIREPROOFING

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
1. Standard Durability sprayed fire-resistive materials for concealed spaces not exposed to view or weather, non-high-rise construction.
 2. Intermediate Durability sprayed fire-resistive materials for interior spaces, concealed or exposed to view only, and not exposed to weather, high-rise construction.
 3. Medium Durability sprayed fire-resistive materials for interior spaces exposed to view and abrasion (in final construction) but not to weather.
 4. High Durability sprayed fire-resistive materials for exposed spaces, including at loading docks, at parking garages, and where exposed to weather.
 5. Super High Rise Durability sprayed fire-resistive materials for interior spaces, concealed or exposed to view only, and not exposed to weather, super high-rise construction.
 6. Exposed thin-film mastic and intumescent fire-resistive coatings.
 7. Patching existing fireproofing as required by new construction activities, and at areas where fireproofing is missing in existing construction.
- B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council. Refer to Section 018110, SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
1. Section 033000 - CAST-IN-PLACE CONCRETE for concrete protecting structural steel.
 2. Section 042000 - UNIT MASONRY for masonry protecting structural steel.
 3. Section 051200 - STRUCTURAL STEEL FRAMING for surface conditions required for structural steel receiving sprayed fire-resistive materials.
 4. Section 078410 - PENETRATION FIRESTOPPING for firestopping and firesafing insulation.
 5. Section 092110 - GYPSUM BOARD ASSEMBLIES for fire-resistance-rated assemblies.
 6. Section 092120 - GYPSUM BOARD SHAFT-WALL ASSEMBLIES for fire-resistance-rated assemblies.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. LEED Submittals:
 - 1. For paints and coatings, documentation including printed statement of VOC content.
 - 2. Laboratory Test Reports for Credit EQ 4: For paints and coatings used inside the weatherproofing system, documentation indicating that products 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."
- C. Shop Drawings: Structural framing plans indicating the following:
 - 1. Locations and types of surface preparations required before applying sprayed fire-resistive material.
 - 2. Extent of sprayed fire-resistive material for each construction and fire-resistance rating, including the following:
 - a. Applicable fire-resistance design designations of a qualified testing and inspecting agency acceptable to authorities having jurisdiction.
 - b. Minimum thicknesses needed to achieve required fire-resistance ratings of structural components and assemblies.
 - 3. Treatment of sprayed fire-resistive material after application.
- D. Samples for Verification: For each type of colored, exposed sprayed fire-resistive material, two Samples, each 4 inches square, of each color, texture, and material formulation to be applied. Where finishes involve normal color and texture variations, include Sample sets showing the full range of variations expected.
- E. Qualification Data: For Installer, manufacturer, and testing agency.
- F. Compatibility and Adhesion Test Reports: From sprayed fire-resistive material manufacturer indicating the following:
 - 1. Materials have been tested for bond with substrates.
 - 2. Materials have been verified by sprayed fire-resistive material manufacturer to be compatible with substrate primers and coatings.
 - 3. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.
- G. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for proposed sprayed fire-resistive materials.
 - 1. Engineering Evaluation: Provide engineering evaluation of modification of submitted fire-resistance design, if required to comply with required fire-test-response characteristics, specified under Quality Assurance Article herein.

1.4 QUALITY ASSURANCE

- A. **Installer Qualifications:** A firm or individual certified, licensed, or otherwise qualified by sprayed fire-resistive material manufacturer as experienced and with sufficient trained staff to install manufacturer's products according to specified requirements. A manufacturer's willingness to sell its sprayed fire-resistive materials to Contractor or to an installer engaged by Contractor does not in itself confer qualification on the buyer.
- B. **Testing Agency Qualifications:** An independent approved testing agency, acceptable to authorities having jurisdiction, with the experience and capability to conduct the testing indicated, as documented in accordance with local State Building Code.
- C. **Source Limitations:** Obtain sprayed fire-resistive materials through one source from a single manufacturer for each type of material.
- D. **Sprayed Fire-Resistive Materials Testing:** By an approved testing and inspecting agency engaged by Contractor or manufacturer to test for compliance with specified requirements for performance and test methods.
 - 1. Sprayed fire-resistive materials are randomly selected for testing from bags bearing the applicable classification marking of UL or another testing and inspecting agency acceptable to authorities having jurisdiction.
 - 2. Testing is performed on specimens of sprayed fire-resistive materials that comply with laboratory testing requirements specified in Part 2 and are otherwise identical to installed fire-resistive materials, including application of accelerant, sealers, topcoats, tamping, troweling, rolling, and water overspray, if any of these are used in final application.
 - 3. Testing is performed on specimens whose application the independent testing and inspecting agency witnessed during preparation and conditioning. Include in test reports a full description of preparation and conditioning of laboratory test specimens.
- E. **Compatibility and Adhesion Testing:** Engage a qualified testing and inspecting agency to test for compliance with requirements for specified performance and test methods.
 - 1. Test for bond per ASTM E 736 and requirements in UL's "Fire Resistance Directory" for coating materials. Provide bond strength indicated in referenced fire-resistance design, but not less than minimum specified in Part 2.
 - 2. Verify that manufacturer, through its own laboratory testing or field experience, has not found primers or coatings to be incompatible with sprayed fire-resistive material.
- F. **Fire-Test-Response Characteristics:** Provide sprayed fire-resistive materials with the fire-test-response characteristics indicated, as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify bags containing sprayed fire-resistive materials with appropriate markings of applicable testing and inspecting agency.
 - 1. **Fire-Resistance Ratings:** Indicated by design designations from UL's "Fire Resistance Directory" or from the listings of another testing and inspecting agency acceptable to authorities having jurisdiction, for sprayed fire-resistive material serving as direct-applied protection tested per ASTM E 119.
 - a. Steel members shall be considered restrained unless specifically noted otherwise. Structural design capacity for framing members shall be assumed as "fully-loaded".

Non-load restricted fire-resistance designs shall be utilized for steel beams and joists requiring more than a 1 hour rating. Fire-resistance designs that indicate a load restriction factor are not permitted for steel beams and joists requiring more than a 1 hour rating.

- b. As required by Code, the individual beam and joist must match the assembly rating ratings.
 - 2. Surface-Burning Characteristics: ASTM E 84, limits in accordance with applicable local Building Code.
 - G. Provide products containing no detectable asbestos as determined according to the method specified in 40 CFR 763, Subpart E, Appendix E, Section 1, "Polarized Light Microscopy."
 - H. Code-Required Inspections: Notify Architect and Owner's independent testing agency a minimum of 72 hours prior to commencing work of this Section, for Code-required special inspections.
 - I. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01. Review methods and procedures related to sprayed fire-resistive materials including, but not limited to, the following:
 - 1. Review and finalize construction schedule and verify sequencing and coordination requirements.
- 1.5 DELIVERY, STORAGE, AND HANDLING
- A. Deliver products to Project site in original, unopened packages with intact and legible manufacturers' labels identifying product and manufacturer, date of manufacture, shelf life if applicable, and fire-resistance ratings applicable to Project.
 - B. Use materials with limited shelf life within period indicated. Remove from Project site and discard materials whose shelf life has expired.
 - C. Store materials inside, under cover, aboveground, and kept dry until ready for use. Remove from Project site and discard wet or deteriorated materials.
- 1.6 PROJECT CONDITIONS
- A. Environmental Limitations: Do not apply sprayed fire-resistive material when ambient or substrate temperature is 40 deg F or lower unless temporary protection and heat is provided to maintain temperature at or above this level for 24 hours before, during, and for 24 hours after product application.
 - B. Ventilation: Ventilate building spaces during and after application of sprayed fire-resistive material. Use natural means or, if they are inadequate, forced-air circulation until fire-resistive material dries thoroughly. Comply with manufacturer's recommended ventilation procedures.
- 1.7 COORDINATION
- A. Sequence and coordinate application of sprayed fire-resistive materials with other related work specified in other Sections to comply with the following requirements:

1. Provide temporary enclosure as required to confine spraying operations and protect the environment.
2. Provide temporary enclosures for applications to prevent deterioration of fire-resistive material due to exposure to weather and to unfavorable ambient conditions for humidity, temperature, and ventilation.
3. Avoid unnecessary exposure of fire-resistive material to abrasion and other damage likely to occur during construction operations subsequent to its application.
4. Do not apply fire-resistive material to metal roof deck substrates until concrete topping, if any, has been completed. For metal roof decks without concrete topping, do not apply fire-resistive material to metal roof deck substrates until roofing has been completed; prohibit roof traffic during application and drying of fire-resistive material.
5. Do not apply fire-resistive material to metal floor deck substrates until concrete topping has been completed.
6. Except for thin-film intumescent fireproofing, do not begin applying fire-resistive material until clips, hangers, supports, sleeves, and other items penetrating fire protection are in place.
7. Defer installing ducts, piping, and other items that would interfere with applying fire-resistive material until application of fire protection is completed.
8. Do not install enclosing or concealing construction until after fire-resistive material has been applied, inspected, and tested and corrections have been made to defective applications.

1.8 WARRANTY

- A. Special Warranty: Manufacturer's standard form, signed by Contractor and by Installer, in which manufacturer agrees to repair or replace sprayed fire-resistive materials that fail in materials or workmanship within specified warranty period. Failures include, but are not limited to, the following:
1. Cracking, flaking, spalling, or eroding in excess of specified requirements; peeling; or delaminating of sprayed fire-resistive materials from substrates.
 2. Not covered under the warranty are failures due to damage by occupants and the Owner's maintenance personnel, exposure to environmental conditions other than those investigated and approved during fire-response testing, and other causes not reasonably foreseeable under conditions of normal use.
- B. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

- A. VOC Content: Products shall comply with VOC content limits of authorities having jurisdiction and the following VOC limits when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
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. Anticorrosive and Antirust Paints Applied to Ferrous Metals: 250 g/L.

- B. Low-Emitting Materials: Fireproofing used within the weatherproofing system 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."

2.2 STANDARD DURABILITY SPRAYED FIRE-RESISTIVE MATERIALS

- A. General: For standard density sprayed fire-resistive materials for concealed spaces not exposed to view or weather, non-high-rise construction, provide manufacturer's standard products complying with requirements indicated for material composition and physical properties representative of installed products.
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Carboline Company, subsidiary of RPM International, Fireproofing Products Div.; AD Southwest Fireproofing Type 5GP.
 - b. GCP Applied Technologies (formerly W.R. Grace); Monokote Type MK-6/HY.
 - c. Isolatek International, Cafco Products; Cafco 300.
- B. Material Composition: Cementitious sprayed fire-resistive material consisting of factory-mixed, dry formulation of portland cement binders and lightweight mineral or synthetic aggregates mixed with water at Project site to form a slurry or mortar for conveyance and application, per ASTM E 1513.
- C. Physical Properties: Minimum values, unless otherwise indicated, or higher values required to attain designated fire-resistance ratings, measured per standard test methods referenced with each property as follows:
 - 1. Dry Density: 15 lb/cu. ft. for average and individual densities regardless of density indicated in referenced fire-resistance design, or greater if required to attain fire-resistance ratings indicated, per ASTM E 605 or AWCI Technical Manual 12-A, Section 5.4.5, "Displacement Method."
 - 2. Thickness: Provide minimum average thickness required for fire-resistance design indicated according to the following criteria, but not less than 0.375 inch, per ASTM E 605:
 - a. Where the referenced fire-resistance design lists a thickness of 1 inch or greater, the minimum allowable individual thickness of sprayed fire-resistive material is the design thickness minus 0.25 inch.
 - b. Where the referenced fire-resistance design lists a thickness of less than 1 inch but more than 0.375 inch, the minimum allowable individual thickness of sprayed fire-resistive material is the greater of 0.375 inch or 75 percent of the design thickness.
 - c. No reduction in average thickness is permitted for those fire-resistance designs whose fire-resistance ratings were established at densities of less than 15 lb/cu. ft.
 - 3. Bond Strength: 150 lbf/sq. ft. minimum per ASTM E 736 under the following conditions:

- a. Field test sprayed fire-resistive material that is applied to flanges of wide-flange, structural-steel members on surfaces matching those that will exist for remainder of steel receiving fire-resistive material.
 - b. If surfaces of structural steel receiving sprayed fire-resistive material are primed or otherwise painted for coating materials, perform series of bond tests in accordance with ASTM E736 while using criteria of acceptance in UL's "Fire Resistance Directory."
 - c. Minimum thickness of sprayed fire-resistive material tested in laboratory shall be 0.75 inch.
4. Compressive Strength: Minimum 1200 psf as determined in the laboratory per ASTM E 761. Minimum thickness of sprayed fire-resistive material tested shall be 0.75 inch and minimum dry density shall be as specified, but not less than 15 lb/cu. ft.
 5. Corrosion Resistance: No evidence of corrosion per ASTM E 937.
 6. Deflection: No cracking, spalling, or delamination per ASTM E 759.
 7. Effect of Impact on Bonding: No cracking, spalling, or delamination per ASTM E 760.
 8. Air Erosion: Maximum weight loss of 0.025 g/sq. ft. in 24 hours per ASTM E 859. For laboratory tests, minimum thickness of sprayed fire-resistive material is 0.75 inch maximum dry density is 15 lb/cu. ft. test specimens are not prepurged by mechanically induced air velocities, and tests are terminated after 24 hours.
 9. Fungal Resistance: No observed growth on specimens per ASTM G 21.

2.3 INTERMEDIATE DURABILITY SPRAYED FIRE-RESISTIVE MATERIALS (HIGH-RISE)

- A. General: For standard density sprayed fire-resistive materials for interior spaces, or exposed to view only, and not exposed to weather, at high-rise construction and FM insured projects, provide manufacturer's standard products complying with requirements indicated for material composition and physical properties representative of installed products.
 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Carboline Company, subsidiary of RPM International, Fireproofing Products Div.; Type 5MD.
 - b. GCP Applied Technologies (formerly W.R. Grace); Monokote Type MK-10HB.
 - c. Isolatek International, Inc. Cafco 300 HS or Cafco 400 AC.
- B. Material Composition: Cementitious sprayed fire-resistive material consisting of factory-mixed, dry formulation of portland cement binders and lightweight mineral or synthetic aggregates mixed with water at Project site to form a slurry or mortar for conveyance and application, per ASTM E 1513.
- C. Physical Properties: Minimum values, unless otherwise indicated, or higher values required to attain designated fire-resistance ratings, measured per standard test methods referenced with each property as follows:
 1. Dry Density: 15 lb/cu. ft. for average and individual densities regardless of density indicated in referenced fire-resistance design, or greater if required to attain fire-resistance ratings indicated, per ASTM E 605 or AWCI Technical Manual 12-A, Section 5.4.5, "Displacement Method."

2. Thickness: Provide minimum average thickness required for fire-resistance design indicated according to the following criteria, but not less than 0.375 inch, per ASTM E 605:
 - a. Where the referenced fire-resistance design lists a thickness of 1 inch or greater, the minimum allowable individual thickness of sprayed fire-resistive material is the design thickness minus 0.25 inch.
 - b. Where the referenced fire-resistance design lists a thickness of less than 1 inch but more than 0.375 inch, the minimum allowable individual thickness of sprayed fire-resistive material is the greater of 0.375 inch or 75 percent of the design thickness.
 - c. No reduction in average thickness is permitted for those fire-resistance designs whose fire-resistance ratings were established at densities of less than 15 lb/cu. ft.
3. Bond Strength: 430 lbf/sq. ft. minimum per ASTM E 736 under the following conditions:
 - a. Field test sprayed fire-resistive material that is applied to flanges of wide-flange, structural-steel members on surfaces matching those that will exist for remainder of steel receiving fire-resistive material.
 - b. If surfaces of structural steel receiving sprayed fire-resistive material are primed or otherwise painted for coating materials, perform series of bond tests in accordance with ASTM E736 while using criteria of acceptance in UL's "Fire Resistance Directory."
 - c. Minimum thickness of sprayed fire-resistive material tested in laboratory shall be 0.75 inch.
4. Compressive Strength: 10 lbf/sq. in. as determined in the laboratory per ASTM E 761. Minimum thickness of sprayed fire-resistive material tested shall be 0.75 inch and minimum dry density shall be as specified, but not less than 15 lb/cu. ft.
5. Corrosion Resistance: No evidence of corrosion per ASTM E 937.
6. Deflection: No cracking, spalling, or delamination per ASTM E 759.
7. Effect of Impact on Bonding: No cracking, spalling, or delamination per ASTM E 760.
8. Air Erosion: Maximum weight loss of 0.025 g/sq. ft. in 24 hours per ASTM E 859. For laboratory tests, minimum thickness of sprayed fire-resistive material is 0.75 inch maximum dry density is 15 lb/cu. ft. test specimens are not prepurged by mechanically induced air velocities, and tests are terminated after 24 hours.
9. Fungal Resistance: No observed growth on specimens per ASTM G 21.

2.4 MEDIUM-DURABILITY CEMENTITIOUS SPRAYED FIRE-RESISTIVE MATERIALS

- A. General: **For medium-density sprayed fire-resistive materials for interior spaces exposed to view and abrasion (in final construction) but not to weather** provide manufacturer's standard products complying with requirements indicated for material composition and for minimum physical properties of each product listed, measured by standard test methods referenced with each property.
 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Carboline Company, subsidiary of RPM International, Fireproofing Products Div.; AD Southwest Fireproofing Type 7GP.

- b. GCP Applied Technologies (formerly W.R. Grace); Monokote Type Z-106/HY.
 - c. Isolatek International Corp., Cafco Products.; Cafco 300 or Cafco 400.
- B. Material Composition: Cementitious sprayed fire-resistive material consisting of factory-mixed, dry formulation of portland cement binders and lightweight mineral or synthetic aggregates mixed with water at Project site to form a slurry or mortar for conveyance and application, per ASTM E 1513.
- C. Physical Properties: Minimum values, unless otherwise indicated, or higher values required to attain designated fire-resistance ratings, measured per standard test methods referenced with each property as follows:
 - 1. Dry Density: 22 lb/cu. ft. for average and individual densities regardless of density indicated in referenced fire-resistance design, or greater if required to attain fire-resistance ratings indicated, per ASTM E 605 or AWCI Technical Manual 12-A, Section 5.4.5, "Displacement Method."
 - 2. Thickness: Provide minimum average thickness required for fire-resistance design indicated according to the following criteria, but not less than 0.375 inch, per ASTM E 605:
 - a. Where the referenced fire-resistance design lists a thickness of 1 inch or greater, the minimum allowable individual thickness of sprayed fire-resistive material is the design thickness minus 0.25 inch.
 - b. Where the referenced fire-resistance design lists a thickness of less than 1 inch but more than 0.375 inch, the minimum allowable individual thickness of sprayed fire-resistive material is the greater of 0.375 inch or 75 percent of the design thickness.
 - c. No reduction in average thickness is permitted for those fire-resistance designs whose fire-resistance ratings were established at densities of less than 22 lb/cu. ft.
 - 3. Bond Strength: 430 lbf/sq. ft. minimum per ASTM E 736 under the following conditions:
 - a. Field test sprayed fire-resistive material that is applied to flanges of wide-flange, structural-steel members on surfaces matching those that will exist for remainder of steel receiving fire-resistive material.
 - b. If surfaces of structural steel receiving sprayed fire-resistive material are primed or otherwise painted for coating materials, perform series of bond tests in accordance with ASTM E736 while using criteria of acceptance in UL's "Fire Resistance Directory."
 - c. Minimum thickness of sprayed fire-resistive material tested in laboratory shall be 0.75 inch.
 - 4. Compressive Strength: 100 psi as determined in the laboratory per ASTM E 761. Minimum thickness of sprayed fire-resistive material tested shall be 0.75 inch and minimum dry density shall be as specified, but not less than 22 lb/cu. ft.
 - 5. Corrosion Resistance: No evidence of corrosion per ASTM E 937.
 - 6. Deflection: No cracking, spalling, or delamination per ASTM E 759.
 - 7. Effect of Impact on Bonding: No cracking, spalling, or delamination per ASTM E 760.
 - 8. Air Erosion: Maximum weight loss of 0.025 g/sq. ft. in 24 hours per ASTM E 859. For laboratory tests, minimum thickness of sprayed fire-resistive material is 0.75 inch maximum dry density is 15 lb/cu. ft. test specimens are not prepurged by mechanically induced air velocities, and tests are terminated after 24 hours.

9. Fungal Resistance: No observed growth on specimens per ASTM G 21.

2.5 HIGH-DURABILITY CEMENTITIOUS SPRAYED FIRE-RESISTIVE MATERIALS

- A. General: For high-density sprayed fire-resistive materials for exposed spaces, including at loading docks, at parking garages, and where exposed to weather, provide manufacturer's standard products complying with requirements indicated for material composition and for minimum physical properties of each product listed, measured by standard test methods referenced with each property.
1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- a. Carboline Company, subsidiary of RPM International, Fireproofing Products Div.; AD Southwest Fireproofing Type 7HD.
 - b. GCP Applied Technologies (formerly W.R. Grace); Monokote Type Z146.
 - c. Isolatek International Corp., Cafco Products.; Fendolite MII.
- B. Material Composition: Cementitious sprayed fire-resistive material consisting of factory-mixed, dry formulation of portland cement binders and lightweight mineral or synthetic aggregates mixed with water at Project site to form a slurry or mortar for conveyance and application, per ASTM E 1513.
- C. Physical Properties: Minimum values, unless otherwise indicated, or higher values required to attain designated fire-resistance ratings, measured per standard test methods referenced with each property as follows:
1. Dry Density: 40 lb/cu. ft. for average and individual densities regardless of density indicated in referenced fire-resistance design, or greater if required to attain fire-resistance ratings indicated, per ASTM E 605.
2. Thickness: Provide minimum average thickness required for fire-resistance design indicated according to the following criteria, but not less than 0.375 inch, per ASTM E 605:
- a. Where the referenced fire-resistance design lists a thickness of 1 inch or greater, the minimum allowable individual thickness of sprayed fire-resistive material is the design thickness minus 0.25 inch.
 - b. Where the referenced fire-resistance design lists a thickness of less than 1 inch but more than 0.375 inch, the minimum allowable individual thickness of sprayed fire-resistive material is the greater of 0.375 inch or 75 percent of the design thickness.
 - c. No reduction in average thickness is permitted for those fire-resistance designs whose fire-resistance ratings were established at densities of less than 40 lb/cu. ft.
3. Bond Strength: 10,000 lbf/sq. ft. minimum per ASTM E 736 under the following conditions:
- a. Field test sprayed fire-resistive material that is applied to flanges of wide-flange, structural-steel members on surfaces matching those that will exist for remainder of steel receiving fire-resistive material.

- b. If surfaces of structural steel receiving sprayed fire-resistive material are primed or otherwise painted for coating materials, perform series of bond tests in accordance with ASTM E736 while using criteria of acceptance in UL's "Fire Resistance Directory."
 - c. Minimum thickness of sprayed fire-resistive material tested in laboratory shall be 0.75 inch.
- 4. Compressive Strength: Minimum 500 psi as determined in the laboratory per ASTM E 761. Minimum thickness of sprayed fire-resistive material tested shall be 0.75 inch and minimum dry density shall be as specified, but not less than 40 lb/cu. ft.
- 5. Corrosion Resistance: No evidence of corrosion per ASTM E 937.
- 6. Deflection: No cracking, spalling, or delamination per ASTM E 759.
- 7. Effect of Impact on Bonding: No cracking, spalling, or delamination per ASTM E 760.
- 8. Air Erosion: Maximum weight loss of 0.025 g/sq. ft. in 24 hours per ASTM E 859. For laboratory tests, minimum thickness of sprayed fire-resistive material is 0.75 inch maximum dry density is 15 lb/cu. ft. test specimens are not prepurged by mechanically induced air velocities, and tests are terminated after 24 hours.
- 9. Fungal Resistance: No observed growth on specimens per ASTM G 21.

2.6 SUPER HIGH-RISE DURABILITY SPRAYED FIRE-RESISTIVE MATERIALS

- A. Super High Rise Durability SFRM for interior locations, concealed or exposed to view only and not exposed to weather for buildings greater than 420 feet tall, provide manufacturer's standard products complying with requirements indicated for material composition and physical properties representative of installed products.
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Carboline Company, RPM International; AD Southwest Fireproofing Type 5MD.
 - b. GCP Applied Technologies (formerly W.R. Grace); Monokote Z-106 HY.
 - c. Isolatek International, Inc; Cafco 400.
- B. Material Composition: Cementitious sprayed fire-resistive material consisting of factory-mixed, lightweight, dry formulation, complying with indicated fire-resistance design, and mixed with water at Project site to form a slurry or mortar before conveyance and application, per ASTM E 1513.
- C. Physical Properties: Minimum values, unless otherwise indicated, or higher values required to attain designated fire-resistance ratings, measured per standard test methods referenced with each property as follows:
 - 1. Density: Not less than 18 lb/cu. ft. (240 kg/cu. m) and as specified in the approved fire-resistance design, according to ASTM E 605.
 - 2. Thickness: As required for fire-resistance design indicated, measured according to requirements of fire-resistance design or ASTM E 605, whichever is thicker, but not less than 0.375 inch (9 mm).
 - 3. Bond Strength: Minimum 1,000-lbf/sq. ft. (47.9-kPa) cohesive and adhesive strength based on field testing according to ASTM E 736.
 - 4. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

- a. Flame-Spread Index: 0.
- b. Smoke-Developed Index: 0.
- 5. Compressive Strength: Minimum 50 lbf/sq. in. (344 kPa) according to ASTM E 761.
- 6. Corrosion Resistance: No evidence of corrosion according to ASTM E 937.
- 7. Deflection: No cracking, spalling, or delamination according to ASTM E 759.
- 8. Effect of Impact on Bonding: No cracking, spalling, or delamination according to ASTM E 760.
- 9. Air Erosion: Maximum weight loss of 0.0 g/sq. ft. (0. 0 g/sq. m) in 24 hours according to ASTM E 859.
- 10. Fungal Resistance: Treat products with manufacturer's standard antimicrobial formulation to result in no growth on specimens per ASTM G 21.

2.7 EXPOSED THIN-FILM MASTIC AND INTUMESCENT FIRE-RESISTIVE COATINGS (MIFRC)

- A. Conditioned Interior Space Conditions: Coatings limited to interior climate controlled spaces having no exposure to condensation, and where the relative humidity and temperature are controlled according to the manufacturers recommendations or to not more than 75 percent, which ever is less, during the application and curing of the coating, the construction and the occupancy of the building.
 - 1. Isolatek International Corp., Cafco Products; Cafco SprayFilm WB 4 with topcoat.
 - 2. Carboline.; Thermo-Sorb VOC without topcoat.
 - 3. Sherwin Williams; Firetex FX5120 without topcoat.
- B. Interior General Use Conditions: Coatings limited to interior service where protection of the coating during application and curing, the construction and the occupancy of the building are as recommended by the product manufacturer for the specific application.
 - 1. Carboline; Firefilm III.
 - 2. Carboline; Thermo-Sorb VOC.
 - 3. Isolatek Internaional Corp., Cafco Products; Cafco SprayFilm WB-5.
- C. Exterior Use Conditions: Coatings for exterior use or interior use where exterior environmental conditions exist.
 - 1. Isolatek International Corp., Cafco Products; Cafco SprayFilm-WB 4 with Topseal.
 - 2. International Paint, LLC; Interchar 212 with topcoat.
 - 3. Carboline.; Thermo-Lag E100 with topcoat.
- D. Thin-Film Mastic and Intumescent Fire-Resistive Coating: Factory-mixed formulation.
 - 1. Approved by manufacturer and authorities having jurisdiction for interior or exterior use.
 - 2. Multicomponent system consisting of primer, intumescent base coat and topcoat.
 - 3. Systems shall comply with applicable VOC requirements and meet OTC emission regulations.
- E. Color and Gloss: As indicated by manufacturer's designations.

2.8 PATCHING EXISTING FIREPROOFING

- A. Patch Kit: Patch existing fireproofing disturbed by construction activities and areas with missing fireproofing in the area of work. Use patching materials and methods per products listed in the UL directory. Areas more than 1 square foot in area will require spray application with patch pump.
 - 1. Installer shall examine materials on site to identify original product; typically existing materials can be identified by appearance, color or size of vermiculite.
 - 2. Verify compatibility with existing fireproofing.
 - 3. Materials shall comply with recommendations in "UL Requirements for Patching SFRM."

2.9 AUXILIARY FIRE-RESISTIVE MATERIALS

- A. General: Provide auxiliary fire-resistive materials that are compatible with sprayed fire-resistive materials and substrates and are approved by UL or another testing and inspecting agency acceptable to authorities having jurisdiction for use in fire-resistance designs indicated.
- B. Substrate Primers: For use on each substrate and with each sprayed fire-resistive product, provide primer that complies with one or more of the following requirements:
 - 1. Primer's bond strength complies with requirements specified in UL's "Fire Resistance Directory," for coating materials based on a series of bond tests per ASTM E 736.
 - 2. Primer is identical to those used in assemblies tested for fire-test-response characteristics of sprayed fire-resistive material per ASTM E 119 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.
- C. Adhesive for Bonding Fire-Resistive Material: Product approved by manufacturer of sprayed fire-resistive material.
- D. Metal Lath: Expanded metal lath fabricated from material of weight, configuration, and finish required to comply with fire-resistance designs indicated and fire-resistive material manufacturer's written recommendations. Include clips, lathing accessories, corner beads, and other anchorage devices required to attach lath to substrates and to receive sprayed fire-resistive material.
- E. Reinforcing Fabric for Use with Intumescent Coatings: Glass-fiber fabric of type, weight, and form required to comply with fire-resistance designs indicated, approved by manufacturer of thin-film mastic and intumescent coating fire-resistive material.
- F. Topcoats: Provide fireproofing manufacturer recommended topcoats for exposed fireproofing.
 - 1. Color and Gloss: Provide custom colors as selected by Architect.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for substrates and other conditions affecting performance of work. A substrate is in satisfactory condition if it complies with the following:

1. Substrates comply with requirements in the Section where the substrate and related materials and construction are specified.
 2. Substrates are free of dirt, oil, grease, release agents, rolling compounds, mill scale, loose scale, incompatible primers, incompatible paints, incompatible encapsulants, or other foreign substances capable of impairing bond of fire-resistive materials with substrates under conditions of normal use or fire exposure.
 3. Objects penetrating fire-resistive material, including clips, hangers, support sleeves, and similar items, are securely attached to substrates.
 4. Substrates are not obstructed by ducts, piping, equipment, and other suspended construction that will interfere with applying fire-resistive material.
- B. Verify that concrete work on steel deck has been completed.
- C. Verify that roof construction, installation of rooftop HVAC equipment, and other related work are completed.
- D. Conduct tests according to fire-resistive material manufacturer's written recommendations to verify that substrates are free of substances capable of interfering with bond.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Cover other work subject to damage from fallout or overspray of fire-resistive materials during application.
- B. Clean substrates of substances that could impair bond of fire-resistive material, including dirt, oil, grease, release agents, rolling compounds, mill scale, loose scale, and incompatible primers, paints, and encapsulants.
- C. For exposed applications, repair substrates to remove surface imperfections that could affect uniformity of texture and thickness in finished surface of sprayed fire-resistive material. Remove minor projections and fill voids that would telegraph through fire-resistive products after application.

3.3 APPLICATION, GENERAL

- A. Comply with fire-resistive material manufacturer's written instructions for mixing materials, application procedures, and types of equipment used to mix, convey, and spray on fire-resistive material, as applicable to particular conditions of installation and as required to achieve fire-resistance ratings indicated.
- B. Apply sprayed fire-resistive material that is identical to products tested as specified in Part 1 "Quality Assurance" Article and substantiated by test reports, with respect to rate of application, accelerator use, sealers, topcoats, tamping, troweling, water overspray, or other materials and procedures affecting test results.
- C. Install metal lath and reinforcing fabric, as required, to comply with fire-resistance ratings and fire-resistive material manufacturer's written recommendations for conditions of exposure and intended use. Securely attach lath and fabric to substrate in position required for support and reinforcement of fire-resistive material. Use anchorage devices of type recommended in writing

by sprayed fire-resistive material manufacturer. Attach accessories where indicated or required for secure attachment of lath and fabric to substrate.

- D. Coat substrates with bonding adhesive before applying fire-resistive material where required to achieve fire-resistance rating or as recommended in writing by sprayed fire-resistive material manufacturer for material and application indicated.
- E. Extend fire-resistive material in full thickness over entire area of each substrate to be protected. Unless otherwise recommended in writing by sprayed fire-resistive material manufacturer, install body of fire-resistive covering in a single course.
- F. Spray apply fire-resistive materials to maximum extent possible. Following the spraying operation in each area, complete the coverage by trowel application or other placement method recommended in writing by sprayed fire-resistive material manufacturer.
- G. Where sealers are used, apply products that are tinted to differentiate them from sprayed fire-resistive material over which they are applied.

3.4 APPLICATION, CONCEALED SPRAYED FIRE-RESISTIVE MATERIALS

- A. Apply concealed sprayed fire-resistive material in thicknesses and densities not less than those required to achieve fire-resistance ratings designated for each condition.
- B. Cure concealed sprayed fire-resistive material according to product manufacturer's written recommendations.

3.5 APPLICATION, EXPOSED SPRAYED FIRE-RESISTIVE MATERIALS

- A. Apply exposed sprayed fire-resistive material in thicknesses and densities not less than those required to achieve fire-resistance ratings designated for each condition, but apply in greater thicknesses and densities if indicated.
- B. Provide a uniform finish complying with description indicated for each type of material and matching Architect's sample or, if none, finish approved for field-erected mockup.
- C. Apply exposed cementitious sprayed fire-resistive materials to produce the following finish:
 - 1. Even, spray-textured finish, produced by rolling flat surfaces of fire-protected members with a damp paint roller to remove drippings and excessive roughness.
- D. Cure exposed sprayed fire-resistive material according to product manufacturer's written recommendations.

3.6 APPLICATION, EXPOSED MASTIC AND INTUMESCENT FIRE-RESISTIVE COATINGS

- A. Apply exposed thin-film mastic and intumescent fire-resistive coatings in thicknesses and densities not less than those required to achieve fire-resistance ratings designated for each condition.
- B. Apply mastic and intumescent fire-resistive coating as follows:

1. Install reinforcing fabric as required to obtain designated fire-resistance rating and where indicated.
2. Finish: Even, spray-textured finish produced by lightly rolling flat surfaces of fire-protected members before fire-resistive material dries, to smooth out surface irregularities and to seal in surface fibers.

3.7 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections and prepare test reports, as required by 2015 IBC 1705.15.
 1. Cooperate with testing agency, provide access.
- B. Remove and replace applications of sprayed fire-resistive material that do not pass tests and inspections for cohesion and adhesion, for density, or for both and retest as specified above.
- C. Apply additional sprayed fire-resistive material, per manufacturer's written instructions, where test results indicate that thickness does not comply with specified requirements, and retest as specified above.
- D. Field inspect intumescent materials in accordance with AWCI Tech Manual 12B.

3.8 CLEANING, PROTECTING, AND REPAIR

- A. Cleaning: Immediately after completing spraying operations in each containable area of Project, remove material overspray and fallout from surfaces of other construction and clean exposed surfaces to remove evidence of soiling.
- B. Protect sprayed fire-resistive material, according to advice of product manufacturer and Installer, from damage resulting from construction operations or other causes so fire protection will be without damage or deterioration at time of Substantial Completion.
- C. Coordinate application of sprayed fire-resistive material with other construction to minimize need to cut or remove fire protection. As installation of other construction proceeds, inspect sprayed fire-resistive material and patch any damaged or removed areas.
- D. Repair or replace work that has not successfully protected steel.

END OF SECTION

SECTION 078410

PENETRATION FIRESTOPPING

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Through-penetration firestop systems for penetrations through fire-resistance-rated constructions, including both empty openings and openings containing penetrating items.
- B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council. Refer to Section 018110, SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.
- C. Related Work: The following items are not included in this Section and will be performed under the designated Sections:
 - 1. Section 078440 - FIRE-RESISTIVE JOINT SYSTEMS for fire-resistive joint sealers.
 - 2. Section 079200 - JOINT SEALANTS for standard joint sealers.
 - 3. Section 142100 - ELECTRIC TRACTION ELEVATORS for cutting penetrations for traction elevator piping, cabling and conduit penetrations and providing firestopping complying with requirements in this Section.
 - 4. Division 21 - FIRE SUPPRESSION for cutting penetrations for fire-suppression piping and providing firestopping complying with requirements in this Section.
 - 5. Division 22 - PLUMBING for cutting penetrations for plumbing piping and providing firestopping complying with requirements in this Section.
 - 6. Division 23 - HEATING, VENTILATING AND AIR CONDITIONING for cutting penetrations for ductwork and HVAC piping and providing firestopping complying with requirements in this Section.
 - 7. Division 25 - INTEGRATED AUTOMATION for cutting penetrations for cable and conduit and providing firestopping complying with requirements in this Section.
 - 8. Division 26 - ELECTRICAL for cutting penetrations for cable and conduit and providing firestopping complying with requirements in this Section.
 - 9. Division 27 - COMMUNICATIONS for cutting penetrations for cable and conduit and providing firestopping complying with requirements in this Section.
 - 10. Division 28 - ELECTRONIC SAFETY AND SECURITY for cutting penetrations for cable and conduit and providing firestopping complying with requirements in this Section.

1.3 COORDINATION

- A. Jobsite conditions of each through-penetration firestop system must meet all details of the UL-Classified System selected. If jobsite conditions do not match any UL-classified systems, contact firestop manufacturer for alternative systems or Engineer Judgment Drawings.
- B. Coordinate work with other trades to assure that penetration-opening sizes are appropriate for penetrant locations.
- C. Verify that the schedule is current at the time of construction, and that each referenced system is suitable for the intended application.

1.4 PERFORMANCE REQUIREMENTS

- A. General: For penetrations through fire-resistance-rated constructions, including both empty openings and openings containing penetrating items, provide through-penetration firestop systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated.
- B. Penetrations in Fire-Resistance-Rated Walls: Provide penetration firestopping with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg (2.49 Pa).
 - 1. Fire-resistance-rated walls include fire walls, fire-barrier walls, smoke-barrier walls and fire partitions.
 - 2. F-Rating: Not less than the fire-resistance rating of constructions penetrated.
- C. Penetrations in Horizontal Assemblies: Provide penetration firestopping with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg (2.49 Pa).
 - 1. Horizontal assemblies include floors, floor/ceiling assemblies and ceiling membranes of roof/ceiling assemblies.
 - 2. F-Rating: At least 1 hour, but not less than the fire-resistance rating of constructions penetrated.
 - 3. T-Rating: At least 1 hour, but not less than the fire-resistance rating of constructions penetrated except for floor penetrations within the cavity of a wall.
- D. Penetrations in Smoke Barriers: Provide penetration firestopping with ratings determined per UL 1479.
 - 1. L-Rating: Not exceeding 5.0 cfm/sq. ft. (0.025 cu. m/s per sq. m) of penetration opening at 0.30-inch wg (74.7 Pa) at both ambient and elevated temperatures.
- E. Exposed Penetration Firestopping:
 - 1. Provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.
 - 2. For through-penetration firestop systems exposed to view, traffic, moisture, and physical damage, provide products that, after curing, do not deteriorate when exposed to these conditions both during and after construction.

- a. For piping penetrations for plumbing and wet-pipe sprinkler systems, provide moisture-resistant through-penetration firestop systems demonstrating no evidence of water leakage when tested according to UL 1479.
 - b. For floor penetrations with annular spaces exceeding 4 inches in width and exposed to possible loading and traffic, provide firestop systems capable of supporting floor loads involved, either by installing floor plates or by other means.
- F. For penetrations involving insulated piping, provide through-penetration firestop systems not requiring removal of insulation.

1.5 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. LEED Submittals:
 - 1. Building Product Disclosure and Optimization, Material Ingredients:
 - a. Option 1, Material Ingredient Reporting: For firestopping products, submit Health Product Declarations (HPD) or Declare product labels.
 - 2. Low-Emitting Materials, General Emissions Evaluation: Building products must be tested and determined compliant in accordance with California Department of Public Health (CDPH) Standard Method v1.1–2010, using the applicable exposure scenario.
 - a. For firestopping, submit test results, including TVOC emissions and VOC content.
 - b. For wet-applied products, submit volume used.
- C. Shop Drawings: For each through-penetration firestop system, show each type of construction condition penetrated, relationships to adjoining construction, and type of penetrating item. Include firestop design designation of qualified testing and inspecting agency that evidences compliance with requirements for each condition indicated.
 - 1. Submit documentation, including illustrations, from a qualified testing and inspecting agency that is applicable to each through-penetration firestop system configuration for construction and penetrating items.
- D. Through-Penetration Firestop System Schedule: Indicate locations of each through-penetration firestop system, along with the following information:
 - 1. Types of penetrating items.
 - 2. Types of constructions penetrated, including fire-resistance ratings and, where applicable, thicknesses of construction penetrated.
 - 3. Through-penetration firestop systems for each location identified by firestop design designation of qualified testing and inspecting agency.

- E. Qualification Data: For Installer.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: Either a firm that has been approved by FMG according to FMG 4991, "Approval of Firestop Contractors" or a firm experienced in installing through-penetration

firestop systems similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction of a minimum of five projects with a record of successful performance. Qualifications include having the necessary experience, staff, and training to install manufacturer's products per specified requirements.

- B. Installation Responsibility: Assign installation of through-penetration firestop systems and fire-resistive joint systems in Project to a single qualified installer.
- C. Source Limitations: Obtain through-penetration firestop systems, for each kind of penetration and construction condition indicated, through one source from a single manufacturer.
- D. Fire-Test-Response Characteristics: Provide through-penetration firestop systems that comply with the following requirements and those specified in Part 1 "Performance Requirements" Article:
 - 1. Firestopping tests are performed by a qualified testing and inspecting agency. A qualified testing and inspecting agency is UL or another agency performing testing and follow-up inspection services for firestop systems acceptable to authorities having jurisdiction.
 - 2. Through-penetration firestop systems are identical to those tested per testing standard referenced in "Part 1 Performance Requirements" Article. Provide rated systems complying with the following requirements:
 - a. Through-penetration firestop system products bear classification marking of qualified testing and inspecting agency.
 - b. Through-penetration firestop systems correspond to those indicated by reference to through-penetration firestop system designations listed in the UL "Fire Resistance Directory."
- E. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver through-penetration firestop system products to Project site in original, unopened containers or packages with intact and legible manufacturers' labels identifying product and manufacturer, date of manufacture, lot number, shelf life if applicable, qualified testing and inspecting agency's classification marking applicable to Project, curing time, and mixing instructions for multicomponent materials.
- B. Store and handle materials for through-penetration firestop systems to prevent their deterioration or damage due to moisture, temperature changes, contaminants, or other causes.

1.8 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install through-penetration firestop systems when ambient or substrate temperatures are outside limits permitted by through-penetration firestop system manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.
- B. Ventilate through-penetration firestop systems per manufacturer's written instructions by natural means or, where this is inadequate, forced-air circulation.

1.9 COORDINATION

- A. Coordinate construction of openings and penetrating items to ensure that through-penetration firestop systems are installed according to specified requirements.
- B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate through-penetration firestop systems.
- C. Do not cover up through-penetration firestop system installations that will become concealed behind other construction until each installation has been examined building inspector, if required by authorities having jurisdiction.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Products: Subject to compliance with requirements, through-penetration firestop systems that may be incorporated into the Work include, but are not limited to the following:
 - 1. Hilti, Inc.
 - 2. BioFireShield; RectorSeal Corporation.
 - 3. Specified Technologies, Inc. (STI).
 - 4. 3M; Fire Protection Products Division.

2.2 FIRESTOPPING MATERIALS

- A. Low-Emitting Materials: Penetration firestopping sealants and sealant primers 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. VOC Content: Penetration firestopping sealants and sealant primers shall comply with the following limits for VOC content:
 - 1. Sealants: 250 g/L.
 - 2. Sealant Primers for Nonporous Substrates: 250 g/L.
 - 3. Sealant Primers for Porous Substrates: 775 g/L.
 - 4. Methylene chloride and perchloroethylene may not be intentionally added to sealants.
- C. Compatibility: Provide through-penetration firestop systems that are compatible with one another; with the substrates forming openings; and with the items, if any, penetrating through-penetration firestop systems, under conditions of service and application, as demonstrated by through-penetration firestop system manufacturer based on testing and field experience.
- D. Materials: Provide through-penetration firestop systems containing primary materials and fill materials which are part of the tested assemblies indicated in the approved Through-Penetration Firestop System Schedule submittal. Fill materials are those referred to in directories of referenced testing and inspecting agencies as "fill," "void," or "cavity" materials.
 - 1. Available Products:

- a. BioFireshield; RectorSeal Smoke and Acoustic Sealant.
 - b. Hilti; CP 606 Flexible Firestop Sealant.
 - c. Hilti; CP 653 BA Firestop Speed Sleeve.
 - d. Hilti; FS-ONE Intumescent Firestop Sealant.
- E. Accessories: Provide components for each through-penetration firestop system that are needed to install fill materials and to comply with Part 1 "Performance Requirements" Article. Use only components specified by through-penetration firestop system manufacturer and approved by qualified testing and inspecting agency for firestop systems indicated.
- F. Endothermic Mats: 3M Interam Endothermic Mats by 3M Fire Protection Products; located in rated walls behind cabinet unit heaters, fire extinguisher cabinets and electrical panels where there are space limitations to maintain the wall rating.

2.3 MIXING

- A. For those products requiring mixing before application, comply with through-penetration firestop system manufacturer's written instructions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other items or procedures needed to produce products of uniform quality with optimum performance characteristics for application indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of work. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Cleaning: Clean out openings immediately before installing through-penetration firestop systems to comply with firestop system manufacturer's written instructions and with the following requirements:
 - 1. Remove from surfaces of opening substrates and from penetrating items foreign materials that could interfere with adhesion of through-penetration firestop systems.
 - 2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with through-penetration firestop systems. Remove loose particles remaining from cleaning operation.
 - 3. Remove laitance and form-release agents from concrete.
- B. Priming: Prime substrates where recommended in writing by through-penetration firestop system manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.
- C. Masking Tape: Use masking tape to prevent through-penetration firestop systems from contacting adjoining surfaces that will remain exposed on completion of Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to

remove smears from firestop system materials. Remove tape as soon as possible without disturbing firestop system's seal with substrates.

3.3 THROUGH-PENETRATION FIRESTOP SYSTEM INSTALLATION

- A. General: Install through-penetration firestop systems to comply with Part 1 "Performance Requirements" Article and with firestop system manufacturer's written installation instructions and published drawings for products and applications indicated.
- B. Install forming/damming/backing materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.
- C. Install fill materials for firestop systems by proven techniques to produce the following results:
 - 1. Fill voids and cavities formed by openings, forming materials, accessories, and penetrating items as required to achieve fire-resistance ratings indicated.
 - 2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
 - 3. For fill materials that will remain exposed after completing Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.4 FIELD QUALITY CONTROL

- A. Inspecting Agency: Owner will engage a qualified testing agency to perform tests and inspections and prepare test reports, as required by 2015 IBC 1705.17 and 1705.17.1. Independent inspecting agency shall comply with ASTM E 2174 requirements including those related to qualifications, conducting inspections, and preparing test reports
- B. Where deficiencies are found, repair or replace through-penetration firestop systems so they comply with requirements.
- C. Proceed with enclosing through-penetration firestop systems with other construction only after inspection reports are issued and firestop installations comply with requirements.

3.5 CLEANING AND PROTECTING

- A. Clean off excess fill materials adjacent to openings as Work progresses by methods and with cleaning materials that are approved in writing by through-penetration firestop system manufacturers and that do not damage materials in which openings occur.
- B. Provide final protection and maintain conditions during and after installation that ensure that through-penetration firestop systems are without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated through-penetration firestop systems immediately and install new materials to produce systems complying with specified requirements.

END OF SECTION

SECTION 078440

FIRE-RESISTIVE JOINT SYSTEMS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the Work of this Section, including but not limited to fire-resistive joint systems for the following:
 - 1. Floor-to-floor joints.
 - 2. Floor-to-wall joints.
 - 3. Head-of-wall joints.
 - 4. Wall-to-wall joints.
 - 5. Perimeter fire-resistive joint systems consisting of floor-to-wall joints between perimeter edge of fire-resistance-rated floor assemblies and exterior curtain walls.
- B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council. Refer to Section 018110, SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.
- C. Related Work: The following items are not included in this Section and will be performed under the designated Sections:
 - 1. Section 078410 - PENETRATION FIRESTOPPING for firestopping.
 - 2. Division 21 - FIRE SUPPRESSION for fire-protection piping penetrations.
 - 3. Division 22 - PLUMBING for piping penetrations.
 - 4. Division 23 - HEATING, VENTILATING AND AIR CONDITIONING for duct and piping penetrations.
 - 5. Division 26 - ELECTRICAL for cable and conduit penetrations.

1.3 PERFORMANCE REQUIREMENTS

- A. General: Provide fire-resistive joint systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of assembly in which fire-resistive joint systems are installed.
- B. For fire-resistive systems exposed to view, provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. LEED Submittals:
 - 1. Building Product Disclosure and Optimization, Material Ingredients:
 - a. Option 1, Material Ingredient Reporting: For fire-resistive joint system sealants, submit Health Product Declarations (HPD) or Declare product labels.
 - 2. Low-Emitting Materials, General Emissions Evaluation: Building products must be tested and determined compliant in accordance with California Department of Public Health (CDPH) Standard Method v1.1–2010, using the applicable exposure scenario.
 - a. For fire-resistive joint system sealants, submit test results, including TVOC emissions and VOC content.
 - b. For fire-resistive joint system sealants, submit GreenGuard Gold certifications.
 - c. For wet-applied products, submit volume used.
- C. Shop Drawings: For each fire-resistive joint system, show each kind of construction condition in which joints are installed; also show relationships to adjoining construction. Include fire-resistive joint system design designation of testing and inspecting agency acceptable to authorities having jurisdiction that demonstrates compliance with requirements for each condition indicated.
 - 1. Submit documentation, including illustrations, from a qualified testing and inspecting agency that is applicable to each fire-resistive joint system configuration for construction and penetrating items.
- D. Fire-Resistive Joint Systems Schedule: For each fire-resistive joint system. Include location and design designation of qualified testing agency.
 - 1. Where Project conditions require modification to a qualified testing agency's illustration for a particular fire-resistive joint system condition, submit illustration, with modifications marked, approved by fire-resistive joint system manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly.
- E. Product Certificates: For each type of fire-resistive joint system, signed by product manufacturer.
- F. Qualification Data: For Installer.
- G. Field quality-control test reports.
- H. Research/Evaluation Reports: For each type of fire-resistive joint system.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: A firm experienced in installing through-penetration fire stop systems similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction of a minimum of five projects with a record of successful performance.

Qualifications include having the necessary experience, staff, and training to install manufacturer's products per specified requirements. Evidence of FMG 4991 approval is acceptable for installer qualifications, but not mandatory.

- B. Installation Responsibility: Assign installation of through-penetration firestop systems and fire-resistive joint systems in Project to a single qualified installer.
- C. Source Limitations: Obtain fire-resistive joint systems, for each kind of joint and construction condition indicated, through one source from a single manufacturer.
- D. Fire-Test-Response Characteristics: Provide fire-resistive joint systems that comply with the following requirements and those specified in Part 1 "Performance Requirements" Article:
 - 1. Fire-resistance tests are performed by a qualified testing and inspecting agency. A qualified testing and inspecting agency is UL or another agency performing testing and follow-up inspection services for fire-resistive joint systems acceptable to authorities having jurisdiction.
 - 2. Fire-resistive joint systems are identical to those tested per methods indicated in Part 1 "Performance Requirements" Article and comply with the following:
 - a. Fire-resistive joint system products bear classification marking of qualified testing and inspecting agency.
 - b. Fire-resistive joint systems correspond to those indicated by referencing system designations of the qualified testing and inspecting agency.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver fire-resistive joint system products to Project site in original, unopened containers or packages with qualified testing and inspecting agency's classification marking applicable to Project and with intact and legible manufacturers' labels identifying product and manufacturer, date of manufacture, lot number, shelf life, curing time, and mixing instructions for multicomponent materials.
- B. Store and handle materials for fire-resistive joint systems to prevent their deterioration or damage due to moisture, temperature changes, contaminants, or other causes.

1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install fire-resistive joint systems when ambient or substrate temperatures are outside limits permitted by fire-resistive joint system manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.
- B. Ventilate fire-resistive joint systems per manufacturer's written instructions by natural means or, if this is inadequate, forced-air circulation.

1.8 COORDINATION

- A. Coordinate construction of joints to ensure that fire-resistive joint systems are installed according to specified requirements.
- B. Coordinate sizing of joints to accommodate fire-resistive joint systems.

- C. Do not cover up through-penetration firestop system installations that will become concealed behind other construction until each installation has been examined building inspector, if required by authorities having jurisdiction.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Products: Subject to compliance with requirements, fire-resistive joint systems that may be incorporated into the Work include, but are not limited to the following:
 - 1. Hilti, Inc.
 - 2. BioFireShield; RectorSeal Corporation.
 - 3. Specified Technologies, Inc. (STI).
 - 4. 3M; Fire Protection Products Division.

2.2 FIRE-RESISTIVE JOINT SYSTEMS

- A. Low-Emitting Materials: Fire-resistive joint system sealants 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. VOC Content: Provide fire-resistive joint system sealants that comply with the following limits for VOC content:
 - 1. Architectural Sealants: 250 g/L.
 - 2. Sealant Primers for Nonporous Substrates: 250 g/L.
 - 3. Sealant Primers for Porous Substrates: 775 g/L.
 - 4. Methylene chloride and perchloroethylene may not be intentionally added to sealants.
- C. General: Where required, provide fire-resistive joint systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of assemblies in or between which fire-resistive joint systems are installed. Fire-resistive joint systems shall accommodate building movements without impairing their ability to resist the passage of fire and hot gases.
- D. Joints in or between Fire-Resistance-Rated Construction: Provide fire-resistive joint systems with ratings determined per ASTM E 1966 or UL 2079.
- E. Joints at Exterior Curtain-Wall/Floor Intersections: Provide fire-resistive joint systems with rating determined by ASTM E 119 based on testing at a positive pressure differential of 0.01-inch wg (2.49 Pa) or ASTM E 2307.
 - 1. Fire-Resistance Rating: Equal to or exceeding the fire-resistance rating of the floor assembly.
- F. Joints in Smoke Barriers: Provide fire-resistive joint systems with ratings determined per UL 2079.

1. L-Rating: Not exceeding 5.0 cfm/ft (0.00775 cu. m/s x m) of joint at 0.30 inch wg (74.7 Pa) at both ambient and elevated temperatures.
- G. Compatibility: Provide fire-resistive joint systems that are compatible with joint substrates, under conditions of service and application, as demonstrated by fire-resistive joint system manufacturer based on testing and field experience.
- H. Accessories: Provide components of fire-resistive joint systems, including primers and forming materials, that are needed to install fill materials and to comply with Part 1 "Performance Requirements" Article. Use only components specified by fire-resistive joint system manufacturer and approved by the qualified testing and inspecting agency for systems indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for joint configurations, substrates, and other conditions affecting performance of work.
 1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Cleaning: Clean joints immediately before installing fire-resistive joint systems to comply with fire-resistive joint system manufacturer's written instructions and the following requirements:
 1. Remove from surfaces of joint substrates foreign materials that could interfere with adhesion of fill materials.
 2. Clean joint substrates to produce clean, sound surfaces capable of developing optimum bond with fill materials. Remove loose particles remaining from cleaning operation.
 3. Remove laitance and form-release agents from concrete.
- B. Priming: Prime substrates where recommended in writing by fire-resistive joint system manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.
- C. Masking Tape: Use masking tape to prevent fill materials of fire-resistive joint system from contacting adjoining surfaces that will remain exposed on completion of Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove smears from fire-resistive joint system materials. Remove tape as soon as possible without disturbing fire-resistive joint system's seal with substrates or damaging adjoining surfaces.

3.3 INSTALLATION

- A. General: Install fire-resistive joint systems to comply with Part 1 "Performance Requirements" Article and fire-resistive joint system manufacturer's written installation instructions for products and applications indicated.

- B. Install forming/packing/backing materials and other accessories of types required to support fill materials during their application and in position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.
- C. Install fill materials for fire-resistive joint systems by proven techniques to produce the following results:
 - 1. Fill voids and cavities formed by openings and forming/packing/backing materials as required to achieve fire-resistance ratings indicated.
 - 2. Apply fill materials so they contact and adhere to substrates formed by joints.
 - 3. For fill materials that will remain exposed after completing Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.4 FIELD QUALITY CONTROL

- A. Inspecting Agency: Owner will engage a qualified testing agency to perform tests and inspections and prepare test reports, as required by 2015 IBC 1705.17 and 1705.17.2. Independent inspecting agency shall comply with ASTM E 2393 requirements including those related to qualifications, conducting inspections, and preparing test reports.
- B. Testing Services: Inspecting of completed installations of fire-resistive joint systems shall take place in successive stages as installation of fire-resistive joint systems proceeds. Do not proceed with installation of joint systems for the next area until inspecting agency determines completed work shows compliance with requirements.
 - 1. Inspecting agency shall state in each report whether inspected fire-resistive joint systems comply with or deviate from requirements.
- C. Remove and replace fire-resistive joint systems where inspections indicate that they do not comply with specified requirements.
- D. Additional inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
- E. Proceed with enclosing fire-resistive joint systems with other construction only after inspection reports are issued and fire-resistive joint systems comply with requirements.

3.5 CLEANING AND PROTECTING

- A. Clean off excess fill materials adjacent to joints as Work progresses by methods and with cleaning materials that are approved in writing by fire-resistive joint system manufacturers and that do not damage materials in which openings occur.
- B. Provide final protection and maintain conditions during and after installation that ensure fire-resistive joint systems are without damage or deterioration at time of Substantial Completion. If damage or deterioration occurs despite such protection, cut out and remove damaged or deteriorated fire-resistive joint systems immediately and install new materials to produce fire-resistive joint systems complying with specified requirements.

END OF SECTION

SECTION 079200

JOINT SEALANTS

(Part of Work of Section 070001 - WATERPROOFING, DAMPPROOFING AND CAULKING,
Filed Sub-Bid Required)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Joint sealants and fillers.
- B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council. Refer to Section 018110, SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 042000 - UNIT MASONRY for masonry control and expansion joint fillers and gaskets.
 - 2. Section 088000 - GLAZING for glazing sealants.
 - 3. Section 092110 - GYPSUM BOARD ASSEMBLIES for sealing perimeter joints of gypsum board partitions to reduce sound transmission.
 - 4. Section 093000 - TILING for sealing of expansion, contraction, control, and isolation joints in tile surfaces.
 - 5. Section 095100 - ACOUSTICAL CEILINGS for sealing edge moldings at perimeters of acoustical ceilings.

1.3 PERFORMANCE REQUIREMENTS

- A. Provide elastomeric joint sealants that establish and maintain watertight and airtight continuous joint seals without staining or deteriorating joint substrates.
- B. Provide joint sealants for interior applications that establish and maintain airtight and water-resistant continuous joint seals without staining or deteriorating joint substrates.

1.4 SUBMITTALS

- A. Product Data: For each product indicated.
- B. LEED Submittals:
 - 1. Building Product Disclosure and Optimization, Material Ingredients:
 - a. Option 1, Material Ingredient Reporting: For sealants, submit Health Product Declarations (HPD) or Declare product labels.
 - 2. Low-Emitting Materials, General Emissions Evaluation: Building products must be tested and determined compliant in accordance with California Department of Public Health (CDPH) Standard Method v1.1–2010, using the applicable exposure scenario.
 - a. For sealants, submit test results, including TVOC emissions and VOC content.
 - b. For sealants, submit GreenGuard Gold certifications.
 - c. For wet-applied products, submit volume used.
- C. Samples for Verification: For each type and color of joint sealant required, provide Samples with joint sealants in 1/2-inch- wide joints formed between two 6-inch-long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.
- D. 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.
- E. Qualification Data: For Installer and qualified testing agency.
- F. Product Test Reports: Based on comprehensive testing of product formulations performed by a qualified testing agency, indicating that sealants comply with requirements.
- G. Preconstruction Field Test Reports: Indicate which sealants and joint preparation methods resulted in optimum adhesion to joint substrates based on preconstruction testing specified in "Quality Assurance" Article.
- H. Compatibility and Adhesion Test Reports: From sealant manufacturer, indicating the following:
 - 1. Materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with joint sealants.
 - 2. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.
- I. Field Test Report Log: For each elastomeric sealant application.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized Installer who is approved or licensed for installation of elastomeric sealants required for this Project.

- 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.
- C. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.
- D. Preconstruction Compatibility and Adhesion Testing: Submit to joint-sealant manufacturers, for testing indicated below, samples of materials that will contact or affect joint sealants.
 - 1. Use manufacturer's standard test method to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.
 - a. Adhesion Testing: Use ASTM C 794 to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.
 - b. Compatibility Testing: Use ASTM C 1087 to determine sealant compatibility when in contact with joint sealant backing and glazing and gasket materials.
 - 2. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
 - 3. For materials failing tests, obtain joint-sealant manufacturer's written instructions for corrective measures including use of specially formulated primers.
 - 4. Testing will not be required if joint-sealant manufacturers submit joint preparation data that are based on previous testing of current sealant products for adhesion to, and compatibility with, joint substrates and other materials matching those submitted.
- E. Preconstruction Field-Adhesion Testing: Before installing elastomeric sealants, field test their adhesion to Project joint substrates as follows:
 - 1. Locate test joints where indicated on Project or, if not indicated, as directed by Architect.
 - 2. Conduct field tests for each application indicated below:
 - a. Each type of elastomeric sealant and joint substrate indicated.
 - b. Each type of nonelastomeric sealant and joint substrate indicated.
 - 3. Notify Architect seven days in advance of dates and times when test joints will be erected.
 - a. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C 1193.
 - 1) 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.
 - 4. Report whether sealant in joint connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each type of product and joint substrate. For sealants that fail adhesively, retest until satisfactory adhesion is obtained.

5. Evaluation of Preconstruction Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing, in absence of other indications of noncompliance with requirements, will be considered satisfactory. Do not use sealants that fail to adhere to joint substrates during testing.

- F. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01.

1.6 PROJECT CONDITIONS

- A. Do not proceed with installation of joint sealants under the following conditions:
 1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F.
 2. When joint substrates are wet.
 3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
 4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.7 WARRANTY

- A. Special Installer's Warranty: Installer's standard form in which Installer agrees to repair or replace elastomeric joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
 1. Warranty Period: Two years from date of Substantial Completion.
- B. Special Manufacturer's Warranty: Manufacturer's standard form in which elastomeric sealant manufacturer agrees to furnish elastomeric joint sealants to repair or replace those that do not comply with performance and other requirements specified in this Section within specified warranty period.
 1. Warranty Period: Five 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 natural 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 MATERIALS, GENERAL

- A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer, based on testing and field experience.
- B. Low-Emitting Materials: Interior sealants 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."
- C. VOC Content: Provide interior sealants and sealant primers that comply with the following limits for VOC content:
 - 1. Architectural Sealants: 250 g/L.
 - 2. Sealant Primers for Nonporous Substrates: 250 g/L.
 - 3. Sealant Primers for Porous Substrates: 775 g/L.
 - 4. Methylene chloride and perchloroethylene may not be intentionally added to sealants.
- D. Colors of Exposed Joint Sealants: Provide colors as selected by the Architect from manufacturer's full range of standard and custom colors; maximum of five colors, three standard colors and two custom colors.

2.2 JOINT SEALANTS

- A. Elastomeric Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied chemically curing sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.
- B. Stain-Test-Response Characteristics: Elastomeric sealants shall be nonstaining to porous substrates. Provide products that have undergone testing according to ASTM C 1248 and have not stained porous joint substrates indicated for Project.
- C. Suitability for Contact with Food: Where elastomeric sealants are indicated for joints that will come in repeated contact with food, provide products that comply with 21 CFR 177.2600 or ANSI/NSF Standard 51.
- D. Exterior Silicone Sealant, Single-Component Neutral-Curing Type:
 - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Dow Corning Corporation; 790.
 - b. GE Silicones; SilPruf LM SCS2700.
 - c. Pecora Corporation; 864.
 - d. Tremco Inc.; Spectrem 1.
 - 2. Extent of Use: Exterior joints in vertical and soffit surfaces.
- E. Exterior Urethane Sealant, Multicomponent Pourable (Self-Leveling) Type for Pedestrian Traffic: ASTM C 920, Type M, Grade P, Class 25, Use T, M, & O.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Meadows, W. R., Inc.; POURTHANE.
 - b. Pecora Corporation; Urexpan NR-200.
 - c. Sika; Sikaflex-2c SL.
 - d. Tremco Inc.; THC-901.
 2. Extent of Use: Exterior joints in horizontal surfaces.
- F. Interior Sanitary Silicone Sealant, Single-Component Mildew-Resistant, Acid-Curing (Acetoxy) Type: ASTM C 920, Type S, Grade NS, Class 25, Use NT, G, A, and O.
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Bostik; Pure Silicone.
 - b. Dow Corning Corporation; 786 Mildew Resistant.
 - c. GE Silicones; Sanitary SCS1700.
 - d. Pecora; 898NST.
 - e. Sika; Sikasil GP.
 - f. Tremco; Tremsil 200.
 2. Extent of Use: Interior sanitary joints at toilet rooms, kitchens, and other wet areas.
- G. Interior Acrylic Latex Sealant: Acrylic latex or siliconized acrylic latex, ASTM C 834, Type OP, Grade NF.
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Henkel Corp.; Loctite Polyseamseal Acrylic Caulk with Silicone.
 - b. Pecora Corporation; AC-20+.
 - c. Tremco Inc.; Tremflex 834.
 2. Extent of Use: Interior non-moving joints.
- 2.3 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.
 - B. Cylindrical Sealant Backings: ASTM C 1330, Type B (bicellular material with a surface skin) or other type, as approved in writing by joint-sealant manufacturer for joint application indicated, and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.
 1. Availavle Products: Armacell Canada Inc.; ITP Standard Backer Rod; or approved equal.
 - 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 where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

2.4 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 joint-sealant performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions 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, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include concrete, masonry, unglazed surfaces of ceramic tile, and exterior insulation and finish systems.
 - 3. Remove laitance and form-release agents from concrete.
 - 4. Clean nonporous 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 metal, glass, porcelain enamel, and glazed surfaces of ceramic tile.
- B. Joint Priming: Prime joint substrates, where recommended in writing by joint-sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience. Apply

primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

- C. Masking Tape: Use masking tape where required to prevent contact of sealant with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 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 type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
 - 1. 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 below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
 - 1. Remove excess sealant from surfaces adjacent to joints.
 - 2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
 - 3. Provide concave joint configuration per Figure 5A in ASTM C 1193, unless otherwise indicated.

3.4 FIELD QUALITY CONTROL

- A. Field-Adhesion Testing: Field test joint-sealant adhesion to joint substrates as follows:
 - 1. Extent of Testing: Test completed and cured sealant joints as follows:

- a. Perform one test for each 1000 feet of joint length thereafter or one test per each floor per elevation.
 2. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C1193 or Method A, Tail Procedure, in ASTM C1521.
 - 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 and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

END OF SECTION

SECTION 079500
EXPANSION CONTROL

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Architectural expansion joint systems for interior and exterior joints as scheduled on the Drawings and specified in this Section.
- B. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 033000 - CAST-IN-PLACE CONCRETE for block-outs for architectural joint systems in concrete floors, decks, and walls.
 - 2. Section 042000 - UNIT MASONRY for masonry wall expansion joint cover.
 - 3. Section 075400 - THERMOPLASTIC MEMBRANE ROOFING for roof level expansion joint.
 - 4. Section 078446 - FIRE-RESISTIVE JOINT SYSTEMS for fire-resistive joints not associated with expansion control assemblies.
 - 5. Section 079200 - JOINT SEALANTS for elastomeric sealants and preformed compressed-foam sealants without metal frames.
 - 6. Section 092110 - GYPSUM BOARD ASSEMBLIES for framing joint in gypsum board assemblies.

1.3 DEFINITIONS

- A. Architectural Joint System: Any filler or cover used to span, fill, cover, or seal a joint, except expanding foam seals and poured or foamed in-place sealants.
- B. Cyclic Movement: Periodic change between widest and narrowest joint widths in an automatically mechanically controlled system.
- C. Fire Barriers: Any material or material combination, when fire tested after cycling, designated to resist passage of flame and hot gases through a movement joint.
- D. Maximum Joint Width: Widest linear gap a joint system tolerates and performs its designed function without damaging its functional capabilities.

- E. Minimum Joint Width: Narrowest linear gap a joint system tolerates and performs its designed function without damaging its functional capabilities.
- F. Movement Capability: Value obtained from the difference between widest and narrowest widths of a joint opening typically expressed in numerical values (mm or inches) or a percentage of nominal value of joint width.
- G. Nominal Joint Width: Width of linear gap indicated as representing the conditions existing when architectural joint systems will be installed or, if no nominal joint width is indicated, a width equal to the sum of maximum and minimum joint widths divided by two.

1.4 PERFORMANCE REQUIREMENTS

- A. General: Provide factory-fabricated architectural joint systems capable of withstanding the types of loads and of accommodating the kinds of movement, and the other functions for which they are designed including those specified below, without failure. Types of failure include those listed in Appendix X3 of ASTM E 1399.
 - 1. Vehicular Traffic Joints: Support vehicular traffic across joint, including construction equipment and full-loaded fire apparatus.
 - 2. Pedestrian Traffic Joints: Support pedestrian traffic across joint.
 - 3. Exterior Joints: Maintain continuity of weather enclosure.
 - 4. Joints in Fire-Resistance-Rated Assemblies: Maintain fire-resistance ratings of assemblies.
 - 5. Joints in Smoke Barriers: Maintain integrity of smoke barrier.
 - 6. Joints in Acoustically Rated Assemblies: Inhibit passage of airborne noise.
 - 7. Other Joints: Where indicated, provide joint systems that prevent penetration of water, moisture, and other substances deleterious to building components or content.
 - 8. Seismic Performance: Expansion control systems shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
 - a. The term "withstand" means "the system will remain in place without separation of any parts when subjected to the seismic forces specified and the system will be fully operational after the seismic event."
 - b. Component Importance Factor is 1.5.
 - 9. Joints in Surfaces with Architectural Finishes: Serve as finished architectural joint closures.

1.5 SUBMITTALS

- A. Product Data: Include manufacturer's product specifications, construction details, material and finish descriptions, and dimensions of individual components and seals.
- B. Shop Drawings: For each joint system specified, provide the following:
 - 1. Placement Drawings: Include line diagrams showing entire route of each joint system, plans, elevations, sections, details, joints, splices, locations of joints and splices, and attachments to other Work. Where joint systems change planes, provide Isometric Drawings depicting how components interconnect to achieve continuity of joint covers and fillers.

- C. Samples for Verification: Full-size units 6 inches long of each type of joint system indicated; in sets for each finish, color, texture, and pattern specified, showing the full range of variations expected in these characteristics.
- D. Product Test Reports: From a qualified testing agency indicating architectural joint systems comply with requirements, based on comprehensive testing of current products.

1.6 QUALITY ASSURANCE

- A. Source Limitations: Obtain architectural joint systems through one source from a single manufacturer. Coordinate compatibility with adjoining joint systems specified in other Sections.
- B. Fire-Test-Response Characteristics: Where indicated, provide joint systems incorporating fire barriers that are identical to those of assemblies tested for fire resistance per UL 2079 or ASTM E 1966, including hose-stream test of vertical wall assemblies and wall-to-ceiling assemblies, by a testing and inspecting agency acceptable to authorities having jurisdiction.
 - 1. Hose Stream Test: Wall-to-wall and wall-to-ceiling systems shall be subjected to hose stream testing.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Balco, Inc.
 - 2. Construction Specialties, Inc.
 - 3. JointMaster/InPro Corporation.
 - 4. Michael Rizza Company, LLC.
 - 5. MM Systems Corporation.
 - 6. Nystrom, Inc.
 - 7. Sika / Emseal.
 - 8. Watson Bowman Acme Corp.; a BASF Construction Chemicals business.

2.2 MATERIALS

- A. Aluminum: ASTM B 221, alloy 6063-T5 for extrusions; ASTM B 209, alloy 6061-T6 for sheet and plate.
 - 1. Apply manufacturer's standard protective coating on aluminum surfaces to be placed in contact with cementitious materials.
- B. Stainless Steel: ASTM A 666, Type 304 with No. 2B finish, unless otherwise indicated, for plates, sheet, and strips.
- C. Preformed Seals: Single or multicellular extruded elastomeric seals designed with or without continuous, longitudinal, internal baffles. Formed to be installed in frames or with anchored flanges, in color indicated or, if not indicated, as selected by Architect from manufacturer's standard colors.

- D. Strip Seals: Elastomeric membrane or tubular extrusions with a continuous longitudinal internal baffle system throughout complying with ASTM E 1783; used with compatible frames, flanges, and molded-rubber anchor blocks.
- E. Compression Seals: Preformed, elastomeric extrusions having internal baffle system complying with ASTM E 1612 in sizes and profiles indicated or as recommended by manufacturer.
- F. Preformed Cellular Foams: Nonextruded, low-density, crosslinked, nitrogen-blown ethylene-vinyl-acetate copolymer extruded, compressible foam.
- G. Fire Barriers: Any material or material combination, when fire tested after cycling, designated to resist the passage of flame and hot gases through a movement joint.
- H. Accessories: Manufacturer's standard anchors, clips, fasteners, set screws, spacers, flexible moisture barrier and filler materials, drain tubes, lubricants, adhesives, and other accessories compatible with material in contact, as indicated or required for complete installations.

2.3 ARCHITECTURAL JOINT SYSTEMS

- A. General: Provide joint systems of design, basic profile, materials, and operation indicated. Provide units with the capability to accommodate joint widths indicated and variations in adjacent surfaces.
 - 1. Furnish units in longest practicable lengths to minimize number of end joints. Provide hairline mitered corners where joint changes directions or abuts other materials.
 - 2. Include closure materials and transition pieces, tee-joints, corners, curbs, cross-connections, and other accessories as required to provide continuous joint systems.
 - 3. Frames for Strip Seals: Designed with semiclosed cavity that provides a mechanical lock for seals of type indicated.
 - 4. Public Area Seals: Non-slip seals designed for installation on treads and risers and to lie flat with adjacent surfaces, and complying with ADA guidelines for public areas.

2.4 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.

2.5 ALUMINUM FINISHES

- A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
- B. Class I, Clear Anodic Finish: AA-M12C22A41 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 611.

2.6 STAINLESS-STEEL FINISHES

- A. Remove tool and die marks and stretch lines or blend into finish.

- B. Grind and polish surfaces to produce uniform, directionally textured, polished finish indicated, free of cross scratches. Run grain with long dimension of each piece.
- C. Bright, Directional Polish: No. 4 finish.
- D. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Prepare substrates according to architectural joint system manufacturer's written instructions.
- B. Coordinate and furnish anchorages, Placement Drawings, and instructions for installing joint systems to be embedded in or anchored to concrete or to have recesses formed into edges of concrete slab for later placement and grouting-in of frames.
- C. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary to secure joint systems to in-place construction, including threaded fasteners with drilled-in expansion shields for masonry and concrete where anchoring members are not embedded in concrete. Provide fasteners of metal, type, and size to suit type of construction indicated and to provide for secure attachment of joint systems.
- D. Provide the services of a surveyor licensed in the **state the project is located** prior to and after paving substrate to confirm alignment of joint.

3.2 INSTALLATION

- A. Comply with manufacturer's written instructions for handling and installing architectural joint assemblies and materials, unless more stringent requirements are indicated.
- B. Coordinate installation of architectural joint assembly materials and associated work so complete assemblies comply with assembly performance requirements.
- C. Terminate exposed ends of exterior architectural joint assemblies with factory-fabricated termination devices to maintain waterproof system.
- D. Install factory-fabricated transitions between building expansion-joint cover assemblies and roof expansion-joint assemblies to provide continuous, uninterrupted, watertight construction.
- E. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required to install joint systems.
 - 1. Install joint cover assemblies in true alignment and proper relationship to joints and adjoining finished surfaces measured from established lines and levels.
 - 2. Allow adequate free movement for thermal expansion and contraction of metal to avoid buckling.
 - 3. Set covers in horizontal surfaces at elevations that place exposed surfaces flush with adjoining finishes.
 - 4. Locate covers in continuous contact with adjacent surfaces.

5. Securely attach in place with required accessories.
 6. Locate anchors at interval recommended by manufacturer, but not less than 3 inches from each end and not more than 24 inches o.c.
- F. Continuity: Maintain continuity of joint systems with a minimum number of end joints and align metal members. Cut and fit ends to produce joints that will accommodate thermal expansion and contraction of metal to avoid buckling of frames. Adhere flexible filler materials, if any, to frames with adhesive or pressure-sensitive tape as recommended by manufacturer.
- G. Extruded Preformed Seals: Install seals to comply with manufacturer's written instructions and with minimum number of end joints.
1. For straight sections, provide preformed seals in continuous lengths.
 2. Vulcanize or heat-weld field splice joints in preformed seal material to provide watertight joints using procedures recommended by manufacturer.
 3. Apply adhesive, epoxy, or lubricant adhesive approved by manufacturer to both frame interfaces before installing preformed seals.
 4. Seal transitions according to manufacturer's written instructions.
 5. Install foam seals with adhesive recommended by manufacturer and heat seal all splices.
- H. Joint Systems with Seals: Seal end joints within continuous runs and joints at transitions according to manufacturer's written instructions to provide a watertight installation.
- I. Seismic Seals: Install interior seals in continuous lengths. Install exterior seal in standard lengths and vulcanize or heat-weld field splice joints to provide watertight joints using manufacturer's recommended procedures. Seal transitions and end joints according to manufacturer's written instructions.
- J. Fire Barriers: Install fire barriers to provide continuous, uninterrupted fire resistance throughout length of joint, including transitions and end joints.

3.3 CLEANING AND PROTECTION

- A. Do not remove protective covering until finish work in adjacent areas is complete. When protective covering is removed, clean exposed metal surfaces to comply with manufacturer's written instructions.

END OF SECTION

SECTION 080001

METAL WINDOWS

(Filed Sub-Bid Required)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

- B. Time, Manner and Requirements for Submitting Sub-Bids:

1. Sub-bids for work under this Section shall be for the complete work and shall be filed in a sealed envelope with the _____ at a time and place as stipulated in the "NOTICE TO CONTRACTORS".

The following should appear on the upper left hand corner of the envelope:

NAME OF SUB-BIDDER: (Insert name of sub-bidder)

MASS. STATE PROJECT: ((Insert project number from top of page))

SUB-BID FOR SECTION: 080001 – METAL WINDOWS

2. Each sub-bid submitted for work under this Section shall be on forms furnished by the _____ as required by Section 44F of Chapter 149 of the General Laws, as amended. Sub-bid forms may be obtained at the office of the _____, or may be obtained by written or telephone request; telephone _____.
3. Sub-bids filed with the _____ shall be accompanied by BID BOND or CASH or CERTIFIED CHECK or TREASURER'S CHECK or CASHIER'S CHECK issued by a responsible bank or trust company payable to the _____ in the amount of five percent of the sub-bid. A sub-bid accompanied by any other form of bid deposit than those specified will be rejected.

- C. Sub Sub-Bid Requirements: (None required under this Section.)

- D. Reference Drawings: The Work of this Filed Sub-Bid is shown on the following Contract Drawings: *to be inserted with final documents*

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. All Work of Section 085110 - ALUMINUM WINDOWS.

END OF SECTION

SECTION 080002

GLASS AND GLAZING

(Filed Sub-Bid Required)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

- B. Time, Manner and Requirements for Submitting Sub-Bids:

1. Sub-bids for work under this Section shall be for the complete work and shall be filed in a sealed envelope with the _____ at a time and place as stipulated in the "NOTICE TO CONTRACTORS".

The following should appear on the upper left hand corner of the envelope:

NAME OF SUB-BIDDER: (Insert name of sub-bidder)

MASS. STATE PROJECT: ((Insert project number from top of page))

SUB-BID FOR SECTION: 080002 – GLASS AND GLAZING

2. Each sub-bid submitted for work under this Section shall be on forms furnished by the _____ as required by Section 44F of Chapter 149 of the General Laws, as amended. Sub-bid forms may be obtained at the office of the _____, or may be obtained by written or telephone request; telephone _____.
3. Sub-bids filed with the _____ shall be accompanied by BID BOND or CASH or CERTIFIED CHECK or TREASURER'S CHECK or CASHIER'S CHECK issued by a responsible bank or trust company payable to the _____ in the amount of five percent of the sub-bid. A sub-bid accompanied by any other form of bid deposit than those specified will be rejected.

- C. Sub Sub-Bid Requirements: (None required under this Section.)

- D. Reference Drawings: The Work of this Filed Sub-Bid is shown on the following Contract Drawings: *to be inserted with final documents.*

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. All Work of Section 088000 - GLAZING.

END OF SECTION

SECTION 081110

HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Standard hollow-metal steel doors and frames.
- B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council. Refer to Section 018110 - SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 042000 - UNIT MASONRY for building anchors into masonry construction.
 - 2. Section 087100 - DOOR HARDWARE for door hardware for steel doors.
 - 3. Section 088000 - GLAZING for glazed lites.
 - 4. Section 092110 - GYPSUM BOARD ASSEMBLIES for insulation.
 - 5. Section 099000 - PAINTING AND COATING for field painting steel doors and frames.

1.3 SUBMITTALS

- A. Product Data: Include construction details, material descriptions, core descriptions, label compliance, fire-resistance rating, temperature-rise ratings, and finishes for each type of steel door and frame specified.
- B. LEED Submittals:
 - 1. Building Product Disclosure and Optimization, Environmental Product Declarations (EPD):
 - a. Option 1: For doors and frames, submit product-specific Type III EPDs.
 - 2. Building Product Disclosure and Optimization, Sourcing of Raw Materials:

- a. General: For credit achievement calculation, submit location of products sourced (extracted, manufactured, and purchased), indicating number of miles from the project site.
 - b. Option 2, Leadership Extraction Practices:
 - 1) Recycled Content: Submit percentages by weight of postconsumer and preconsumer recycled content for products having recycled content. Include statement indicating costs for each product having recycled content.
 - 3. Building Product Disclosure and Optimization, Material Ingredients:
 - a. Option 1, Material Ingredient Reporting: For doors and frames, submit Health Product Declarations (HPD) or Declare product labels.
 - 4. Low-Emitting Materials, General Emissions Evaluation: Building products must be tested and determined compliant in accordance with California Department of Public Health (CDPH) Standard Method v1.1–2010, using the applicable exposure scenario.
 - a. For doors and insulation, submit GreenGuard Gold certification.
 - C. Shop Drawings:
 - 1. Elevations of each door design.
 - 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.
 - 4. Locations of reinforcement and preparations for hardware.
 - 5. Details of each different wall opening condition.
 - 6. Details of anchorages, joints, field splices, and connections.
 - 7. Details of accessories.
 - 8. Details of moldings, removable stops, and glazing.
 - 9. Details of conduit and preparations for power, signal, and control systems.
 - D. Schedule: Provide a schedule of hollow metal work prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with door hardware schedule.
 - E. Qualification Data: For Installer.
 - F. Product Test Reports: Based on evaluation of comprehensive fire tests performed by a qualified testing agency, for each type of standard steel door and frame.
- 1.4 QUALITY ASSURANCE
- A. Installer Qualifications: An employer of workers trained and approved by manufacturer.
 - B. Source Limitations: Obtain standard steel doors and frames through one source from a single manufacturer.
 - C. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings and temperature-rise limits indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.

1. Smoke- and Draft-Control Assemblies: Provide an assembly with gaskets listed and labeled for smoke and draft control by a qualified testing agency acceptable to authorities having jurisdiction, based on testing according to UL 1784 and installed in compliance with NFPA 105.
 2. Temperature-Rise Limit: Fire door assemblies in interior exit stairways and ramps and exit passageways shall have a maximum transmitted temperature rise of not more than 450 degrees F (250 degrees C) above ambient at the end of 30 minutes of standard fire test exposure. Exception: The maximum transmitted temperature rise is not required in buildings equipped throughout with an automatic sprinkler system installed in accordance with IBC Section 903.3.1.1 or 903.3.1.2.
- D. Fire-Rated, Borrowed-Light Assemblies (Including Sidelights and Transoms): Complying with NFPA 80 and listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction for fire-protection ratings indicated, based on testing according to NFPA 257 or UL 9.
- E. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01.
- 1.5 DELIVERY, STORAGE, AND HANDLING
- A. Deliver doors and frames palletized, wrapped, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.
- B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.
- C. Store hollow metal work under cover at Project site. Place in stacks of five units maximum in a vertical position with heads up, spaced by blocking, on minimum 4-inch-high wood blocking. Do not store in a manner that traps excess humidity.
1. Provide minimum 1/4-inch space between each stacked door to permit air circulation.
- 1.6 PROJECT CONDITIONS
- A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.
- 1.7 COORDINATION
- A. Coordinate installation of anchorages for hollow metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Ceco Door Products; an ASSA ABLOY Group Company.
2. CURRIES Company; an ASSA ABLOY Group Company.
3. de LaFontaine
4. Philipp Manufacturing Company.
5. Steelcraft; an Allegion (formerly Ingersoll-Rand) company.

2.2 MATERIALS

- A. Recycled Content of Steel Products: Provide products with average recycled content of steel products so post-consumer recycled content plus one-half of pre-consumer recycled content is not less than 25 percent.
- B. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.
- C. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.
- D. Metallic-Coated, (Galvanized/Galvannealed) Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum G60/A60 metallic coating.
- E. Frame Anchors: ASTM A 591/A 591M, Commercial Steel (CS), 40Z coating designation; mill phosphatized.
 1. For anchors built into exterior walls, steel sheet complying with ASTM A 1008/A 1008M or ASTM A 1011/A 1011M, hot-dip galvanized according to ASTM A 153/A 153M, Class B.
- F. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.
- G. Powder-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow metal frames of type indicated.
- H. Insulation: Comply with requirements in Section 092110 - GYPSUM BOARD ASSEMBLIES.
- I. Glazing: Comply with requirements in Section 088000 - GLAZING.
- J. Environmental Product Declarations (EPD): Product-specific Type III EPDs for hollow metal doors and frames are available from manufacturers listed herein.
- K. Low-Emitting Materials: Provide building products in compliance with the 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."

2.3 STANDARD STEEL DOORS

- A. General: Provide doors of design indicated, not less than thickness indicated; fabricated with smooth surfaces, without visible joints or seams on exposed faces, unless otherwise indicated. Comply with ANSI A250.8.
 1. Design: Flush panel.

2. Core Construction: Manufacturer's standard kraft-paper honeycomb, polystyrene, polyurethane, mineral-board, or vertical steel-stiffener core that produces doors complying with ANSI A250.8.
 - a. Fire Door Core: As required to provide fire-protection and temperature-rise ratings indicated.
 - b. Thermal-Rated (Insulated) Exterior Doors: Where indicated, provide doors fabricated with thermal-resistance value (R-value) of not less than 2.5 when tested according to ASTM C 1363.
 3. Top and Bottom Edges: Closed with flush or inverted 0.042-inch-thick end closures or channels of same material as face sheets.
 4. Tolerances: Comply with SDI 117, "Manufacturing Tolerances for Standard Steel Doors and Frames."
- B. Exterior Doors: Face sheets fabricated from metallic-coated (galvanized/galvannealed) steel sheet. Provide doors complying with requirements indicated below by referencing ANSI A250.8 for level and model and ANSI A250.4 for physical-endurance level:
1. Level 3 and Physical Performance Level A (Extra Heavy Duty), Model 2 (Seamless), 1-3/4 inches thick.
- C. Interior Doors: Face sheets fabricated from cold-rolled steel sheet. Provide doors complying with requirements indicated below by referencing ANSI A250.8 for level and model and ANSI A250.4 for physical-endurance level:
1. Level 2 and Physical Performance Level B (Heavy Duty), Model 2 (Seamless), 1-3/4 inches thick.
- D. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.
- E. Fabricate concealed stiffeners and hardware reinforcement from either cold- or hot-rolled steel sheet.
- 2.4 STANDARD STEEL FRAMES
- A. General: Comply with ANSI A250.8 and with details indicated for type and profile.
- B. Exterior Frames: Fabricated from metallic-coated (galvanized/galvannealed) steel sheet.
1. Fabricate frames with full profile welded joints.
 2. Frames for Level 3 Steel Doors: 0.067-inch-thick steel sheet.
- C. Interior Frames: Fabricated from cold-rolled steel sheet.
1. Fabricate frames with full profile welded joints.
 2. Frames for Level 2 Steel Doors: 0.053-inch-thick steel sheet.
- D. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 with reinforcement plates from same material as frames.

2.5 FRAME ANCHORS

- A. Jamb Anchors:
 - 1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, not less than 0.042 inch thick, with corrugated or perforated straps not less than 2 inches wide by 10 inches long; or wire anchors not less than 0.177 inch thick.
 - 2. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.042 inch thick.
 - 3. Compression Type for Drywall Slip-on Frames: Adjustable compression anchors.
 - 4. Postinstalled Expansion Type for In-Place Concrete or Masonry: Minimum 3/8-inch-diameter bolts with expansion shields or inserts. Provide pipe spacer from frame to wall, with throat reinforcement plate, welded to frame at each anchor location.
- B. Floor Anchors: Formed from same material as frames, not less than 0.042 inch (1.0 mm) thick, and as follows:
 - 1. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.
 - 2. Separate Topping Concrete Slabs: Adjustable-type anchors with extension clips, allowing not less than 2-inch height adjustment. Terminate bottom of frames at finish floor surface.

2.6 HOLLOW METAL PANELS

- A. Provide hollow metal panels of same materials, construction, and finish as specified for adjoining hollow metal work.

2.7 STOPS AND MOLDINGS

- A. Moldings for Glazed Lites in Doors: Minimum 0.032 inch thick, fabricated from same material as door face sheet in which they are installed.
- B. Fixed Frame Moldings: Formed integral with hollow metal frames, a minimum of 5/8 inch high unless otherwise indicated.
- C. Loose Stops for Glazed Lites in Frames: Minimum 0.032 inch thick, fabricated from same material as frames in which they are installed.

2.8 LOUVERS

- A. Provide louvers for interior doors, where indicated, that comply with SDI 111C, with blades or baffles formed of 0.020-inch-thick, cold-rolled steel sheet set into 0.032-inch-thick steel frame.
 - 1. Sightproof Louver: Stationary louvers constructed with inverted V-shaped or Y-shaped blades.
 - 2. Fire-Rated Automatic Louvers: Louvers constructed with movable blades closed by actuating fusible link, and listed and labeled for use in fire-rated door assemblies of type and fire-resistance rating indicated by same testing and inspecting agency that established fire-resistance rating of door assembly.

2.9 ACCESSORIES

- A. Mullions and Transom Bars: Join to adjacent members by welding or rigid mechanical anchors.
- B. Ceiling Struts: Minimum 1/4-inch-thick by 1-inch-wide steel.

2.10 FABRICATION

- A. Fabricate hollow metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.
- B. Tolerances: Fabricate hollow metal work to tolerances indicated in SDI 117.
- C. Hollow Metal Doors:
 - 1. Exterior Doors: Provide weep-hole openings in bottom of exterior doors to permit moisture to escape. Seal joints in top edges of doors against water penetration.
 - 2. Glazed Lites: Factory cut openings in doors.
 - 3. Astragals: Provide overlapping astragal on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated. Extend minimum 3/4 inch beyond edge of door on which astragal is mounted.
- D. Hollow Metal Frames: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.
 - 1. Full Profile Welded Frames: Weld joints continuously; grind, fill, dress, and make smooth, flush, and not visible.
 - 2. Full Profile Welded Frames at Fire-Rated Doors and Exterior Doors: Weld joints continuously; grind, fill, dress, and make smooth, flush, and not visible.
 - 3. Interlocking (Knock-Down) Frames at 20-Minute-Rated Doors and Non-Rated Doors: Interlocking with visible seams.
 - 4. Sidelight and Transom Bar Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as doorframe. Fasten members at crossings and to jambs by butt welding.
 - 5. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
 - 6. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.
 - 7. Jamb Anchors: Provide number and spacing of anchors as follows:
 - a. Masonry Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
 - 1) Two anchors per jamb up to 60 inches high.
 - 2) Three anchors per jamb from 60 to 90 inches high.
 - 3) Four anchors per jamb from 90 to 120 inches high.
 - 4) Four anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 120 inches high.

- b. Stud-Wall Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
 - 1) Three anchors per jamb up to 60 inches high.
 - 2) Four anchors per jamb from 60 to 90 inches high.
 - 3) Five anchors per jamb from 90 to 96 inches high.
 - 4) Five anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 96 inches high.
 - 5) Two anchors per head for frames above 42 inches wide and mounted in metal-stud partitions.
 - c. Compression Type: Not less than two anchors in each jamb.
 - d. Postinstalled Expansion Type: Locate anchors not more than 6 inches from top and bottom of frame. Space anchors not more than 26 inches o.c.
 - 8. Door Silencers: Except on weather-stripped doors, 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.
- E. Fabricate concealed stiffeners, edge channels, and hardware reinforcement from either cold- or hot-rolled steel sheet.
- F. Hardware Preparation: Factory prepare hollow metal work to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to the Door Hardware Schedule and templates furnished as specified in Section 087100 - DOOR HARDWARE.
 - 1. Locate hardware as indicated, or if not indicated, according to ANSI/SDI A250.8.
 - 2. Reinforce doors and frames to receive nontemplated, mortised and surface-mounted door hardware.
 - 3. Comply with applicable requirements in ANSI/SDI A250.6 and ANSI/DHI A115 Series specifications for preparation of hollow metal work for hardware.
 - 4. Coordinate locations of conduit and wiring boxes for electrical connections with Division 26 - ELECTRICAL.
- G. Stops and Moldings: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with butted or mitered hairline joints.
 - 1. Single Glazed Lites: Provide fixed stops and moldings welded on secure side of hollow metal work.
 - 2. Multiple Glazed Lites: Provide fixed and removable stops and moldings, so that each glazed lite is capable of being removed independently.
 - 3. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames.
 - 4. Provide loose stops and moldings on inside of hollow metal work.
 - 5. Coordinate rabbet width between fixed and removable stops with type of glazing and type of installation indicated.

2.11 STEEL FINISHES

- A. Prime Finish: Apply manufacturer's standard epoxy primer immediately after cleaning and pretreating.
 - 1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with ANSI/SDI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.
 - 2. Refer to Section 099000 – PAINTING AND COATING for field-applied coating.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in for embedded and built-in anchors to verify actual locations before frame installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.
- B. Prior to installation, adjust and securely brace welded hollow metal frames for squareness, alignment, twist, and plumbness to the following tolerances:
 - 1. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
 - 2. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
 - 3. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
 - 4. Plumbness: Plus or minus 1/16 inch, measured at jambs on a perpendicular line from head to floor.
- C. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

3.3 INSTALLATION

- A. General: Install hollow metal work plumb, rigid, properly aligned, and securely fastened in place; comply with Drawings and manufacturer's written instructions.
- B. Hollow Metal Frames: Install hollow metal frames of size and profile indicated. 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, leaving surfaces smooth and undamaged.
 - a. At fire-protection-rated openings, install frames according to NFPA 80.
 - b. Where frames are fabricated in sections because of shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
 - c. Install frames with removable glazing stops located on secure side of opening.
 - d. Remove temporary braces necessary for installation only after frames have been properly set and secured.
 - e. Check plumbness, squareness, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
 2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with postinstalled expansion anchors.
 - a. Floor anchors may be set with powder-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.
 3. Metal-Stud Partitions: Solidly pack insulation behind frames.
 4. Masonry Walls: Coordinate installation of frames to allow for filling space between frames and masonry with insulation.
 5. Concrete Walls: Solidly fill space between frames and concrete with insulation.
 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. In-Place Gypsum Board Partitions: Secure frames in place with postinstalled expansion anchors through floor anchors at each jamb. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
 8. Ceiling Struts: Extend struts vertically from top of frame at each jamb to overhead structural supports or substrates above frame unless frame is anchored to masonry or to other structural support at each jamb. Bend top of struts to provide flush contact for securing to supporting construction. Provide adjustable wedged or bolted anchorage to frame jamb members.
 9. Installation Tolerances: Adjust hollow metal door frames for squareness, alignment, twist, and plumb to the following tolerances:
 - a. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
 - b. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
 - c. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
 - d. Plumbness: Plus or minus 1/16 inch, measured at jambs at floor.
- C. Hollow Metal Doors: Fit hollow metal doors accurately in frames, within clearances specified below. Shim as necessary.
1. Non-Fire-Rated Standard Steel Doors:
 - a. Jambs and Head: 1/8 inch plus or minus 1/16 inch.

- b. Between Edges of Pairs of Doors: 1/8 inch plus or minus 1/16 inch.
 - c. Between Bottom of Door and Top of Threshold: Maximum 3/8 inch.
 - d. Between Bottom of Door and Top of Finish Floor (No Threshold): Maximum 3/4 inch.
 - 2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.
 - 3. Smoke-Control Doors: Install doors according to NFPA 105.
 - D. Glazing: Comply with hollow metal manufacturer's written instructions.
 - 1. Secure stops with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches o.c. and not more than 2 inches o.c. from each corner.
- 3.4 ADJUSTING AND CLEANING
- A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow metal work that is warped, bowed, or otherwise unacceptable.
 - B. 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.
 - C. Metallic-Coated (Galvanized/Galvannealed) Surfaces: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.

END OF SECTION

SECTION 081400
FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
1. Solid-core flush wood doors for transparent and opaque finishes.
 2. Factory finishing for wood doors with transparent finish.
 3. Factory fitting flush wood doors to frames and factory machining for hardware.
 4. Louvers and glass lites for flush wood doors.
- B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council. Refer to Section 018110 - SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
1. Section 064020 - INTERIOR ARCHITECTURAL WOODWORK for wood door frames.
 2. Section 087100 - DOOR HARDWARE for hardware for wood doors.
 3. Section 088000 - GLAZING for glass and glazing requirements.
 4. Section 099000 - PAINTING AND COATING for field finishing of opaque wood doors.

1.3 SUBMITTALS

- A. Product Data: For each type of product, including the following:
1. Door core and edge construction, face type, louvers, and trim for openings.
 2. Factory-finishing specifications.
- B. LEED Submittals:
1. Building Product Disclosure and Optimization, Environmental Product Declarations (EPD):
 - a. Option 1: For wood doors, submit product-specific Type III EPDs.
 2. Building Product Disclosure and Optimization, Sourcing of Raw Materials:

- a. General: For credit achievement calculation, submit location of products sourced (extracted, manufactured, and purchased), indicating number of miles from the project site.
 - b. Option 2, Leadership Extraction Practices:
 - 1) Wood Products: Wood products must be certified by the Forest Stewardship Council or USGBC-approved equivalent. Products meeting wood products criteria are valued at 100% of their cost for the purposes of credit achievement calculation.
 - 2) Recycled Content: Submit percentages by weight of postconsumer and preconsumer recycled content for products having recycled content. Include statement indicating costs for each product having recycled content.
- 3. Building Product Disclosure and Optimization, Material Ingredients:
 - a. Option 1, Material Ingredient Reporting: For wood doors, submit Health Product Declarations (HPD) or Declare product labels.
- 4. Low-Emitting Materials, General Emissions Evaluation: Building products must be tested and determined compliant in accordance with California Department of Public Health (CDPH) Standard Method v1.1–2010.
 - a. For wood doors, submit GreenGuard Gold or SCS Indoor Advantage Gold certification.
- C. Shop Drawings: Indicate location, size, and hand of each door; elevation of each type of door; construction details not covered in Product Data; and the following:
 - 1. Door schedule indicating door and frame location, type, size, fire protection rating, and swing.
 - 2. Door elevations, dimension and locations of hardware, lite and louver cutouts, and glazing thicknesses.
 - 3. Details of frame for each frame type, including dimensions and profile.
 - 4. Details of electrical raceway and preparation for electrified hardware, access control systems, and security systems.
 - 5. Dimensions and locations of blocking for hardware attachment.
 - 6. Dimensions and locations of mortises and holes for hardware.
 - 7. Clearances and undercuts.
 - 8. Requirements for veneer matching.
 - 9. Doors to be factory primed or finished and application requirements.
 - 10. Apply AWI Quality Certification Program label to Shop Drawings.
- D. Samples for Verification:
 - 1. Factory finishes applied to actual door face materials, approximately 8 by 10 inches for each material and finish. For each wood species and transparent finish, provide set of three samples showing typical range of finish color, sheen, and grain to be expected in finished work.
 - 2. Frames for light openings, 6 inches long, for each material, type, and finish required.
- E. Field quality-control reports.

F. Quality Standard Compliance Certificates: AWI Quality Certification Program certificates.

1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain flush wood doors through one source from a single manufacturer.
- B. Quality Standard: Comply with AWI/AWMAC/WI's "Architectural Woodwork Standards," current edition.
 - 1. Provide AWI Quality Certification Program (QCP) labels or certificates indicating that doors comply with requirements of grades specified. Register the work under this Section with the AWI QCP.
- C. Quality Standard: In addition to requirements specified, comply with WDMA I.S.1-A, "Architectural Wood Flush Doors."
 - 1. WDMA I.S.1-A Performance Grade: Extra Heavy Duty.
- D. Fire-Rated Door Inspector Qualifications: Inspector for field quality-control inspections of fire-rated door assemblies shall comply with qualifications set forth in NFPA 80, Section 5.2.3.1 and the following:
- E. Egress Door Inspector Qualifications: Inspector for field quality-control inspections of egress door assemblies shall comply with qualifications set forth in NFPA 101, Section 7.2.1.15.4 and the following:
- F. Fire-Rated Wood Doors: Doors 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 at positive pressure according to NFPA 252 or UL 10C.
 - 1. Oversize Fire-Rated Door Assemblies: For units exceeding sizes of tested assemblies provide certification by a qualified testing agency that doors comply with standard construction requirements for tested and labeled fire-rated door assemblies except for size.
 - 2. Temperature-Rise Limit: At vertical exit enclosures and exit passageways, provide doors that have a maximum transmitted temperature end point of not more than 450 deg F (250 deg C) above ambient after 30 minutes of standard fire-test exposure.
- G. 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 in accordance with UL 1784 and installed in compliance with NFPA 105.
- H. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Comply with requirements of referenced standard and manufacturer's written instructions.
- B. Package doors individually in plastic bags or cardboard cartons.
- C. Mark each door on top rail with opening number used on Shop Drawings.

1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install doors until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, and HVAC system is operating and maintaining temperature and relative humidity at levels designed for building occupants for the remainder of construction period.

1.7 WARRANTY

- A. Special Warranty: Manufacturer's standard form, signed by manufacturer, Installer, and Contractor, in which manufacturer agrees to repair or replace doors that are defective in materials or workmanship, have warped (bow, cup, or twist) more than 1/4 inch in a 42-by-84-inch section, or show telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch span.
 - 1. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors.
 - 2. Warranty shall include hardware installation and replacement of glass and glazing.
 - 3. Warranty shall be in effect during the following period of time from date of Substantial Completion:
 - a. Solid-Core Interior Doors: Life of installation.

PART 2 - PRODUCTS

2.1 SUSTAINABLE DESIGN PERFORMANCE REQUIREMENTS

- A. Certified Wood: Materials shall be produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship."
 - 1. Salvaged and reclaimed wood is excluded from certified wood requirements.
- B. Low-Emitting Materials: Provide wood doors in compliance with the 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 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Lambton Doors; EnviroDesign Series.
 - 2. Masonite Architectural; Aspiro and Graham Series (formerly Algoma and Marshfield).
Cendura Series is not acceptable.
 - 3. Oregon Doors; Architectural Series.
 - 4. VT Industries Inc.; Eggers and Heritage collections.

2.3 DOOR CONSTRUCTION, GENERAL

- A. Doors for Transparent Finish:

1. Grade: AWI Premium, with AWI Grade AA faces, 4 inch veneer width.
2. Species and Cut: Select White Maple, plain sawn/sliced.
3. Match between Veneer Leaves: Book match.
4. Assembly of Veneer Leaves on Door Faces: Center-balance.
5. Pair and Set Match: Provide for doors hung in same opening or separated only by mullions.
6. Transom Match: Continuous match.
7. Stiles: Same species as face.
8. Cross-Banding: 1/8 in. high density fiberboard, no added formaldehyde (NAF).
9. Adhesives: WDMA T.M.-6, Type I.

B. Doors for Opaque Finish:

1. Grade: Premium.
2. Faces for Interior Doors: Either medium-density overlay (MDO) or high-density fiberboard (HDF).
3. Stiles: Match face.
4. Cross-Banding: 1/8 in. high density fiberboard, no added formaldehyde (NAF).
5. Adhesives: WDMA T.M.-6, Type I.
6. Factory Primer: Manufacturer's standard water-based low VOC primer.

2.4 SOLID-CORE DOORS

A. Cores: Comply with the following requirements:

1. Composite Wood, General: CARB II compliant or made with binder containing no added formaldehyde (NAF).
2. Particle Core: ANSI A 208.1, Grade 1-LD-2.
3. Agrifiber Core: ANSI A 208.1, Grade 1-LD-2.
4. Structural Composite Lumber Core: WDMA I.S.10, Timberstrand LSL.
5. Provide doors with structural composite lumber cores instead of particleboard cores at locations where exit devices are indicated or where light or louver cutouts exceed 40% of the door area.

B. Interior Veneer-Faced Doors:

1. Construction: Five plies, hot-pressed, with stiles and rails bonded to core, then entire unit abrasive planed before veneering.

C. Fire-Rated Doors:

1. Construction: Construction and core specified above for type of face indicated or manufacturer's standard mineral-core construction as needed to provide fire rating indicated.
 - a. Fire Retardant Mineral Core, with no added formaldehyde cross-banding.
2. Blocking: For mineral-core doors, provide composite blocking with improved screw-holding capability approved for use in doors of fire ratings indicated as needed to eliminate through-bolting hardware.

3. Edge Construction: At hinge stiles, provide manufacturer's standard laminated-edge construction with improved screw-holding capability and split resistance and with outer stile matching face veneer.
 - a. Screw-Holding Capability: 550 lbf per WDMA T.M.-10.
4. Pairs: Provide fire-rated pairs with fire-retardant stiles matching face veneer that are labeled and listed for kinds of applications indicated without formed-steel edges and astragals. Provide stiles with concealed intumescent seals.

2.5 LOUVERS AND LIGHT FRAMES

- A. Wood Louvers: Door manufacturer's standard solid-wood louvers, unless otherwise indicated.
 1. Wood Species: Same species as door faces.
 2. Profile: Flat.
- B. Fire Door Louvers (not required on 20 min. doors): Metal louvers with fusible link and closing device, listed and labeled for use in doors with fire rating of one and one-half hours and less.
 1. Metal and Finish: Galvanized steel, 0.0396 inch thick, hot-dip zinc coated and factory primed for paint finish.
- C. Wood Beads for Light Openings in Wood Doors: Provide manufacturer's standard wood beads unless otherwise indicated.
 1. Wood Species: Same species as door faces.
 2. Profile: Manufacturer's standard shape.
 3. At wood-core doors with 20-minute fire-protection ratings, provide wood beads and metal glazing clips approved for such use.
- D. Wood-Veneered Beads for Light Openings in Fire Doors: Manufacturer's standard wood-veneered noncombustible beads matching veneer species of door faces and approved for use in doors of fire rating indicated. Include concealed metal glazing clips where required for opening size and fire rating indicated.

2.6 GLAZING SYSTEMS

- A. Glazing: Provide factory installed glass products in accordance with requirements in Section 088000 - GLAZING.

2.7 FABRICATION

- A. Factory fit doors to suit frame-opening sizes indicated, with the following uniform clearances and bevels, unless otherwise indicated:
 1. Comply with clearance requirements of referenced quality standard for fitting. Comply with requirements in NFPA 80 for fire-rated doors.
- B. Factory machine doors for hardware that is not surface applied. Locate hardware to comply with DHI-WDHS-3. Comply with final hardware schedules, door frame Shop Drawings, ANSI/BHMA/DHI A115-W series standards, and hardware templates.

1. Coordinate measurements of hardware mortises in metal frames to verify dimensions and alignment before factory machining. Drill pilot holes for screws for butt hinges and lock fronts at the factory.
 2. Metal Astragals: Factory prime and premachine astragals and formed-steel edges for hardware for pairs of fire-rated doors to receive concealed vertical rod exit devices.
- C. Transom and Side Panels: Fabricate matching panels with same construction, exposed surfaces, and finish as specified for associated doors. Finish bottom edges of transoms and top edges of rabbeted doors same as door stiles.
1. Fabricate door and transom panels with full-width, solid-lumber meeting rails. Provide factory-installed spring bolts for concealed attachment into jambs of metal doorframes.
- D. Openings: Cut and trim openings through doors to comply with applicable requirements of referenced standards for kind(s) of door(s) required.
1. Light Openings: Trim openings with moldings of material and profile indicated.
 2. Louvers: Factory install louvers in prepared openings.
 3. Glazing: Factory install glazing in doors indicated to be factory finished. Comply with applicable requirements in Section 088000 - GLAZING.

2.8 FACTORY FINISHING

- A. General: Comply with AWI's "Architectural Woodwork Quality Standards Illustrated" for factory finishing.
- B. Doors for Opaque Finish: Factory prime faces and edges of doors, including cutouts, with one coat of wood primer specified in Section 099000 - PAINTING AND COATING.
- C. Doors for Transparent Finish: Factory finish doors that are indicated to receive transparent finish. Finish faces and edges of doors, including cutouts.
- D. Transparent Finish:
1. Grade: Premium.
 2. Finish: AWS System-9, UV Curable, Acrylated Epoxy, Polyester or Urethane.
 3. Finish: WDMA TR-8, UV cured acrylated polyester or urethane.
 4. Staining: None required.
 5. Staining: Provide water-based stain, custom color as selected by Architect.
 6. Sheen: Satin.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine doors and installed door frames, with Installer present, before hanging doors.
1. Verify that frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
 2. Reject doors with defects.

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

3.2 INSTALLATION

- A. Hardware: For installation, see Section 087100 - DOOR HARDWARE.
- B. Install doors to comply with manufacturer's written instructions, referenced quality standard, and as indicated.
 - 1. Install fire-rated doors in corresponding fire-rated frames according to NFPA 80.
 - 2. Install smoke- and draft-control doors according to NFPA 105.
- C. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.
- D. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

3.3 FIELD QUALITY CONTROL

- A. Inspection Agency: Engage a qualified inspector to perform inspections and to furnish reports to Architect.
- B. Inspections:
 - 1. Provide inspection of installed Work through AWI's Quality Certification Program, certifying that wood doors and frames, including installation, comply with requirements of AWI/AWMCA/WI's "Architectural Woodwork Standards" for the specified grade.
 - 2. Fire-Rated Door Inspections: Inspect each fire-rated door in accordance with NFPA 80, Section 5.2.
 - 3. Egress Door Inspections: Inspect each door equipped with panic hardware, each door equipped with fire exit hardware, each door located in an exit enclosure, each electrically controlled egress door, and each door equipped with special locking arrangements in accordance with NFPA 101, Section 7.2.1.15.
- C. Repair or remove and replace installations where inspections indicate that they do not comply with specified requirements.
- D. Reinspect repaired or replaced installations to determine if replaced or repaired door assembly installations comply with specified requirements.
- E. Prepare and submit separate inspection report for each fire-rated door assembly indicating compliance with each item listed in NFPA 80 and NFPA 101.

3.4 ADJUSTING

- A. Operation: Rehang or replace doors that do not swing or operate freely.
- B. Protection: Provide temporary protection to ensure work being without damage or deterioration at time of final acceptance. Remove protections and reclean as necessary immediately before final acceptance.

- C. Finished Doors: Replace doors that are damaged or do not comply with requirements. Doors may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION

SECTION 083110

ACCESS DOORS AND FRAMES

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Access doors and frames for walls and ceilings.
- B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council. Refer to Section 018110, SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 033000 - CAST-IN-PLACE CONCRETE for blocking out openings for access doors and frames in concrete.
 - 2. Section 042000 - UNIT MASONRY for anchoring and grouting access door frames set in masonry construction.
 - 3. Section 087100 - DOOR HARDWARE for rim cylinder locks and master keying.

1.3 SUBMITTALS

- A. Product Data: For each type of access door and frame indicated. Include construction details, fire ratings, materials, individual components and profiles, and finishes.
- B. Shop Drawings: Show fabrication and installation details of access doors and frames for each type of substrate. Include plans, elevations, sections, details, and attachments to other work.
- C. Samples: For each door face material, at least 3 by 5 inches in size, in specified finish.
- D. Access Door and Frame Schedule: Provide complete access door and frame schedule, including types, locations, sizes, latching or locking provisions, and other data pertinent to installation.
- E. Ceiling Coordination Drawings: Reflected ceiling plans, drawn to scale, on which ceiling-mounted items including access doors and frames, lighting fixtures, diffusers, grilles, speakers, sprinklers, and special trim are shown and coordinated with each other.

1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain each type of access door and frame through one source from a single manufacturer.
- B. Fire-Rated Access Doors and Frames: Units complying with NFPA 80 that are identical to access door and frame assemblies tested for fire-test-response characteristics per the following test method and that are listed and labeled by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:
 - 1. NFPA 252 for vertical access doors and frames.
 - 2. ASTM E 119 for horizontal access doors and frames.
- C. Size Variations: Obtain Architect's acceptance of manufacturer's standard-size units, which may vary slightly from sizes indicated.

1.5 COORDINATION

- A. Verification: Determine specific locations and sizes for access doors needed to gain access to concealed plumbing, mechanical, or other concealed work, and indicate in the schedule specified in "Submittals" Article.

PART 2 - PRODUCTS

2.1 STEEL MATERIALS

- A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
 - 1. ASTM A 123/A 123M, for galvanizing steel and iron products.
 - 2. ASTM A 153/A 153M, for galvanizing steel and iron hardware.
- B. Steel Sheet: Electrolytic zinc-coated, ASTM A 879/A 879M with cold-rolled steel sheet substrate complying with ASTM A 1008/A 1008M, Commercial Steel (CS), exposed.
- C. Steel Finishes: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
 - 1. Surface Preparation for Steel Sheet: Clean surfaces to comply with SSPC-SP 1, "Solvent Cleaning," to remove dirt, oil, grease, or other contaminants that could impair paint bond. Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning," or SSPC-SP 8, "Pickling."
 - a. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.
 - 2. Factory-Primed Finish: Apply shop primer immediately after cleaning and pretreating.
- D. Drywall Beads: Edge trim formed from 0.0299-inch zinc-coated steel sheet formed to receive joint compound and in size to suit thickness of gypsum board.

2.2 STAINLESS-STEEL MATERIALS

- A. Rolled-Stainless-Steel Floor Plate: ASTM A 793, manufacturer's standard finish.
- B. Stainless-Steel Sheet, Strip, Plate, and Flat Bars: ASTM A 666, Type 316. Remove tool and die marks and stretch lines or blend into finish.
 - 1. Finish: Directional Satin Finish, No. 4.

2.3 ACCESS DOORS AND FRAMES FOR WALLS AND CEILINGS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Acudor Products, Inc.
 - 2. Babcock-Davis.
 - 3. Dur-Red Products.
 - 4. JL Industries (a division of Activar Construction Products Group).
 - 5. Karp Associates, Inc.
 - 6. Larsen's Manufacturing Company.
 - 7. Milcor Inc.
 - 8. Nystrom, Inc.
- B. Flush Access Doors and Trimless Frames: Fabricated from steel sheet at typical areas and from stainless-steel sheet at toilet and wet areas.
 - 1. Locations: Wall and ceiling surfaces.
 - 2. Door: Minimum 0.060-inch-thick sheet metal, set flush with surrounding finish surfaces.
 - 3. Frame: Minimum 0.060-inch-thick sheet metal with drywall bead flange.
 - 4. Hinges: Continuous piano.
 - 5. Lock: Cylinder.
 - a. Lock Preparation: Prepare door panel to accept cylinder specified in Section 087100, DOOR HARDWARE.
- C. Recessed Access Doors and Trimless Frames: Fabricated from steel sheet at typical areas and from stainless-steel sheet at toilet and wet areas.
 - 1. Locations: Wall and ceiling surfaces.
 - 2. Door: Minimum 0.060-inch-thick sheet metal in the form of a pan recessed 5/8 inch for gypsum board infill.
 - 3. Frame: Minimum 0.060-inch-thick sheet metal with drywall bead for gypsum board surfaces.
 - 4. Hinges: Concealed pivoting rod hinge.
 - 5. Lock: Cylinder.
 - a. Lock Preparation: Prepare door panel to accept cylinder specified in Section 087100, DOOR HARDWARE.
- D. Fire Rated, Uninsulated, Flush Access Doors and Frames with Exposed Trim: Fabricated from steel at typical areas and from stainless-steel sheet at toilets and wet areas.

1. Locations: Wall surfaces.
2. Fire-Resistance Rating: Not less than that of adjacent construction.
3. Door: Minimum 0.060-inch-thick sheet metal, flush construction.
4. Frame: Minimum 0.060-inch-thick sheet metal with 1-inch-wide, surface-mounted trim.
5. Hinges: Continuous piano.
6. Automatic Closer: Spring type.
7. Lock: Self-latching device with cylinder lock.

- a. Lock Preparation: Prepare door panel to accept cylinder specified in Section 087100, DOOR HARDWARE

2.4 FABRICATION

- A. General: Provide access door and frame assemblies manufactured as integral units ready for installation.
- B. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.
- C. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish attachment devices and fasteners of type required to secure access panels to types of supports indicated.
 1. For trimless frames with drywall bead, provide edge trim for gypsum board and gypsum base securely attached to perimeter of frames.
 2. For trimless frames with plaster bead for full-bed plaster applications, provide zinc-coated expanded metal lath and exposed casing bead welded to perimeter of frames.
 3. Provide mounting holes in frames for attachment of units to metal or wood framing.
 4. Provide mounting holes in frame for attachment of masonry anchors.
- D. Recessed Access Doors: Form face of panel to provide recess for application of applied finish. Reinforce panel as required to prevent buckling.
 1. For recessed doors with plaster infill, provide self-furring expanded metal lath attached to door panel.
- E. Latching Mechanisms: Furnish number required to hold doors in flush, smooth plane when closed.
 1. For cylinder lock, furnish two keys per lock and key all locks alike.
 2. For recessed panel doors, provide access sleeves for each locking device. Furnish plastic grommets and install in holes cut through finish.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with manufacturer's written instructions for installing access doors and frames.

- B. Set frames accurately in position and attach securely to supports with plane of face panels aligned with adjacent finish surfaces.
- C. Install doors flush with adjacent finish surfaces or recessed to receive finish material.

3.2 ADJUSTING AND CLEANING

- A. Adjust doors and hardware after installation for proper operation.
- B. Remove and replace doors and frames that are warped, bowed, or otherwise damaged.

END OF SECTION

SECTION 083470

INTERIOR SOUND CONTROL DOOR ASSEMBLIES

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Wood and steel sound-control door types.
 - 2. Steel frames and sound-control seals.
- B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council. Refer to Section 018110, SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 081100 - HOLLOW METAL DOORS AND FRAMES for standard steel doors.
 - 2. Section 081400 - FLUSH WOOD DOORS for standard flush wood doors.
 - 3. Section 087100 - DOOR HARDWARE for hardware for wood doors.
 - 4. Section 088000 - GLAZING for glazed lites.
 - 5. Section 099000 - PAINTING AND COATING for field finishing doors and frames.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
 - 1. Include sound ratings, construction details, material descriptions, core descriptions, fire-resistance rating, temperature-rise ratings, and finishes.
 - 2. Include factory-finishing specifications.
- B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; location and extent of hardware blocking; and other pertinent data.
 - 1. Indicate dimensions and locations of mortises and holes for hardware.
 - 2. Indicate dimensions and locations of cutouts.
 - 3. Indicate requirements for veneer matching.
 - 4. Indicate doors to be factory finished and finish requirements.

INTERIOR SOUND CONTROL DOOR ASSEMBLIES

5. Indicate fire ratings for fire doors.
6. Details of sound-control seals, door bottoms, and thresholds.

C. Samples for Verification:

1. Factory finishes applied to actual door face materials, approximately 8 by 10 inches for each material and finish. For each wood species and transparent finish, provide set of three samples showing typical range of color and grain to be expected in the finished work.
2. Frames for light openings, 6 inches long, for each material, type, and finish required.

D. Schedule: Provide a schedule of sound-control door assemblies prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with the Door Hardware Schedule.

E. Product Certificates: For each type of sound-control door assembly, from manufacturer.

F. Field Test Report.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain sound-control door assemblies, including doors, frames, sound-control seals, hinges (when integral for sound control), thresholds, and other items essential for sound control, from single source from single manufacturer.

B. Quality Standard: Comply with AWI's "Architectural Woodwork Quality Standards Illustrated."

1. Provide AWI Quality Certification Labels or an AWI letter of licensing for Project indicating that doors comply with requirements of grades specified.

C. Forest Certification: Provide doors made from wood products obtained from forests certified by an FSC-accredited certification body to comply with FSC 1.2, "Principles and Criteria."

D. Fire-Rated Wood Doors and Frames: Doors and frames 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 NFPA 252.

E. Acoustical Testing Agency Qualifications: An independent agency accredited as an acoustical laboratory according to the National Voluntary Laboratory Accreditation Program of NIST.

F. Sound Rating: Provide sound-control door assemblies identical to those of assemblies tested as sound-retardant units by an acoustical testing agency, and have the following minimum rating:

1. STC Rating: As indicated in the Door Schedule, as determined by ASTM E 413 when tested in an operable condition according to ASTM E 90 and ASTM E 1408.

G. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Comply with requirements of referenced standard and manufacturer's written instructions.
- B. Package doors individually in plastic bags or cardboard cartons.
- C. Mark each door on top and bottom rail with opening number used on Shop Drawings.

1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install wood sound-control wood doors until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

1.7 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of sound-control door assemblies that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Failure to meet sound rating requirements.
 - b. Faulty operation of sound seals.
 - c. Deterioration of metals, metal finishes, and other materials beyond normal use or weathering.
 - d. Wood doors that are warped (bow, cup, or twist) more than 1/4 inch in a 42-by-84-inch section, or show telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch span.
 - 2. Warranty shall be in effect during the following period of time from date of Substantial Completion:
 - a. Interior Solid-Core Wood Doors: Life of installation.
 - b. Steel Doors: Five years.

PART 2 - PRODUCTS

2.1 SOUND-CONTROL DOORS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. AMBICO Limited.
 - 2. Industrial Acoustics.
 - 3. Krieger Specialty Products Company.
 - 4. Overly Door Company.

- B. Description: Provide flush-design sound-control doors, 1-3/4 inches thick; with manufacturer's standard sound-retardant core as required to provide STC and fire rating indicated on Door Schedule.
- C. Materials: Comply with for fabrication, and other requirements unless otherwise indicated.
 - 1. Steel Doors: Comply with Section 081100 - HOLLOW METAL DOORS AND FRAMES.
 - 2. Wood Doors: Comply with Section 081400 - FLUSH WOOD DOORS.
 - 3. Glazing: As required by sound-control door assembly manufacturer to comply with sound-control and fire-rated-door labeling requirements.

2.2 SOUND-CONTROL FRAMES

- A. Description: Fabricate sound-control door frames with corners mitered, reinforced, and continuously welded full depth and width of frame. Fabricate according to ANSI/NAAMM-HMMA 865.
 - 1. Weld frames according to NAAMM-HMMA 820.
 - 2. Interior Frames: Fabricate from cold-rolled steel sheet unless otherwise indicated, 0.075-inch nominal thickness, or thicker as required to provide STC rating indicated.
 - 3. Sound-Control Panel Stops: Formed integral with frames, a minimum of 5/8 inch high, unless otherwise indicated.
 - 4. Hardware Reinforcement: Fabricate according to ANSI/NAAMM-HMMA 865 of same material as face sheets.
 - 5. Head Reinforcement: Reinforce frames with metallic-coated steel channel or angle stiffener, 0.108-inch nominal thickness, welded to head.
 - 6. Jamb Anchors:
 - a. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, not less than 0.064-inch nominal thickness metallic-coated steel with corrugated or perforated straps not less than 2 inches wide by 10 inches long; or wire anchors not less than 0.156 inch thick.
 - b. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.048-inch nominal thickness uncoated steel unless otherwise indicated.
 - c. Postinstalled Expansion Type for In-Place Concrete or Masonry: Minimum 3/8-inch- diameter, metallic-coated steel bolts with expansion shields or inserts. Provide pipe spacer from frame to wall, with throat reinforcement plate, welded to frame at each anchor location.
 - 7. Floor Anchors: Not less than 0.079-inch nominal thickness metallic-coated steel, and as follows:
 - a. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.
 - b. Separate Topping Concrete Slabs: Adjustable-type anchors with extension clips, allowing not less than 2-inch height adjustment. Terminate bottom of frames at finish floor surface.
 - 8. Ceiling Struts: Minimum 3/8-inch-thick by 2-inch- wide uncoated steel unless otherwise indicated.
 - 9. Plaster Guards: Metallic-coated steel sheet, not less than 0.026 inch thick.
- B. Materials:

1. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B, suitable for exposed applications.
2. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.
3. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B, with G60 zinc (galvanized) or A40 zinc-iron-alloy (galvannealed) coating designation.
4. Supports and Anchors: After fabricating, galvanize units to be built into exterior walls according to ASTM A 153/A 153M, Class B.
5. Inserts, Bolts, and Fasteners: Provide items to be built into exterior walls, hot-dip galvanized according to ASTM A 153/A 153M or ASTM F 2329.
6. Powder-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 sound-control door frames of type indicated.
7. Mineral-Fiber Insulation: Insulation composed of rock-wool fibers, slag-wool fibers, or glass fibers.

2.3 SOUND-CONTROL HARDWARE

- A. Description: Provide manufacturer's standard sound-control system, including head and jamb seals, door bottoms, cam-lift hinges, and thresholds, as required by testing to achieve STC and fire rating indicated.
1. Compression Seals: One-piece units; consisting of closed-cell sponge neoprene seal held in place by metal retainer; with retainer cover of same material as door frame; attached to door frame with concealed screws.
 2. Magnetic Seals: One-piece units; consisting of closed-cell sponge neoprene seal and resiliently mounted magnet held in place by metal retainer; with retainer cover of same material as door frame; attached to door frame with concealed screws.
 3. Automatic Door Bottoms: Neoprene or silicone gasket, held in place by metal housing, that automatically drops to form seal when door is closed; mounted to bottom edge of door with screws.
 4. Door Bottoms: Neoprene or silicone gasket held in place by metal housing; mortised into bottom edge of door.
 5. Cam-Lift Hinges: Full-mortise template type that raises door 1/2 inch when door is fully open; with hardened pin; fabricated from stainless steel.
 6. Thresholds: Flat, smooth, unfluted type as recommended by manufacturer. Material and finish as required by Door Hardware Schedule.
- B. Other Door Hardware: Comply with requirements in Section 087100 - DOOR HARDWARE.

2.4 SOUND-CONTROL ACCESSORIES

- A. Glazing: Comply with requirements in Section 088000 - GLAZING.
- B. Grout: Comply with ASTM C 476, with a slump of not more than 4 inches as measured according to ASTM C 143/C 143M.
- C. Isolation (Corrosion-Resistant) Coating: Cold-applied asphalt mastic, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.5 FABRICATION

- A. Sound-Control Steel Door Fabrication: Sound-control doors to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal.
1. Seamless Edge Construction: Fabricate doors with faces joined at vertical edges by welding; welds shall be ground, filled, and dressed to make them invisible and to provide a smooth, flush surface.
 2. Glazed Lites: Factory install glazed lites according to requirements of tested assembly to achieve STC rating indicated. Provide fixed stops and moldings welded on secure side of door.
 3. Hardware Preparation: Factory prepare sound-control doors to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping, according to the Door Hardware Schedule and templates furnished as specified.
 - a. Reinforce doors to receive nontemplated mortised and surface-mounted door hardware.
 - b. Locate door hardware as indicated, or if not indicated, according to NAAMM-HMMA 831, "Recommended Hardware Locations for Custom Hollow Metal Doors and Frames."
 4. Tolerances: Fabricate doors to tolerances indicated in ANSI/NAAMM-HMMA 865.
- B. Sound-Control Wood Door Fabrication: Factory fit doors to suit frame-opening sizes indicated, with uniform clearances and bevels according to referenced quality standard, unless otherwise indicated. Comply with final door hardware schedules and hardware templates.
1. Comply with clearance requirements in NFPA 80 for fire-rated doors.
 2. Locate door hardware as indicated, or if not indicated, according to DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."
 - a. Coordinate measurements of hardware mortises in steel frames to verify dimensions and alignment before factory machining.
- C. Sound-Control Frame Fabrication: Fabricate sound-control frames to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.
1. Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible. Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated from same thickness metal as frames.
 2. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
 3. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.
 4. Jamb Anchors: Provide number and spacing of anchors as follows:

- a. Masonry Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
 - 1) Two anchors per jamb up to 60 inches in height.
 - 2) Three anchors per jamb from 60 to 90 inches in height.
 - 3) Four anchors per jamb from 90 to 96 inches in height.
 - 4) Four anchors per jamb plus one additional anchor per jamb for each 24 inches or fraction thereof more than 96 inches in height.
 - b. Stud Wall Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
 - 1) Three anchors per jamb up to 60 inches in height.
 - 2) Four anchors per jamb from 60 to 90 inches in height.
 - 3) Five anchors per jamb from 90 to 96 inches in height.
 - 4) Five anchors per jamb plus one additional anchor per jamb for each 24 inches or fraction thereof more than 96 inches in height.
 - 5) Two anchors per head for frames more than 42 inches wide and mounted in metal stud partitions.
 - c. Postinstalled Expansion Type: Locate anchors not more than 6 inches from top and bottom of frame. Space anchors not more than 26 inches o.c.
5. Head Reinforcement: For frames more than 48 inches wide, provide continuous head reinforcement for full width of opening, welded to back of frame at head.
 6. Hardware Preparation: Factory prepare sound-control frames to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping, according to the Door Hardware Schedule and templates furnished as specified.
 - a. Reinforce frames to receive nontemplated mortised and surface-mounted door hardware.
 - b. Locate hardware as indicated, or if not indicated, according to NAAMM-HMMA 831, "Recommended Hardware Locations for Custom Hollow Metal Doors and Frames."
 7. Plaster Guards: Weld guards to frame at back of hardware cutouts and glazing-stop screw and sound-control seal preparations to close off interior of openings in frames to be grouted.
 8. Tolerances: Fabricate frames to tolerances indicated in ANSI/NAAMM-HMMA 865.

2.6 FINISHES

- A. Steel Doors and Frames, Painted Finish: Match Section 081100 - HOLLOW METAL DOORS AND FRAMES.
 1. Refer to Section 099000 – PAINTING AND COATING for field-applied coating.
- B. Wood Doors, Transparent Finish: Match Section 081400 - FLUSH WOOD 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 sound-control door assemblies.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.
- B. Prior to installation and with installation spreaders in place, adjust and securely brace sound-control door frames to the following tolerances:
 - 1. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
 - 2. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
 - 3. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
 - 4. Plumbness: Plus or minus 1/16 inch, measured at jambs on a perpendicular line from head to floor.
- C. Drill and tap doors and frames to receive nontemplated mortised and surface-mounted door hardware.

3.3 INSTALLATION

- A. General: Install sound-control door assemblies plumb, rigid, properly aligned, and securely fastened in place; comply with manufacturer's written instructions.
- B. Frames: Install sound-control door frames in sizes and profiles indicated.
 - 1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.
 - a. At fire-rated openings, install frames according to NFPA 80.
 - b. At openings requiring smoke and draft control, install frames according to NFPA 105.
 - c. Where frames are fabricated in sections due to shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, and dress; make splice smooth, flush, and invisible on exposed faces.
 - d. Install sound-control frames with removable glazing stops located on secure side of opening.
 - e. Remove temporary braces only after frames or bucks have been properly set and secured.

- f. Check squareness, twist, and plumbness of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
 - g. Apply corrosion-resistant coatings coating to backs of frames to be filled with mortar, grout, and plaster containing antifreezing agents.
 - 2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor and secure with postinstalled expansion anchors.
 - a. Floor anchors may be set with powder-actuated fasteners instead of postinstalled expansion anchors, if so indicated and approved on Shop Drawings.
 - 3. Metal-Stud Partitions: Solidly pack mineral-fiber insulation behind frames.
 - 4. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout.
 - 5. Concrete Walls: Solidly fill space between frames and concrete with grout. Take precautions, including bracing frames, to ensure that frames are not deformed or damaged by grout forces.
 - 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. In-Place Gypsum Board Partitions: Secure frames in place with postinstalled expansion anchors through floor anchors at each jamb. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
 - 8. Ceiling Struts: Extend struts vertically from top of frame at each jamb to supporting construction above, unless frame is anchored to masonry or to other structural support at each jamb. Bend top of struts to provide flush contact for securing to supporting construction above. Provide adjustable wedged or bolted anchorage to frame jamb members.
 - 9. Grouted Frames: Solidly fill space between frames and substrate with grout. Take precautions, including bracing frames, to ensure that frames are not deformed or damaged by grout forces.
 - 10. Installation Tolerances: Adjust sound-control door frames for squareness, alignment, twist, and plumbness to the following tolerances:
 - a. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
 - b. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
 - c. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
 - d. Plumbness: Plus or minus 1/16 inch, measured at jambs on a perpendicular line from head to floor.
- C. Doors: Fit sound-control doors accurately in frames, within clearances indicated below. Shim as necessary. Install doors to comply with manufacturer's written instructions, referenced quality standard, and as indicated.
 - 1. Install fire-rated doors in corresponding fire-rated frames according to NFPA 80.
 - 2. Install smoke- and draft-control doors according to NFPA 105.
- D. Door Hardware, General: For installation, see Section 087100 - DOOR HARDWARE.

- E. Sound-Control Seals: Where seals have been prefitted and preinstalled in the factory and subsequently removed for shipping, reinstall seals and adjust according to manufacturer's written instructions.
- F. Cam-Lift Hinges: Install hinges according to manufacturer's written instructions.
- G. Thresholds: Set thresholds in full bed of sealant complying with requirements in Section 079200 - JOINT SEALANTS.
- H. Glazing: Comply with installation requirements in Section 088000 - GLAZING and with sound-control door assembly manufacturer's written instructions.
 - 1. Secure stops with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches o.c., and not more than 2 inches o.c. from each corner.

3.4 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Testing Services: Acoustical testing and inspecting agency shall select three sound-control door(s) at random from sound-control door assemblies that are completely installed and perform testing for verification that assembly complies with STC rating requirements.
 - 1. Field tests shall be conducted according to ASTM E 336, with results calculated according to ASTM E 413. Acceptable field STC values shall be within 5 dB of laboratory STC values.
 - 2. Inspection Report: Acoustical testing agency shall submit report in writing to Design Professional and Construction Manager within 24 hours after testing.
 - 3. If tested door fails, replace or rework all sound-control door assemblies to bring them into compliance at Contractor's expense.
 - a. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
- C. Prepare test and inspection reports.

3.5 ADJUSTING AND CLEANING

- A. Final Adjustments: Check and adjust seals, door bottoms, and other sound-control hardware items right before final inspection. Leave work in complete and proper operating condition.
- B. Remove and replace defective work, including defective or damaged sound seals and doors and frames that are warped, bowed, or otherwise unacceptable.
 - 1. Adjust gaskets, gasket retainers, and retainer covers to provide contact required to achieve STC rating.
- C. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying primer.
- D. Metallic-Coated Surfaces: Clean abraded areas of doors and repair with galvanizing repair paint according to manufacturer's written instructions.

- E. Finished Wood Doors: Replace doors that are damaged or do not comply with requirements. Doors may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION

SECTION 084110

ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Exterior and interior aluminum-framed storefronts.
 - 2. Exterior and interior manual-swing aluminum doors.
 - 3. Insulating glass units for aluminum storefront and doors.
- B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council. Refer to Section 018110, SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 079200 - JOINT SEALANTS for installation of joint sealants installed with aluminum-framed systems and for sealants to the extent not specified in this Section.
 - 2. Section 084410 - GLAZED ALUMINUM CURTAIN WALLS for curtain-wall systems that mechanically retain glazing on four sides.
 - 3. Section 087100 - DOOR HARDWARE for lock cylinders and keying.
 - 4. Section 089000 - LOUVERS AND VENTS for units installed with aluminum-framed systems.

1.3 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design entrance and storefront system, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. General: Provide aluminum-framed systems, including anchorage, capable of withstanding, without failure, the effects of the following:
 - 1. Structural loads.
 - 2. Thermal movements.
 - 3. Dimensional tolerances of building frame and other adjacent construction.
 - 4. Failure includes the following:

ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

- a. Deflection exceeding specified limits.
 - b. Thermal stresses transferred to building structure.
 - c. Framing members transferring stresses, including those caused by thermal and structural movements, to glazing.
 - d. Noise or vibration created by wind and thermal and structural movements.
 - e. Loosening or weakening of fasteners, attachments, and other components.
 - f. Sealant failure.
 - g. Failure of operating units to function properly.
- C. Structural Loads: Wind and seismic loads as indicated on the Structural Drawings, but not less than that required by Code.
- D. Deflection of Framing Members:
 - 1. Deflection Normal to Wall Plane: Limited to 1/175 of clear span for spans up to 13 feet 6 inches (and to 1/240 of clear span plus 1/4 inch for spans greater than 13 feet 6 inches or an amount that restricts edge deflection of individual glazing lites to 3/4 inch, whichever is less.
 - 2. Deflection Parallel to Glazing Plane: Limited to 1/360 of clear span or 1/8 inch, whichever is smaller, amount not exceeding that which reduces glazing bite to less than 75 percent of design dimension and that which reduces edge clearance between framing members and glazing or other fixed components directly below to less than 1/8 inch and clearance between members and operable units directly below to less than 1/16 inch.
- E. Thermal Movements: Provide aluminum-framed systems that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures. 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.
- F. Air Infiltration: Provide doors and storefront which comply with the following. Test unit in accordance with ASTM E 283.
 - 1. Swinging Entrance Doors, ASHRAE Requirement: 1.0 cfm/sf maximum air leakage at a pressure differential of 1.57 psf.
 - 2. Storefront, ASHRAE Requirement: 0.06 cfm/sf maximum air leakage at a pressure differential of 1.57 psf or higher.
- G. Water Leakage Test: Test fixed framing system in accordance with ASTM E 331.
 - 1. Test Pressure: 8 psf.
 - 2. Performance: No leakage as defined in test method at specified test pressure. No uncontrolled water penetrating system or appearing on normally exposed interior surfaces.
- H. Solar Heat-Gain Coefficient: Provide units with a whole-unit SHGC maximum as required by Code, determined according to NFRC 200 procedures. Submit proof of compliance with submittals as specified.
- I. Thermal Transmittance: Provide window units that have a U-value as required by Code rated in BTU/hour/sq. ft./degrees F at 15-mph exterior wind velocity, when tested in accordance with

AAMA 1503.1. Test unit to be 4 ft. x 6 ft. Submit proof of compliance with submittals as specified.

- J. Condensation Resistance: Provide aluminum-framed systems with fixed glazing and framing areas having condensation-resistance factor (CRF) of not less than 65 for fixed storefront units and not less than 55 for doors when tested according to AAMA 1503.

1.4 SUBMITTALS

- A. Product Data: Include installation instructions, construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of product indicated. Indicate special procedures and perimeter conditions requiring special attention.
- B. LEED Submittals:
 - 1. Building Product Disclosure and Optimization, Material Ingredients:
 - a. Option 1, Material Ingredient Reporting: For factory-applied metal finishes, submit Declare product labels.
- C. Shop Drawings: Prepared under the supervision of a qualified professional engineer detailing fabrication and assembly of aluminum-framed systems. For aluminum-framed systems. Include plans, elevations, sections, details, and attachments to other work.
 - 1. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
 - 2. Include structural analysis of story drift and deflection from anticipated live loads, and determination whether head receptors are required.
 - 3. Include details of provisions for system expansion and contraction and for draining moisture occurring within the system to the exterior.
 - 4. For entrances, include hardware schedule and indicate operating hardware types, functions, quantities, and locations.
 - 5. Wiring diagrams for power, signal, and control wiring.
 - 6. Activation and safety devices.
 - 7. Include full-size isometric details of each vertical-to-horizontal intersection of storefronts, showing the following:
 - a. Joinery, including concealed welds.
 - b. Anchorage.
 - c. Expansion provisions
 - d. Glazing
 - e. Flashing and drainage.
 - 8. Include details showing interface with perimeter conditions to depict interface with adjacent thermal, weather, air and vapor barriers, and adjacent flashings.
 - 9. Shop drawings must be signed and stamped by a professional engineer.
- D. Delegated-Design Submittal: For entrance and storefront systems indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation. Show structural testing for

attachment of the storefront to the existing structure. Contractor should survey slab edge locations and conditions of the embeds to develop the attachment details.

- E. Samples for Verification: For each type of exposed finish required, in manufacturer's standard sizes.
- F. Qualification Data: For Installer.
- G. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for aluminum-framed systems.
- H. Performance Reports: Based on systems, components and glazing methods proposed for use on this Project, proof that units as glazed for this Project meet or exceed Code requirements for the following:
 - 1. U-value.
 - 2. Solar heat-gain coefficient.
- I. Maintenance Data: For aluminum-framed systems to include in maintenance manuals.
- J. Warranties: Special warranties specified in this Section.

1.5 QUALITY ASSURANCE

- A. Engineering Responsibility: Preparation of Shop Drawings, design calculations, and other structural data by a qualified professional engineer.
- B. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in the jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of entrance and storefront systems that are similar to those indicated for this Project in material, design, and extent.
- C. Installer Qualifications: Capable of assuming engineering responsibility and performing work of this Section and who is acceptable to manufacturer.
- D. Accessible Entrances: Comply with authorities having jurisdiction, local state building code and the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)."
- E. Preinstallation Conference: Conduct conference at Project site. Review methods and procedures related to storefront system, including, but not limited to, the following:
 - 1. Review structural load limitations.
 - 2. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - 3. Review required testing, inspection, and certifying procedures.

1.6 PROJECT CONDITIONS

- A. Field Measurements: Verify actual locations of structural supports for aluminum-framed systems 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 dimensions and proceed with fabricating aluminum-framed systems without field measurements. Coordinate construction to ensure that actual dimensions correspond to established dimensions.

1.7 WARRANTY

- A. Special Finish Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components on which finishes fail within specified warranty period. Warranty does not include normal weathering.
 - 1. Warranty Period: 10 years from date of Substantial Completion.
- B. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of automatic entrances that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including, but not limited to, excessive deflection.
 - b. Faulty operation of operators, controls, and hardware.
 - c. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.
 - 2. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Exterior Storefront, Thermal Break, 2 inch by 4-1/2 inch profile:
 - a. (Basis of Design) EFCO Corporation, 403X.
 - b. Kawneer North America, 451UT.
 - c. Oldcastle BuildingEnvelope, 3000XT.
 - d. Tubelite Inc., TU24000.
 - e. YKK AP America Inc., YES 45 XT.
 - 2. Interior Storefront, 1-3/4 inch by 4-1/2 inch profile:
 - a. (Basis of Design) EFCO Corporation, 401 NT.
 - b. Kawneer North America, Trifab 400.

- c. Oldcastle BuildingEnvelope, FG-1000.
- d. Tubelite Inc., INT45.
- e. YKK AP America Inc., YES 40 FS.

3. Interior Doors, Wide Stile:

- a. (Basis of Design) EFCO, a Pella Company, D-500.
- b. Kawneer North America, 500.
- c. Oldcastle BuildingEnvelope, WS-500.
- d. Tubelite Inc., Wide.
- e. YKK AP America Inc., 50D.

4. Exterior Doors, Wide Stile, Thermally-Broken:

- a. (Basis of Design) EFCO, a Pella Company, D-502.
- b. Kawneer North America, Insulpour 500T.
- c. Oldcastle BuildingEnvelope, WS-500TC.
- d. Tubelite Inc., Wide Thermal Block.
- e. YKK AP America Inc., 50XT.

2.2 MATERIALS

A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.

- 1. Sheet and Plate: ASTM B 209.
- 2. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221.
- 3. Extruded Structural Pipe and Tubes: ASTM B 429.
- 4. Structural Profiles: ASTM B 308/B 308M.
- 5. Welding Rods and Bare Electrodes: AWS A5.10/A5.10M.

B. Steel Reinforcement: With manufacturer's standard corrosion-resistant primer complying with SSPC-PS Guide No. 12.00 applied immediately after surface preparation and pretreatment. Select surface preparation methods according to recommendations in SSPC-SP COM and prepare surfaces according to applicable SSPC standard.

- 1. Structural Shapes, Plates, and Bars: ASTM A 36/A 36M.
- 2. Cold-Rolled Sheet and Strip: ASTM A 1008/A 1008M.
- 3. Hot-Rolled Sheet and Strip: ASTM A 1011/A 1011M.

2.3 FRAMING SYSTEMS

A. Framing Members: Manufacturer's standard extruded-aluminum framing members of thickness required and reinforced as required to support imposed loads.

- 1. Construction: Dual thermal-break.

B. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

C. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.

1. Where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration, use self-locking devices.
 2. Reinforce members as required to receive fastener threads.
 3. Use exposed fasteners with countersunk Phillips screw heads, finished to match framing system.
- D. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A 123/A 123M or ASTM A 153/A 153M requirements.
- E. Flashing: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials. Form exposed flashing from sheet aluminum finished to match framing and of sufficient thickness to maintain a flat appearance without visible deflection.
- F. Framing System Gaskets and Sealants: Manufacturer's standard recommended by manufacturer for joint type.

2.4 GLAZING SYSTEMS

- A. Glazing: As specified in Section 088000 - GLAZING.
- B. Glazing Gaskets: Manufacturer's standard compression types, replaceable, molded or extruded, that maintain uniform pressure and watertight seal.
- C. Spacers and Setting Blocks: Manufacturer's standard elastomeric types.

2.5 DOORS

- A. Doors: Manufacturer's standard glazed doors, for manual swing operation.
1. Door Construction: Mechanical clip fastening, SIGMA deep penetration plus welds and 1-1/8 inch long fillet welds inside and outside of all four corners. Glazing stops shall be hook-in type and EPDM glazing gaskets reinforced with non-stretchable cord.

2.6 DOOR HARDWARE

- A. General: Provide heavy-duty units in sizes and types recommended by entrance system and hardware manufacturers for entrances and uses indicated.
1. Opening-Force Requirements:
 - a. Egress Doors: Not more than 30 lbf required to set door in motion and not more than 15 lbf required to open door to minimum required width.
 - b. Accessible Interior Doors: Not more than 5 lbf.

- B. Hardware Sets: Provide as specified in Section 087100 - DOOR HARDWARE.

2.7 ACCESSORY MATERIALS

- A. Insulating Materials: As specified in Section 072100 - THERMAL INSULATION.

- B. Joint Sealants: For installation at perimeter of aluminum-framed systems, as specified in Section 079200 - JOINT SEALANTS.
- C. Bituminous Paint: Cold-applied asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos, formulated for 30-mil thickness per coat.

2.8 FABRICATION

- A. Form aluminum shapes before finishing.
- B. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.
- C. Framing Members, General: Fabricate components that, when assembled, have the following characteristics:
 - 1. Profiles that are sharp, straight, and free of defects or deformations.
 - 2. Accurately fitted joints with ends coped or mitered.
 - 3. Means to drain water passing joints, condensation occurring within framing members, and moisture migrating within the system to exterior.
 - 4. Physical and thermal isolation of glazing from framing members.
 - 5. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
 - 6. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.
- D. Mechanically Glazed Framing Members: Fabricate for flush glazing (without projecting stops).
- E. Door Frames: Reinforce as required to support loads imposed by door operation and for installing hardware.
 - 1. At exterior doors, provide compression weather stripping at fixed stops.
 - 2. At interior doors, provide silencers at stops to prevent metal-to-metal contact. Install three silencers on strike jamb of single-door frames and two silencers on head of frames for pairs of doors.
- F. Doors: Reinforce doors as required for installing hardware.
 - 1. At pairs of exterior doors, provide sliding weather stripping retained in adjustable strip mortised into door edge.
 - 2. At exterior doors, provide weather sweeps applied to door bottoms.
- G. Hardware Installation: Factory install hardware to the greatest extent possible. Cut, drill, and tap for factory-installed hardware before applying finishes.
- H. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.9 ALUMINUM FINISHES

- A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
- C. High-Performance Organic Finish (2-Coat Fluoropolymer): AA-C12C40R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: conversion coating; Organic Coating: manufacturer's standard 2-coat, thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color coat, with color coat containing not less than 70 percent polyvinylidene fluoride resin by weight). Coatings shall be fluorosurfactant free Kynar 500 by Arkema or fluorosurfactant-compliant Hylar 5000 by Solvay; or equal. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with AAMA 2605 and with coating and resin manufacturers' written instructions.
 - 1. Available Products: Sherwin-Williams Coil Coatings; Valspar Fluoropon Pure; or approved equal.
 - 2. Building Product Disclosure and Optimization, Material Ingredients: Declare product label.
 - 3. Color and Gloss: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.
 - 1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General:
 - 1. Comply with manufacturer's written instructions.
 - 2. Do not install damaged components.
 - 3. Fit joints to produce hairline joints free of burrs and distortion.
 - 4. Rigidly secure nonmovement joints.
 - 5. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration.
 - 6. Seal joints watertight, unless otherwise indicated.
- B. Metal Protection:
 - 1. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape or installing nonconductive spacers as recommended by manufacturer for this purpose.
 - 2. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

- C. Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within the system to exterior.
- D. Set continuous sill members and flashing in full sealant bed as specified in Section 079200 - JOINT SEALANTS and to produce weathertight installation.
- E. Install components plumb and true in alignment with established lines and grades, without warp or rack.
- F. Install glazing as specified in Section 088000 - GLAZING.
 - 1. Structural-Sealant Glazing:
 - a. Prepare surfaces that will contact structural sealant according to sealant manufacturer's written instructions to ensure compatibility and adhesion. Preparation includes, but is not limited to, cleaning and priming surfaces.
 - b. Install weatherseal sealant according to Section 079200 - JOINT SEALANTS and according to sealant manufacturer's written instructions to produce weatherproof joints. Install joint filler behind sealant as recommended by sealant manufacturer.
- G. Entrances: Install to produce smooth operation and tight fit at contact points.
 - 1. Exterior Entrances: Install to produce tight fit at weather stripping and weathertight closure.
 - 2. Field-Installed Hardware: Install surface-mounted hardware according to hardware manufacturers' written instructions using concealed fasteners to greatest extent possible.
- H. Erection Tolerances: Install aluminum-framed systems to comply with the following maximum tolerances:
 - 1. Location and Plane: Limit variation from true location and plane to 1/8 inch in 12 feet; 1/4 inch over total length.
 - 2. Alignment:
 - a. Where surfaces abut in line, limit offset from true alignment to 1/16 inch.
 - b. Where surfaces meet at corners, limit offset from true alignment to 1/32 inch.
 - 3. Diagonal Measurements: Limit difference between diagonal measurement to 1/8 inch.

3.3 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Testing Services: Testing and inspecting of representative areas to determine compliance of installed systems with specified requirements shall take place as follows and in successive stages as indicated on Drawings. Do not proceed with installation of the next area until test results for previously completed areas show compliance with requirements.
 - 1. Air Infiltration: Areas shall be tested for air leakage of 1.5 times the rate specified for laboratory testing under Part 1 "Performance Requirements" Article, but not more than

- 0.09 cfm/sq. ft. of fixed wall area when tested according to ASTM E 783 at a minimum static-air-pressure difference of 6.24 lbf/sq. ft.
2. Water Penetration: Areas shall be tested according to ASTM E 1105 at a minimum cyclic static-air-pressure difference of 0.67 times the static-air-pressure difference specified for laboratory testing under Part 1 "Performance Requirements" Article, but not less than 4.18 lbf/sq. ft., and shall not evidence water penetration.
 3. Water Spray Test: Before installation of interior finishes has begun, a minimum area of 75 feet by 1 story of aluminum-framed systems designated by Architect shall be tested according to AAMA 501.2 and shall not evidence water penetration.
- C. Repair or remove work where test results and inspections indicate that it does not comply with specified requirements.
- 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
- A. Entrances: Adjust operating hardware for smooth operation according to hardware manufacturers' written instructions.
1. For doors accessible to people with disabilities, adjust closers to provide a 3-second closer sweep period for doors to move from a 70-degree open position to 3 inches from the latch measured to the leading door edge.

END OF SECTION

SECTION 084410

GLAZED ALUMINUM CURTAIN WALLS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Glazed aluminum-framed curtain wall systems.
 - 2. Insulating glass units for curtain wall.
- B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council. Refer to Section 018110, SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 078440 - FIRE-RESISTIVE JOINT SYSTEMS for perimeter fire-containment systems (safety insulation) field installed with glazed aluminum curtain wall systems.
 - 2. Section 079200 - JOINT SEALANTS for installation of joint sealants installed with glazed aluminum curtain wall systems and for sealants to the extent not specified in this Section.
 - 3. Section 084110 - ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS for entrance and storefront systems.
 - 4. Section 085110 - ALUMINUM WINDOWS for windows installed with glazed aluminum curtain wall systems.
 - 5. Section 089000 - LOUVERS AND VENTS for units installed with glazed aluminum curtain wall systems.

1.3 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design glazed curtain wall, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. General: Provide glazed aluminum curtain wall systems, including anchorage, capable of withstanding, without failure, the effects of the following:
 - 1. Structural loads.
 - 2. Thermal movements.

3. Movements of supporting structure indicated on Drawings including, but not limited to, story drift, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.
 4. Dimensional tolerances of building frame and other adjacent construction.
 5. Failure includes the following:
 - a. Deflection exceeding specified limits.
 - b. Thermal stresses transferred to building structure.
 - c. Framing members transferring stresses, including those caused by thermal and structural movements, to glazing.
 - d. Noise or vibration created by wind and thermal and structural movements.
 - e. Loosening or weakening of fasteners, attachments, and other components.
 - f. Sealant failure.
- C. Structural Loads: Wind and seismic loads as indicated on the Structural Drawings, but not less than that required by Code.
- D. Structural-Test Performance: Provide glazed aluminum curtain wall systems tested according to ASTM E 330 as follows:
1. When tested at positive and negative wind-load design pressures, systems do not evidence deflection exceeding specified limits.
 2. When tested at 150 percent of positive and negative wind-load design pressures, systems, including anchorage, do not evidence material failures, structural distress, and permanent deformation of main framing members exceeding 0.2 percent of span.
 3. Test Duration: As required by design wind velocity but not less than 10 seconds.
- E. Deflection of Framing Members:
1. Deflection Normal to Wall Plane: Limited to $1/175$ of clear span for spans up to 13 feet 6 inches, and to $1/240$ of clear span plus $1/4$ inch for spans greater than 13 feet 6 inches or an amount that restricts edge deflection of individual glazing lites to $3/4$ inch, whichever is less.
 2. Deflection Parallel to Glazing Plane: Limited to $1/360$ of clear span or $1/8$ inch, whichever is smaller, amount not exceeding that which reduces glazing bite to less than 75 percent of design dimension and which reduces edge clearance between framing members and glazing or other fixed components to less than $1/8$ inch.
- F. Story Drift: Provide glazed aluminum curtain wall systems that accommodate design displacement of adjacent stories indicated.
1. Design Displacement: As indicated on Drawings.
 2. Test Performance: No glass breakage, anchor failures, or structural damage when tested according to AAMA 501.4.
- G. Thermal Movements: Provide glazed aluminum curtain wall systems that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures. 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.

- H. Air Infiltration: Provide glazed aluminum curtain wall systems with maximum air leakage of 0.06 cfm/sq. ft. of fixed wall area when tested according to ASTM E 283 at a minimum static-air-pressure differential of 6.24 lbf/sq. ft.
 - I. Water Penetration Under Static Pressure: Provide aluminum glazed curtain wall systems that do not evidence water penetration when tested according to ASTM E 331 at a minimum differential static pressure of 20 percent of positive design wind load, but not less than 12 lbf/sq. ft.
 - 1. Maximum Water Leakage: No uncontrolled water penetrating systems or appearing on systems' normally exposed interior surfaces from sources other than condensation. Water controlled by flashing and gutters that is drained to exterior and cannot damage adjacent materials or finishes is not considered water leakage.
 - J. Condensation Resistance: Provide glazed aluminum curtain wall systems with condensation-resistance factor (CRF) of not less than 75 when tested according to AAMA 1503.
 - K. Solar Heat-Gain Coefficient: Provide units with a whole-unit SHGC maximum as required by Code, determined according to NFRC 200 procedures. Submit proof of compliance with submittals as specified.
 - L. Thermal Transmittance: Provide window units that have a U-value as required by Code rated in BTU/hour/sq. ft./degrees F at 15-mph exterior wind velocity, when tested in accordance with AAMA 1503.1. Test unit to be 4 ft. x 6 ft. Submit proof of compliance with submittals as specified.
- 1.4 SUBMITTALS
- A. Product Data: For each type of product indicated.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
 - B. LEED Submittals:
 - 1. Building Product Disclosure and Optimization, Material Ingredients:
 - a. Option 1, Material Ingredient Reporting: For factory-applied metal finishes, submit Declare product labels.
 - C. Shop Drawings: Prepared by or under the supervision of a qualified professional engineer detailing fabrication and assembly of glazed aluminum curtain wall systems.
 - 1. Include structural analysis of story drift and deflection from anticipated live loads, and determination whether head receptors are required.
 - 2. Include weatherproofing, drainage and anchorage provisions.
 - 3. Include details, materials, adjacent and adjacent construction. Include isometric views of complex intersections.
 - D. Delegated-Design Submittal: For glazed curtain wall system indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

- E. Samples for Verification: For each type of exposed finish required, in manufacturer's standard sizes.
 - F. Fabrication Sample: Of each vertical-to-horizontal intersection of systems, made from 12-inch lengths of full-size components and showing details of the following:
 - 1. Joinery.
 - 2. Anchorage.
 - 3. Expansion provisions.
 - 4. Glazing.
 - 5. Flashing and drainage.
 - G. Performance Reports: Based on systems, components and glazing methods proposed for use on this Project, proof that units as glazed for this Project meet or exceed Code requirements for the following:
 - 1. U-value.
 - 2. Solar heat-gain coefficient.
 - H. Compatibility Test Reports: Test reports by glazing and/or sealant manufacturers that show chemical compatibility and adhesion (if required) between all non-aluminum components including, but not limited, to:
 - 1. Gaskets
 - 2. Insulated glass edge seals
 - 3. Setting blocks
 - 4. Anti-walk blocks
 - 5. End dams
 - 6. Sealants
 - 7. Silicone sheet membrane flashing
 - I. Welding certificates.
 - J. Qualification data for Installer.
 - K. Field quality-control test reports.
 - L. Warranties: Special warranties specified in this Section.
- 1.5 QUALITY ASSURANCE
- A. Engineering Responsibility: Preparation of Shop Drawings, design calculations, and other structural data by a qualified professional engineer.
 - B. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in the state the project is located, and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of glazed curtain wall system that are similar to those indicated for this Project in material, design, and extent.
 - C. Installer Qualifications: Capable of assuming engineering responsibility and performing Work of this Section and who is acceptable to manufacturer.

- D. Product Options: Information on Drawings and in Specifications establishes requirements for systems' aesthetic effects and performance characteristics. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction. Performance characteristics are indicated by criteria subject to verification by one or more methods including preconstruction testing, field-testing, and in-service performance.
- E. Welding: Qualify procedures and personnel according to AWS D1.2, "Structural Welding Code--Aluminum."
- F. Installation Sequence Conference: Conduct conference at Project site to review sequence of installation of curtain wall systems, including installation of joint sealants, flashing, and glass. Conference shall be attended by all installers of applicable components.
- G. Mockups: Build mockups to demonstrate aesthetic effects and set quality standards for fabrication and installation.
 - 1. Build mockup of typical wall area as indicated on Drawings.
 - 2. Build mockup in sequence recommended by manufacturer including installation of joint sealants, flashing and glass.
 - 3. The construction of the mockup shall be observed by all tradesmen constructing the curtain wall system.
- H. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01. Review methods and procedures related to glazed aluminum curtain wall systems including, but not limited to, the following:
 - 1. Review structural load limitations.
 - 2. Review installation sequence, including installation of sealants, flashing, and glass.
 - 3. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - 4. Review required testing, inspecting, and certifying procedures.

1.6 PROJECT CONDITIONS

- A. Field Measurements: Verify actual locations of structural supports for glazed aluminum curtain wall systems 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 dimensions and proceed with fabricating glazed aluminum curtain wall systems without field measurements. Coordinate construction to ensure that actual dimensions correspond to established dimensions.

1.7 WARRANTY

- A. Special Assembly Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of glazed aluminum curtain wall systems that do not comply with requirements or that deteriorate as defined in this Section within specified warranty period.
 - 1. Failures include, but are not limited to, the following:

- a. Structural failures including, but not limited to, excessive deflection.
 - b. Noise or vibration caused by thermal movements.
 - c. Deterioration of metals and other materials beyond normal weathering.
 - d. Water leakage.
 - e. Failure of operating components to function normally.
 2. Warranty Period: Three years from date of Substantial Completion.
- B. Special Finish Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components on which finishes fail within specified warranty period. Warranty does not include normal weathering.
1. Warranty Period: Ten years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Curtain Wall - Pressure Plate System:
 - a. (Basis of Design) EFCO Corporation, System 5600X.
 - b. Kawneer North America, 1600UT System 1.
 - c. Oldcastle BuildingEnvelope, Reliance-TC.
 - d. Wausau, Superwall.
 - e. YKK AP America Inc., YCW-750 XTP.

2.2 FRAMING SYSTEMS

- A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
1. Sheet and Plate: ASTM B 209
 2. Extruded Bars, Rods, Shapes, and Tubes: ASTM B 221
 3. Extruded Structural Pipe and Tubes: ASTM B 429.
- B. Steel Reinforcement: With manufacturer's standard corrosion-resistant primer complying with SSPC-PS Guide No. 12.00 applied immediately after surface preparation and pretreatment. Select surface preparation methods according to recommendations in SSPC-SP COM and prepare surfaces according to applicable SSPC standard.
1. Structural Shapes, Plates, and Bars: ASTM A 36/A 36M.
 2. Cold-Rolled Sheet and Strip: ASTM A 611.
 3. Hot-Rolled Sheet and Strip: ASTM A 570/A 570M.
- C. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

- D. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.
 - 1. Where fasteners are subject to loosening or turn out from thermal and structural movements, wind loads, or vibration, use self-locking devices.
 - 2. Reinforce members as required to receive fastener threads.
 - 3. Where acceptable, use exposed fasteners with countersunk Phillips screw heads.
 - 4. Finish exposed portions to match framing system.
 - 5. At movement joints, use slip-joint linings, spacers, and sleeves of material and type recommended by manufacturer.
- E. Anchors: Three-way adjustable anchors that accommodate fabrication and installation tolerances in material and finish compatible with adjoining materials and recommended by manufacturer.
 - 1. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A 123/A 123M or ASTM A 153/A 153M requirements.
- F. Concealed Flashing: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials.
- G. Joint Sealants: Provide manufacturer recommended sealants for seams and joints within aluminum framing system.

2.3 GLAZING SYSTEMS

- A. Glazing: As specified in Section 088000 - GLAZING.
- B. Glazing Gaskets: Manufacturer's standard compression types, replaceable, molded or extruded, that maintain uniform pressure and watertight seal.
- C. Spacers and Setting Blocks: Manufacturer's standard elastomeric types.

2.4 INSULATED SPANDREL PANELS

- A. Insulated Spandrel Panels: Laminated, metal-faced flat panels with no deviations in plane exceeding 0.8 percent of panel dimension in width or length.
 - 1. Overall Panel Thickness: 1 inch.
 - 2. Exterior and Interior Skin: Aluminum.
 - a. Thickness: Manufacturer's standard for finish and texture indicated.
 - b. Finish: Matching framing system.
 - c. Texture: Smooth.
 - d. Backing Sheet: Manufacturer's standard.
 - e. Thermal Insulation Core: Manufacturer's standard.

2.5 ACCESSORY MATERIALS

- A. Perimeter Fire-Containment Systems (Safing Insulation): Specified in Section 078440 - FIRE-RESISTANT JOINT SYSTEMS.

- B. Insulating Materials: Specified in Section 072100 - THERMAL INSULATION.
- C. Bituminous Paint: Cold-applied asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos, formulated for 30-mil thickness per coat.
- D. Silicone Membrane: Pre-cured silicone sheet that is physically and chemically compatible with the approved silicone sealant for the curtain wall system.
- E. Foam Tape: Foam glazing tape with adhesive on one side. Select the thickness and width to provide an adequate air and water seal and to provide adequate clamping pressure to silicone flashing.

2.6 FABRICATION

- A. Form aluminum shapes before finishing.
- B. Fabricate components that, when assembled, have the following characteristics:
 - 1. Sharp profiles, straight and free of defects or deformations.
 - 2. Accurately fitted joints with ends coped or mitered.
 - 3. Internal guttering systems or other means to drain water passing joints, condensation occurring within framing members, and moisture migrating within the system to exterior.
 - 4. Physical and thermal isolation of glazing from framing members.
 - 5. Accommodations for thermal and mechanical movements of glazing and framing to prevent glazing-to-glazing contact and to maintain required glazing edge clearances.
- C. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.
- D. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.7 ALUMINUM FINISHES

- A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
- C. High-Performance Organic Finish (2-Coat Fluoropolymer): AA-C12C40R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: conversion coating; Organic Coating: manufacturer's standard 2-coat, thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color coat, with color coat containing not less than 70 percent polyvinylidene fluoride resin by weight). Coatings shall be fluorosurfactant free Kynar 500 by Arkema or fluorosurfactant-compliant Hylar 5000 by Solvay; or equal. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with AAMA 2605 and with coating and resin manufacturers' written instructions.
 - 1. Available Products: Sherwin-Williams Coil Coatings; Valspar Fluoropon Pure; or approved equal.

2. Building Product Disclosure and Optimization, Material Ingredients: Declare product label.
3. Color and Gloss: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.
 1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General:
 1. Comply with manufacturer's written instructions.
 2. Do not install damaged components.
 3. Fit joints to produce hairline joints free of burrs and distortion.
 4. Rigidly secure nonmovement joints.
 5. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.
 6. Seal joints watertight, unless otherwise indicated.
- B. Connecting and Sealing to Adjacent Enclosure Systems:
 1. At locations where the curtain wall will be installed adjacent to back vented and drained rain screen wall systems, connect the curtain wall to the water-resistive barrier of the adjacent wall system with silicone membrane flashing.
 2. Seal and clamp the silicone membrane into the curtain wall glazing pocket.
 - a. Use a sealant that is compatible with the silicone membrane and the silicone in the joints of the curtain wall system.
 - b. Use an L-shaped pressure bar with applied foam tape to clamp the silicone membrane to the curtain wall mullion.
 3. Notch the stem on vertical mullions as needed to install flashing at the tops and bottoms of the curtain wall. Flashing shall be continuously sealed and clamped into the curtain wall glazing pocket and sealed to adjacent air barrier or enclosure system as indicated on the Drawings. Install similar flashing at the jambs of the curtain wall to provide continuous perimeter flashing.
 4. At locations where the curtain wall will be installed adjacent to roofing systems connect the curtain wall to the roofing vapor barrier and the roof membrane. The roofing vapor barrier may be adhered directly to the inboard side of the curtain wall. Provide a metal backpan if needed to allow for this connection. Connect the roofing membrane to the curtain wall by transitioning the roof membrane to a silicone sheet membrane.
 - a. Provide stainless steel sheet or foil-faced membrane as needed to transition between the roofing membrane and the silicone sheet.
 - b. Seal and clamp the silicone sheet into the curtain wall as described above.

C. Metal Protection:

1. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape or installing nonconductive spacers as recommended by manufacturer for this purpose.
2. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

D. Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within the system to exterior.

E. Install components plumb and true in alignment with established lines and grades.

F. Coordinate with glazing and installation of glazing which is specified in Section 088000 - GLAZING.

G. Coordinate with sealants and installation of perimeter sealants which is specified in Section 079200 - JOINT SEALANTS.

H. Coordinate with insulation and installation of insulation which is specified in Section 072100 - THERMAL INSULATION.

I. Coordinate with materials and installation for perimeter fire-containment systems (safing insulation) which is specified in Section 078440 - FIRE-RESISTIVE JOINT SYSTEMS.

J. Erection Tolerances: Install glazed aluminum curtain wall systems to comply with the following maximum tolerances:

1. Plumb: 1/8 inch in 10 feet ; 1/4 inch in 40 feet.
2. Level: 1/8 inch in 20 feet ; 1/4 inch in 40 feet.
3. Alignment:
 - a. Where surfaces abut in line or are separated by reveal or protruding element up to 1/2 inch wide, limit offset from true alignment to 1/16 inch.
 - b. Where surfaces are separated by reveal or protruding element from 1/2 to 1 inch wide, limit offset from true alignment to 1/8 inch.
 - c. Where surfaces are separated by reveal or protruding element of 1 inch wide or greater, limit offset from true alignment to 1/4 inch.
4. Location: Limit variation from plane to 1/8 inch in 12 feet; 1/2 inch over total length.

3.3 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. Testing Services: Testing and inspecting of representative areas to determine compliance of installed system with specified requirements shall take place as follows and in successive stages as indicated on Drawings. Do not proceed with installation of the next area until test results for previously completed areas show compliance with requirements.

1. Air Infiltration: Areas shall be tested for air leakage of 1.5 times the rate specified under Part 1 "Performance Requirements" Article, but not more than 0.09 cfm/sq. ft. of fixed wall area when tested according to ASTM E 783 at a minimum static-air-pressure differential of 6.24 lbf/sq. ft.
 2. Water Penetration: Areas shall be tested according to ASTM E 1105 at minimum cyclic static-air-pressure difference of 0.67 times the pressure specified under Part 1 "Performance Requirements" Article, but not less than 6.24 lbf/sq. ft. and shall not evidence water penetration.
 3. Water Spray Test: After the installation of minimum area of 75-feet-by-2-story glazed aluminum curtain wall system has been completed but before installation of interior finishes has begun, a 2-bay area of system designated by Architect shall be tested according to AAMA 501.2 and shall not evidence water penetration.
- C. Repair or remove work where test results and inspections indicate that it does not comply with specified requirements.
- D. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

END OF SECTION

SECTION 084523

FIBERGLASS-SANDWICH-PANEL ASSEMBLIES

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Aluminum-framed assemblies glazed with fiberglass sandwich panels (translucent) window wall and skylight assemblies, **insulated with aerogel**.
- B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council. Refer to Section 018110, SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 079200 - JOINT SEALANTS for sealants installed at perimeters of assemblies.

1.3 PERFORMANCE REQUIREMENTS

- A. General: Provide fiberglass sandwich panel assemblies, including anchorage, capable of withstanding, without failure, the effects of the following:
 - 1. Structural loads.
 - 2. Thermal movements.
 - 3. Movements of supporting structure indicated on Drawings including, but not limited to, story drift, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.
 - 4. Dimensional tolerances of building frame and other adjacent construction.
 - 5. Failure includes the following:
 - a. Deflection exceeding specified limits.
 - b. Thermal stresses transferred to building structure.
 - c. Framing members transferring stresses, including those caused by thermal and structural movements, to glazing.
 - d. Noise or vibration created by wind and thermal and structural movements.
 - e. Loosening or weakening of fasteners, attachments, and other components.
 - f. Sealant failure.

FIBERGLASS-SANDWICH-PANEL ASSEMBLIES

- B. Structural-Test Performance: Provide glazed aluminum curtain-wall systems tested according to ASTM E 330 as follows:
 - 1. When tested at positive and negative wind-load design pressures, systems do not evidence deflection exceeding specified limits.
 - 2. When tested at 150 percent of positive and negative wind-load design pressures, systems, including anchorage, do not evidence material failures, structural distress, and permanent deformation of main framing members exceeding 0.2 percent of span.
 - 3. Test Duration: As required by design wind velocity but not less than 10 seconds.
- C. Deflection of Framing Members:
 - 1. Deflection Normal to Wall Plane: Limited to 1/60 of clear span.
- D. Thermal Movements: Provide glazed aluminum curtain-wall systems that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures. 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, dimensions of individual components and profiles, and finishes for assemblies.
- B. Shop Drawings: For assemblies. Include plans, elevations, sections, details, and attachments to other work.
 - 1. Include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- C. Samples for Initial Selection: For each type of exposed finish required, in manufacturer's standard sizes.
- D. Samples for Verification: Submit 12 by 12 inch sample panel assemblies, for each color selected.
- E. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for assemblies.
- F. Maintenance Data: For assemblies to include in maintenance manuals.
- G. Warranties: Special warranties specified in this Section.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Capable of assuming engineering responsibility and performing Work of this Section and who is acceptable to manufacturer.
 - 1. Engineering Responsibility: Preparation of data for structured panel assemblies including shop drawings based on testing and engineering analysis of manufacturer's standard

units in assemblies similar to those indicated for this Project and submission of reports of tests performed on manufacturer's standard assemblies.

- B. Product Options: Information on Drawings and in Specifications establishes requirements for systems' aesthetic effects and performance characteristics. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction. Performance characteristics are indicated by criteria subject to verification by one or more methods including preconstruction testing, field testing, and in-service performance.
- C. Welding: Qualify procedures and personnel according to AWS D1.2, "Structural Welding Code--Aluminum."
- D. NFRC Certification: Provide fiberglass sandwich panels that are certified for U-factors indicated according to NFRC 100 and listed in its "National Fenestration Council Incorporated - Certified Products Directory."
- E. Mockups: Build mockups to demonstrate aesthetic effects and set quality standards for fabrication and installation.
 - 1. Build mockup of typical wall area as shown on Drawings.
- F. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01. Review methods and procedures related to glazed aluminum curtain-wall systems including, but not limited to, the following:
 - 1. Review structural load limitations.
 - 2. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - 3. Review required testing, inspecting, and certifying procedures.

1.6 PROJECT CONDITIONS

- A. Field Measurements: Verify actual locations of structural supports for glazed aluminum curtain-wall systems 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 dimensions and proceed with fabricating glazed aluminum curtain-wall systems without field measurements. Coordinate construction to ensure that actual dimensions correspond to established dimensions.

1.7 WARRANTY

- A. Special Assembly Warranty: Manufacturer's standard form in which manufacturer and Installer agree to repair or replace components of assemblies that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including, but not limited to, excessive deflection.

- b. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 - 2. Warranty Period: Two years from date of Substantial Completion.
- B. Special Fiberglass-Sandwich-Panel Warranty: Manufacturer's standard form in which manufacturer agrees to replace panels that exhibit defects in materials or workmanship.
 - 1. Defects include, but are not limited to, the following:
 - a. Delamination of coating, if any, from exterior face sheet.
 - b. Discoloration of exterior face sheet of more than 8.0 units Delta E when measured according ASTM D 2244.
 - c. Delamination of panel face sheets from panel cores.
 - 2. Warranty Period: 10 years from date of Substantial Completion.
- C. Special Aluminum-Finish Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components on which finishes fail within specified warranty period. Warranty does not include normal weathering.
 - 1. Failures include, but are not limited to, checking, crazing, peeling, chalking, and fading of finishes.
 - 2. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Kalwall Corporation.
 - 2. Major Industries, Inc.

2.2 ALUMINUM FRAME SYSTEMS

- A. Aluminum: Alloy and temper recommended in writing by manufacturer for type of use and finish indicated.
 - 1. Sheet and Plate: ASTM B 209.
 - 2. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221.
 - 3. Extruded Structural Pipe and Tubes: ASTM B 429.
- B. Components: Manufacturer's standard extruded-aluminum members of thickness required and reinforced as required to support imposed loads.
- C. Exposed Flashing and Closures: Manufacturer's standard aluminum components not less than 0.040 inch thick.
- D. Frame-System Gaskets: Manufacturer's standard.

- E. Anchors, Fasteners, and Accessories: Manufacturer's standard, corrosion-resistant, nonstaining, and nonbleeding; compatible with adjacent materials.
 - 1. At closures, retaining caps, or battens, use ASTM A 193/A 193M, 300 series stainless-steel screws.
 - 2. Where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration, use self-locking devices.
 - 3. At movement joints, use slip-joint linings, spacers, and sleeves of material and type recommended in writing by manufacturer.
- F. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A 123/A 123M or ASTM A 153/A 153M requirements.
- G. Anchor Bolts: ASTM A 307, Grade A, hot-dip zinc coating, ASTM A 153/A 153M, Class C or mechanically deposited zinc coating, ASTM B 695, Class 50.
- H. Frame System Fabrication:
 - 1. Fabricate components before finishing.
 - 2. Fabricate components that, when assembled, have the following characteristics:
 - a. Profiles that are sharp, straight, and free of defects or deformations.
 - b. Accurately fitted joints with ends coped or mitered.
 - c. Internal guttering systems or other means to drain water passing joints, condensation occurring within components, and moisture migrating within the assembly to exterior.
 - 3. Fabricate sill closures with weep holes and for installation as continuous component.
 - 4. Reinforce components as required to receive fastener threads.
 - 5. Weld components in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.

2.3 FIBERGLASS SANDWICH PANELS

- A. Panel Construction: Assembly of uniformly colored, translucent, thermoset, fiberglass-reinforced-polymer face sheets bonded to both sides of a grid core and complying with requirements applicable to panel materials in ICBO ES AC04, "Sandwich Panels."
 - 1. Face-Sheet, Self-Ignition Temperature: 650 deg F or more per ASTM D 1929.
 - 2. Face-Sheet Burning Extent: 1 inch or less per ASTM D 635.
 - 3. Face-Sheet, Smoke-Developed Index: 450 or less per ASTM E 84.
 - 4. Interior Face-Sheet, Flame-Spread Index: Not more than 25 per ASTM E 84.
 - 5. U-Value: Based on color selections.
 - 6. U-Value: 0.05, center of glazing, for units with aerogel.
 - 7. Light Transmission: Based on color selections.
- B. Panel Thickness: 2-3/4 inches.
- C. Grid Core: Mechanically interlocked extruded-aluminum I-beams, with a minimum flange width of 7/16 inch.

1. Extruded Aluminum: ASTM B 221, in alloy and temper recommended in writing by manufacturer.
2. Grid Pattern: As indicated on Drawings.

D. Face Sheets:

1. Exterior Color: As selected by Architect.
2. Interior Color: As selected by Architect.

E. Insulation: Manufacturer's standard translucent aerogel material.

F. Fiberglass-Sandwich-Panel Adhesive: ASTM D 2559.

G. Panel Fabrication: Factory assemble and seal panels.

2.4 ACCESSORY MATERIALS

- A. Isolation Coating (Bituminous Paint): ASTM D 1187, VOC compliant, cold-applied asphalt-mastic paint, containing no asbestos, formulated for 30-mil thickness per coat.

2.5 ALUMINUM FINISHES

- A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
- C. Class I, Clear Anodic Finish: AA-M12C22A41 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 611.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.
1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General:
1. Comply with manufacturer's written instructions.
 2. Do not install damaged components.
 3. Fit joints between aluminum components to produce hairline joints free of burrs and distortion.
 4. Rigidly secure nonmovement joints.

5. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.
 6. Weld aluminum components in concealed locations to minimize distortion or discoloration of finish. Protect glazing surfaces from welding.
 7. Seal joints watertight, unless otherwise indicated.
- B. Metal Protection: Where aluminum components will contact dissimilar materials, protect against galvanic action by painting contact surfaces with bituminous paint or by installing nonconductive spacers as recommended in writing by manufacturer for this purpose.
- C. Install continuous aluminum sill closure with weatherproof expansion joints and locked and sealed or welded corners. Locate weep holes at rafters.
- D. Install components to drain water passing joints, condensation occurring within aluminum members and panels, and moisture migrating within assembly to exterior.
- E. Install components plumb and true in alignment with established lines and elevations.
- F. Coordinate with sealants and installation of perimeter sealants which is specified in Section 079200 - JOINT SEALANTS.
- G. Erection Tolerances: Install assemblies to comply with the following maximum tolerances:
1. Alignment: Limit offset from true alignment to 1/32 inch where surfaces abut in line, edge to edge, at corners, or where a reveal or protruding element separates aligned surfaces by less than 3 inches; otherwise, limit offset to 1/8 inch.
 2. Location and Plane: Limit variation from true location and plane to 1/8 inch in 12 feet; 1/2 inch over total length.

END OF SECTION

SECTION 085110

ALUMINUM WINDOWS

(Part of Work of Section 080001 - METAL WINDOWS, Filed Sub-Bid Required)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Fixed and operable aluminum-framed windows with factory-installed glass and glazing.
- B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council. Refer to Section 018110, SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 084110 - ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS.
 - 2. Section 084410 - GLAZED ALUMINUM CURTAIN WALLS for curtain wall assemblies.
 - 3. Section 088000 - GLAZING for requirements for glass and glazing.

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 test size indicated below:
 - 1. Minimum size required by AAMA/NWWDA 101/I.S.2.
- B. AAMA/NWWDA Performance Requirements: Provide aluminum windows of the performance class and grade indicated that comply with AAMA/NWWDA 101/I.S.2.
 - 1. Performance Class: Architectural Grade AW.
 - 2. Performance Grade: Minimum for performance class indicated.
 - 3. Exception to AAMA/NWWDA 101/I.S.2: In addition to requirements for performance class and performance grade, design glass framing system to limit lateral deflections of glass edges to less than 1/175 of glass-edge length or 3/4 inch whichever is less, at design pressure based on the following:

ALUMINUM WINDOWS

- C. Structural Performance: Provide aluminum windows capable of withstanding the following, including wind loads based on passing AAMA/NWWDA 101/I.S.2, Uniform Load Structural Test, at basic wind speed indicated and as required by Code:
 - 1. Deflection: Design glass framing system to limit lateral deflections of glass edges to less than 1/175 of glass-edge length or 3/4 inch, whichever is less, at design pressure based on structural computations.
 - 2. Wind and Seismic Loads: As indicated on the Structural Drawings, but not less than that required by Code.
 - 3. Movements of supporting structure including, but not limited to, story drift and deflection from uniformly distributed and concentrated live loads as required by Code. Deflection may require special considerations including but not limited to head receptors.
- D. Air Infiltration: Maximum rate not more than indicated when tested according to AAMA/NWWDA 101/I.S.2, Air Infiltration Test.
 - 1. Maximum Rate: As required by Code.
- E. Water Resistance: No water leakage as defined in AAMA/NWWDA referenced test methods at a water test pressure equaling that indicated, when tested according to AAMA/NWWDA 101/I.S.2, Water Resistance Test.
 - 1. Test Pressure: 15 percent of positive design pressure, but not less than 2.86 lbf/sq. ft. or more than 12 lbf/sq. ft.
- F. Condensation-Resistance Factor: Provide aluminum windows tested for thermal performance according to AAMA 1503, showing a CRF of 52 where windows are indicated to be "thermally improved."
- G. Thermal Transmittance: Provide aluminum windows with a whole-window U-value maximum indicated at 15-mph exterior wind velocity and winter condition temperatures when tested according to AAMA 1503.
 - 1. U-Value: As required by Code. Submit proof of compliance with submittals as specified.
- H. Solar Heat-Gain Coefficient: Provide aluminum windows with a whole-window SHGC maximum as required by Code, determined according to NFRC 200 procedures. Submit proof of compliance with submittals as specified.
- I. Thermal Movements: Provide aluminum windows, including anchorage, that accommodate thermal movements of units resulting from the following maximum change (range) in ambient and surface temperatures without buckling, distortion, opening of joints, failure of joint sealants, damaging loads and stresses on glazing and connections, and other detrimental effects. Base engineering calculation on actual surface temperatures of materials due to 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: For each type of product indicated.

1. Include construction details, material descriptions, fabrication methods, dimensions of individual components and profiles, hardware, finishes, and operating instructions.
- B. LEED Submittals:
 1. Building Product Disclosure and Optimization, Material Ingredients:
 - a. Option 1, Material Ingredient Reporting: For factory-applied metal finishes, submit Declare product labels.
- C. Shop Drawings: Include plans, elevations, sections, details, hardware, attachments to other Work, operational clearances, 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.
 6. Thermal-break details.
 7. Glazing details.
 8. Window cleaning provisions.
 9. Window System Operators: Show locations, mounting, and details for installing operator components and controls.
 10. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation and used to determine the following:
 - a. Structural test pressures and design pressures from basic wind speeds indicated.
 - b. Deflection limitations of glass framing systems.
- D. Samples for Verification: Full-size operable window of each type of window.
- E. Qualification Data: For Installer, professional engineer and testing agency.
- F. Field Quality-Control Test Reports: From a qualified testing and inspecting agency engaged by Contractor.
- G. Product Test Reports: Based on evaluation of comprehensive tests performed within the last four years by a qualified testing agency, for each type, grade, and size of aluminum window. Test results based on use of downsized test units will not be accepted.
- H. Performance Reports: Based on systems, components and glazing methods proposed for use on this Project, proof that windows as glazed for this Project meet or exceed Code requirements for the following:
 1. U-value.
 2. Solar heat-gain coefficient.
- I. Maintenance Data: For operable window sash, operating hardware, weather stripping, and finishes to include in maintenance manuals.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An installer acceptable to aluminum window manufacturer for installation of units required for this Project.
- B. Engineering Responsibility: Preparation of Shop Drawings, design calculations, and other structural data by a qualified professional engineer.
- C. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in the state the project is located, and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of windows that are similar to those indicated for this Project in material, design, and extent.
- D. Source Limitations: Obtain aluminum windows through one source from a single manufacturer.
- E. Product Options: Information on Drawings and in Specifications establishes requirements for aluminum windows' aesthetic effects and performance characteristics. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction. Performance characteristics are indicated by criteria subject to verification by one or more methods including preconstruction testing, field testing, and in-service performance.
- F. Fenestration Standard: Comply with AAMA/NWWDA 101/I.S.2, "Voluntary Specifications for Aluminum, Vinyl (PVC) and Wood Windows and Glass Doors," for minimum standards of performance, materials, components, accessories, and fabrication unless more stringent requirements are indicated.
 - 1. Provide AAMA certified aluminum windows with an attached label.
- G. Glazing Publications: Comply with published recommendations of glass manufacturers and GANA's "Glazing Manual" unless more stringent requirements are indicated.
- H. 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.
- I. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 - 1. Build mockup for types of windows indicated, in locations shown on Drawings.
- J. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01. Review methods and procedures related to aluminum windows including, but not limited to, the following:
 - 1. Inspect and discuss condition of substrate and other preparatory work performed by other trades.
 - 2. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - 3. Review required testing and inspecting procedures.

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. Failures include, but are not limited to, the following:
 - 1. Failure to meet performance requirements.
 - 2. Structural failures including excessive deflection.
 - 3. Water leakage, air infiltration, or condensation.
 - 4. Faulty operation of movable sash and hardware.
 - 5. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 - 6. Insulating glass failure.
- B. Warranty Period: Ten years from date of Substantial Completion.
- C. Warranty Period for Metal Finishes: Ten years from date of Substantial Completion.
- D. Warranty Period for Glass: Ten years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. EFCO, a Pella Company.
 - 2. Graham Architectural Products Corp.
 - 3. Kawneer North America.
 - 4. Peerless Products, Inc.
 - 5. Wausau Window and Wall Systems.

2.2 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 (150-MPa) ultimate tensile strength, not less than 16,000-psi (110-MPa) minimum yield strength, and not less than 0.062-inch (1.6-mm) 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 (3.2 mm) 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, typical: Provide compressible weather stripping designed for permanently resilient sealing under bumper or wiper action and for complete concealment when aluminum window is closed.
- F. Sliding-Type Weather Stripping for Double-Hung and Horizontal-Sliding Windows: 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. Replaceable Weather Seals: Comply with AAMA 701/702.
- H. 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.

2.3 GLAZING

- A. Insulating-Glass Units for Vertical Glazing: 1 inch thick (25.0 mm) insulating glass consisting of two lites of 1/4 inch (6 mm) glass, low e coating on the No. 2 surface and argon gas filled. Provide one of the following or equal:
 - 1. Guardian Industries; SN-68.
 - a. Visible Light Transmittance: 68 percent.
 - b. Reflectance Visible Light: 10 percent.
 - c. U Value (Winter): 0.29.
 - d. Shading Coefficient: 0.43.
 - e. Solar Heat Gain Coefficient: 0.37.
 - 2. Viracon; VE1-2M.

- a. Visible Light Transmittance: 70 percent.
 - b. Reflectance Visible Light: 11 percent.
 - c. U Value (Winter): 0.25.
 - d. Shading Coefficient: 0.43.
 - e. Solar Heat Gain Coefficient: 0.37.
 - 3. Vitro Architectural Glass (formerly PPG Industries); Solarban 60.
 - a. Visible Light Transmittance: 70 percent.
 - b. Reflectance Visible Light: 11 percent.
 - c. U Value (Winter): 0.29.
 - d. Shading Coefficient: 0.44.
 - e. Solar Heat Gain Coefficient: 0.38.
 - B. Glazing System: Manufacturer's standard factory-glazing system that produces weathertight seal.
- 2.4 HARDWARE
- A. Hardware Requirements: Provide hardware that complies with AAMA/NWWDA 101/I.S.2.
 - 1. Hardware Finishes: To be selected by Architect from manufacturer's full range.
- 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. Provide for each operable exterior sash or ventilator.
 - B. Aluminum Insect Screen Frames: Manufacturer's standard aluminum alloy complying with SMA 1004. Fabricate frames with mitered or coped joints, concealed fasteners, and removable PVC spline/anchor concealing edge of frame.
 - 1. Aluminum Tubular Framing Sections and Cross Braces: Roll formed from aluminum sheet with minimum wall thickness as required for class indicated.
 - 2. Finish: Match aluminum window members.
 - C. Stainless-Steel Wire Fabric: 18-by-16 mesh of 0.009-inch-diameter, nonmagnetic stainless-steel wire, Type 304 or 316, complying with FS RR-W-365, Type VI.
 - D. Wickets: Not permitted.
- 2.6 ACCESSORIES
- A. Window Cleaner Anchor Bolts: Provide window cleaner anchor bolts of standard design, complying with requirements of authorities having jurisdiction. Fabricate bolts of nonmagnetic stainless steel.
 - 1. Reinforce window units or mullions to receive bolts and provide additional anchorage of units at bolt locations.

2.7 FABRICATION

- A. General: Fabricate aluminum windows, in sizes indicated, that comply with AAMA/NWWDA 101/I.S.2 for performance class and performance grade indicated. Include a complete system for assembling components and anchoring windows.
- B. Thermally Improved Construction: Fabricate aluminum windows with an integral, concealed, low-conductance thermal barrier; located between exterior materials and window members exposed on interior side; in a manner that eliminates direct metal-to-metal contact.
- C. Weather Stripping: Provide full-perimeter weather stripping for each operable sash and ventilator.
- D. Weep Holes: Provide concealed weep holes and internal passages to conduct infiltrating water to exterior.
- E. 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.
- F. Factory-Glazed Fabrication: Glaze aluminum windows in the factory where practical and possible for applications indicated. Comply with AAMA/NWWDA 101/I.S.2.

2.8 FINISHES

- A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
- C. High-Performance Organic Finish (2-Coat Fluoropolymer): AA-C12C40R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: conversion coating; Organic Coating: manufacturer's standard 2-coat, thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color coat, with color coat containing not less than 70 percent polyvinylidene fluoride resin by weight). Coatings shall be fluorosurfactant free Kynar 500 by Arkema or fluorosurfactant-compliant Hylar 5000 by Solvay; or equal. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with AAMA 2605 and with coating and resin manufacturers' written instructions.
 - 1. Available Products: Sherwin-Williams Coil Coatings; Valspar Fluoropon Pure; or approved equal.
 - 2. Building Product Disclosure and Optimization, Material Ingredients: Declare product label.
 - 3. Color and Gloss: As selected by Architect from manufacturer's full range.

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; rough opening dimensions; levelness of sill plate; coordination with wall flashings, vapor retarders, and other built-in components; operational clearances; and other conditions affecting performance of work.
 - 1. Masonry Surfaces: Visibly dry and free of excess mortar, sand, and other construction debris.
 - 2. Metal Surfaces: Dry; clean; free of grease, oil, dirt, rust, corrosion, and welding slag; without sharp edges or offsets at joints.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Comply with manufacturer's written instructions for installing windows, hardware, accessories, and other components; Drawings; and Shop Drawings.
- 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. Metal Protection: Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials by complying with requirements specified in "Dissimilar Materials" Paragraph in Appendix B in AAMA/NWWDA 101/I.S.2.

3.3 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and to prepare test reports.
- 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.
 - 2. Air-Infiltration Testing:
 - a. Test Pressure: That required to determine compliance with AAMA/WDMA/CSA 101/I.S.2/A440 performance class indicated.
 - b. Allowable Air-Leakage Rate: 1.5 times the applicable AAMA/WDMA/CSA 101/I.S.2/A440 rate for product type and performance class rounded down to one decimal place.
 - 3. Water-Resistance Testing:

- a. Test Pressure: Two-thirds times test pressure required to determine compliance with AAMA/WDMA/CSA 101/I.S.2/A440 performance grade indicated.
 - b. Allowable Water Infiltration: No water penetration.
 - 4. Testing Extent: Three windows of each type as selected by Architect and a qualified independent testing and inspecting agency. Windows shall be tested after perimeter sealants have cured.
 - 5. Test Reports: Prepared according to AAMA 502.
 - C. Remove and replace windows where test results indicate that they do not comply with specified requirements.
 - 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
- A. Adjust operating sashes and ventilators, screens, hardware, operators, and accessories for a tight fit at contact points and weather stripping for smooth operation and weathertight closure. Lubricate hardware and moving parts.
- 3.5 PROTECTION AND CLEANING
- A. 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.
 - 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.

END OF SECTION

SECTION 086200

PLASTIC UNIT SKYLIGHTS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Prefabricated, plastic unit skylights at roof.
- B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council. Refer to Section 018110, SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Division 07 for roofing and joint sealants.
 - 2. Section 075400 - THERMOPLASTIC MEMBRANE ROOFING for roof flashing.
 - 3. Section 079200 - JOINT SEALANTS for perimeter joint sealants.

1.3 SUBMITTALS

- A. Product Data: Submit complete manufacturer's product data to Architect for approval, consisting of complete product description and specifications, complete test data and technical characteristics, installation instructions, complete maintenance instructions, and other pertinent technical data required for complete product and product use information.
- B. Shop Drawings: Submit complete shop drawings of all work of this Section to Architect for approval, showing large scale details of construction and methods of installation and anchorage, including types, sizes, thicknesses, shapes, and finishes of all materials; anchorage; closures; flashings; sealing; and relationship to surrounding work by other trades. Sufficient typical and special conditions shall be shown to fully establish the design, quality, character, and weathertight integrity of the proposed installation.

1.4 QUALITY ASSURANCE

- A. The manufacturer shall be responsible for the configuration, fabrication, and performance of the unit skylights, in general conformance with the Contract Documents.

- B. The manufacturer shall be able to identify at least five projects in the regional area where unit skylights of similar type and size have been installed and have performed satisfactorily since their installation, for a period of at least the last ten consecutive years.

1.5 TESTS AND PERFORMANCE REQUIREMENTS

- A. Manufacturer's Standard Tests: Provide manufacturer's standard test data showing compliance with code requirements. Provide specified tests if manufacturer's standard skylight units have been modified, or when custom skylights are used.
- B. Skylight system shall be designed for design loads for snow, wind, etc., established by the governing laws and the applicable building code, with a maximum deflection of $L/175$ of the unsupported span of any member, and without cracking or breakage of glazing material, permanent deformation of any member, exceeding of the ultimate tensile strength of any member, or failure of any fastening or anchor.
 - 1. Plastic unit skylights shall not transmit any horizontal loads to structure.

1.6 COORDINATION

- A. Coordinate work of this Section with work of other trades affecting, or affected by, this work to assure the steady progress of all the work of the Contract.
- B. Before proceeding with installation work inspect all project conditions and all work of other trades to assure that all such conditions and work are suitable to satisfactorily receive the work of this Section, and notify the Architect in writing of any which are not. Do not proceed further until corrective work has been completed or waived.

1.7 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Package and deliver all materials, and store and handle in such manner, as to assure complete protection of all materials from damage.
- B. Store skylights several inches above the ground, blocked and under cover to prevent warping. Clean all aluminum and panels before installation, and maintain all joint surfaces thoroughly clean until sealants are applied.

1.8 WARRANTY

- A. Include written warranty, signed by manufacturer, installer and Contractor, covering defects of materials and workmanship for a period of ten years from the date of Substantial Completion of Project.
- B. Include manufacturer's standard written warranty covering defects of insulating skylight for a period of ten years against breakage, delamination, or seal failure.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Bristolite Skylights, Coollite ALT-SF-2.
 2. Wasco, EcoSky3.
 3. Approved equal.

2.2 SKYLIGHTS

- A. Factory-Fabricated Skylights:
1. Sizes: As indicated on the Drawings.
 2. Aluminum members shall be extruded 6063 aluminum conforming to ASTM B 221, with a minimum thickness of 0.094 in.
 3. Cap fasteners shall be 1/4 in. diameter stainless steel with stainless steel and neo-prene sealing washers, spaced a maximum of 12 in. o.c.
 4. Internal fasteners shall be stainless steel.
 5. Glazing seal shall be butyl sealant tape to allow for thermal movement of acrylic glaz-ing.
 6. Acrylic shall be double glazed type, clear and translucent as selected by Architect. Outside acrylic panel shall be high impact type to withstand 200 lb. load as required by OSHA.
 7. Glazing Performance Requirements: Comply with minimum requirements of ASHRAE 90.1-2004, and as follows:
 - a. U-value: 0.45 minimum.
 - b. Solar Heat Gain Coefficient (SHGC): 0.34 maximum.
 - c. Visible Light Transmission (VLT): 43%, minimum.
 - d. VLT/SHGC: 1.25 or better.
 8. Curb: Self-flashing curb, 12 in. high.
 9. Finish: Finish shall be selected by Architect from manufacturer's standard finishes.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Plastic unit skylights shall be installed in strict accordance with the approved shop drawings and the manufacturer's printed installation instructions by the skylight manufacturer utilizing his own fully experienced, adequately supervised, erection crews. Installation shall be complete in all respects, including all framing and all related aluminum closures, flashings, fillers, fastenings,

anchors, sealing, required for a complete weathertight installation, including sealing between the skylight system components and the surrounding construction.

- B. Provide positive and adequate fastening and anchorage of all components, including fastening into existing construction. Work shall not void the warranty provisions of existing roof construction.
- C. Contact surfaces between aluminum and dissimilar materials shall be protected with coating of bituminous mastic or application of nonabsorptive, dielectric tape for prevention of electrolytic action and corrosion. Do not use bituminous mastic where it might contaminate a joint or surface to receive sealant.

3.3 SEALING

- A. Do all metal-to-metal sealing required to assure thoroughly weathertight installations throughout, as recommended by sealant manufacturer and conforming to the general procedures specified under Section 079200 - JOINT SEALANTS.

3.4 PROTECTION AND CLEANING OF ALUMINUM

- A. Protect finished metal surfaces from damage during fabrication, shipping, storage, and erection, and from then until acceptance by Owner.
- B. Clean all metal and glazing surfaces promptly after installation. Remove excess sealant, dirt, and other substances.

3.5 PROTECTION AND CLEANING OF GLAZING

- A. Replace all glazing which is broken, cracked, or chipped prior to time of final acceptance of Project by Owner.
- B. Clean glazing surfaces promptly after installation, exercising care to avoid damage to same.

END OF SECTION

SECTION 086300

METAL-FRAMED SKYLIGHTS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Aluminum-framed skylights with glass retained by field-installed pressure caps on four sides.
- B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council. Refer to Section 018110, SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 076200 - SHEET METAL FLASHING AND TRIM for metal flashings installed at perimeters of assemblies.
 - 2. Section 079200 - JOINT SEALANTS for sealants installed at perimeters of metal-framed skylights.
 - 3. Section 088000 - GLAZING for glass units installed in metal-framed skylights.

1.3 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design skylights, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. General: Provide metal-framed skylights, including anchorage, capable of withstanding, without failure, the effects of the following:
 - 1. Structural loads.
 - 2. Thermal movements.
 - 3. Movements of supporting structure.
 - 4. Dimensional tolerances of building frame and other adjacent construction.
- C. Failure includes the following:
 - 1. Deflection exceeding specified limits.

2. Water leakage.
 3. Thermal stresses transferred to building structure.
 4. Noise or vibration created by wind and thermal and structural movements.
 5. Framing members transferring stresses, including those caused by thermal and structural movements, to glazing.
 6. Loosening or weakening of fasteners, attachments, and other components.
 7. Sealant failure.
- D. Structural Loads: Wind loads, snow loads, concentrated live loads and seismic loads as required by Code.
- E. Deflection of Framing Members:
1. Deflection Normal to Glazing Plane:
 - a. Spans Up to 20 Feet: Limited to $1/175$ of clear span or 1 inch whichever is smaller.
 - b. Spans Exceeding 20 Feet: Limited to $1/240$ of clear span.
 - c. Glass Edge Deflection: Limit edge deflection of individual glass lites to $3/4$ inch.
 2. Deflection Parallel to Glazing Plane: Limited to $1/360$ of clear span or $1/8$ inch whichever is smaller and amount not exceeding that which reduces glazing bite to less than 75 percent of design dimension and that which reduces edge clearance between framing members and glazing or other fixed components to less than $1/8$ inch.
- F. Lateral Bracing of Framing Members: Compression flanges of flexural members are laterally braced by cross members with minimum depth equal to 50 percent of flexural member that is braced. Glazing does not provide lateral support.
- G. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes. 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 PERFORMANCE TESTING
- A. Provide metal-framed skylights that comply with test-performance requirements indicated, as evidenced by reports of tests performed on manufacturer's standard assemblies.
- B. Structural-Performance Test: ASTM E 330.
1. Performance at Design Load: When tested at positive and negative wind-load design pressures, assemblies do not evidence deflection exceeding specified limits.
 2. Performance at Maximum Test Load: When tested at 150 percent of positive and negative wind-load design pressures, assemblies, including anchorage, do not evidence material failures, structural distress, and permanent deformation of main supporting members exceeding 0.2 percent of span.
 3. Test Durations: As required by design wind velocity but not less than 10 seconds.
- C. Air-Infiltration Test: ASTM E 283.

1. Minimum Static-Air-Pressure Difference: 1.57 lbf/sq. ft.
2. Maximum Air Leakage: 0.06 cfm/sq. ft.

D. Test for Water Penetration under Static Pressure: ASTM E 331.

1. Minimum Static-Air-Pressure Difference: 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft.
2. Water Leakage: None.

E. Test for Water Penetration under Dynamic Pressure: AAMA 501.1.

1. Dynamic Pressure: 20 percent of positive wind-load design pressure, but not less than 12 lbf/sq. ft.
2. Water Leakage: No uncontrolled water penetrating systems or appearing on systems' normally exposed interior surfaces from sources other than condensation. Water controlled by flashing and gutters that is drained to exterior and cannot damage adjacent materials or finishes is not considered water leakage.

1.5 SUBMITTALS

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

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. LEED Submittals:

1. Building Product Disclosure and Optimization, Material Ingredients:
 - a. Option 1, Material Ingredient Reporting: For factory-applied metal finishes, submit Declare product labels.
2. Low-Emitting Materials, General Emissions Evaluation: Building products must be tested and determined compliant in accordance with California Department of Public Health (CDPH) Standard Method v1.1–2010.
 - a. For adhesives and sealants, submit test results, including TVOC emissions and VOC content, or GreenGuard Gold certifications.
 - b. For wet-applied products, submit volume used.

C. Shop Drawings: For metal-framed skylights. Include plans, elevations, sections, details, and attachments to other work.

D. Delegated-Design Submittal: For skylights indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

E. Samples for Verification: For each type of exposed finish required, in manufacturer's standard sizes.

F. Fabrication Sample: Of each framing intersection of assemblies, made from 12-inch lengths of full-size components and showing details of the following:

1. Joinery.
2. Anchorage.
3. Expansion provisions.
4. Glazing.
5. Flashing and drainage.

- G. Field quality-control test and inspection reports.
- H. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for metal-framed skylights.
- I. Maintenance Data: For metal-framed skylights to include in maintenance manuals.
- J. Warranties: Special warranties specified in this Section.

1.6 QUALITY ASSURANCE

- A. Engineering Responsibility: Preparation of Shop Drawings, design calculations, and other structural data by a qualified professional engineer.
- B. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in the jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of skylights that are similar to those indicated for this Project in material, design, and extent.
- C. Installer Qualifications: Entity capable of assuming engineering responsibility and performing work of this Section and who is acceptable to manufacturer.
- D. Testing Agency Qualifications: An independent agency qualified according to ASTM E 699 for testing indicated.
- E. Product Options: Information on Drawings and in Specifications establishes requirements for skylights' aesthetic effects and performance characteristics. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction. Performance characteristics are indicated by criteria subject to verification by one or more methods including testing conducted by an independent testing agency and in-service performance.
- F. Welding: Qualify procedures and personnel according to AWS D1.2, "Structural Welding Code - Aluminum."
- G. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01.

1.7 PROJECT CONDITIONS

- A. Field Measurements: Indicate measurements on Shop Drawings.

1.8 WARRANTY

- A. Special Assembly Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal-framed skylights that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including, but not limited to, excessive deflection.
 - b. Noise or vibration caused by thermal movements.
 - c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 - d. Adhesive or cohesive sealant failures.
 - e. Water leakage.
 - 2. Warranty Period: Ten years from date of Substantial Completion.
- B. Special Finish Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components on which finishes fail within specified warranty period. Warranty does not include normal weathering.
 - 1. Failures include, but are not limited to, checking, crazing, peeling, chalking, and fading of finishes.
 - 2. Warranty Period: Ten years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Acurlite Structural Skylights.
 - 2. Alumaticor.
 - 3. Kingspan Light + Air.
 - 4. Linel.
 - 5. Oldcastle BuildingEnvelope
 - 6. SkyLine Sky-Lites.
 - 7. Wasco Products, Inc. (part of Velux Commercial).

2.2 FRAMING SYSTEMS

- A. Aluminum: Alloy and temper recommended in writing by manufacturer for type of use and finish indicated.
 - 1. Sheet and Plate: ASTM B 209.
 - 2. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221.
 - 3. Extruded Structural Pipe and Tubes: ASTM B 429.
- B. Pressure Caps: Manufacturer's standard aluminum components that mechanically retain glazing. Include snap-on aluminum trim that conceals fasteners.

- C. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning skylight components.
- D. Anchors, Fasteners, and Accessories: Manufacturer's standard, corrosion-resistant, nonstaining, and nonbleeding; compatible with adjacent materials.
 - 1. At pressure caps, use ASTM A 193/A 193M, 300 series stainless-steel screws.
 - 2. Where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration, use self-locking devices.
 - 3. Exposed Fasteners:
 - a. Use exposed fasteners with countersunk Phillips screw heads.
 - b. Finish exposed portions to match framing system.
 - 4. At movement joints, use slip-joint linings, spacers, and sleeves of material and type recommended in writing by manufacturer.
- E. Anchor Bolts: ASTM A 307, Grade A hot-dip zinc coating, ASTM A 153/A 153M, Class C.
- F. Concealed Flashing: Manufacturer's standard, corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials.
- G. Exposed Flashing and Closures: Manufacturer's standard aluminum components not less than 0.040 inch thick.
- H. Framing Gaskets: Manufacturer's standard
- I. Framing Sealants: As recommended in writing by manufacturer.

2.3 GLAZING SYSTEMS

- A. Glazing: As specified in Section 088000 - GLAZING.
- B. Spacers, Setting Blocks, and Gaskets: Manufacturer's standard elastomeric types.
- C. Glazing Sealants: As recommended in writing by manufacturer.
 - 1. VOC Emissions: Provide adhesives and sealants in compliance with the 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. VOC Content:
 - a. Structural Glazing Adhesives: 100 g/L.
 - b. Architectural Sealants: 250 g/L.
 - 3. Methylene chloride and perchloroethylene may not be intentionally added to adhesives.
 - 4. Do not use adhesives that contain urea formaldehyde.
 - 5. Weatherseal Sealant: ASTM C 920 for Type S, Grade NS, Class 25, Uses NT, G, A, and O; neutral-curing silicone formulation compatible with structural sealant and other components with which it comes in contact; and recommended in writing by structural- and weatherseal-sealant and metal-framed skylight manufacturers for this use.

- a. Color: Matching structural sealant.

2.4 ACCESSORY MATERIALS

- A. Insulating Materials: Specified in Section 072100 - THERMAL INSULATION.
- B. Isolation Coating (Bituminous Paint): ASTM D 1187, cold-applied asphalt emulsion, VOC compliant, compounded for 30-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.5 FABRICATION

- A. Fabricate aluminum components before finishing.
- B. Fabricate aluminum components that, when assembled, have the following characteristics:
 - 1. Profiles that are sharp, straight, and free of defects or deformations.
 - 2. Accurately fitted joints with ends coped or mitered.
 - 3. Internal guttering systems or other means to drain water passing joints, condensation occurring within framing members, and moisture migrating within skylight to exterior.
 - 4. Physical and thermal isolation of glazing from framing members.
 - 5. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
- C. Fabricate aluminum sill closures with weep holes and for installation as continuous component.
- D. Reinforce aluminum components as required to receive fastener threads.
- E. Weld aluminum components in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.

2.6 ALUMINUM FINISHES

- A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. High-Performance Organic Finish (3-Coat Fluoropolymer): AA-C12C40R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: conversion coating; Organic Coating: manufacturer's standard 3-coat, thermocured system consisting of specially formulated inhibitive primer, fluoropolymer color coat, and clear fluoropolymer topcoat, with both color coat and clear topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight). Coatings shall be fluorosurfactant free Kynar 500 by Arkema or fluorosurfactant-compliant Hylar 5000 by Solvay; or equal. 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 manufacturer's full range.
- C. High-Performance Organic Finish (2-Coat Fluoropolymer): AA-C12C40R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: conversion coating; Organic Coating: manufacturer's standard 2-coat, thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color coat, with color coat containing not less than 70

percent polyvinylidene fluoride resin by weight). Coatings shall be fluorosurfactant free Kynar 500 by Arkema or fluorosurfactant-compliant Hylar 5000 by Solvay; or equal. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with AAMA 2605 and with coating and resin manufacturers' written instructions.

1. Available Products: Sherwin-Williams Coil Coatings; Valspar Fluoropon Pure; or approved equal.
 2. Building Product Disclosure and Optimization, Material Ingredients: Declare product label.
 3. Color and Gloss: As selected by Architect from manufacturer's full range.
- D. Powder-Coat Finish: 100% FEVE fluoropolymer powder, meeting or exceeding AAMA 2605 for exterior systems and AAMA 2603 for Interior systems. Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish. Powder coating shall be TGIC-free.
1. Color and Gloss: As selected by Architect from manufacturer's full range.
- E. Color Anodic Finish: AAMA 611, AA-M12C22A42/A44, Class I, 0.018 mm or thicker.
1. Color and Gloss: As selected by Architect from manufacturer's full range.
- F. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.
1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General:
1. Comply with manufacturer's written instructions.
 2. Do not install damaged components.
 3. Fit joints between aluminum components to produce hairline joints free of burrs and distortion.
 4. Rigidly secure nonmovement joints.
 5. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.
 6. Seal joints watertight, unless otherwise indicated.
- B. Metal Protection: Where aluminum will contact dissimilar materials, protect against galvanic action by painting contact surfaces with bituminous paint or by installing nonconductive spacers as recommended in writing by manufacturer for this purpose.
- C. Install continuous aluminum sill closure with weatherproof expansion joints and locked and sealed or welded corners. Locate weep holes at rafters.

- D. Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within skylight to exterior.
- E. Install components plumb and true in alignment with established lines and elevations.
- F. Install glazing in accordance with requirements specified in Section 088000 - GLAZING.
- G. Install insulation materials as specified in Section 072100 - THERMAL INSULATION.
- H. Erection Tolerances: Install metal-framed skylights to comply with the following maximum tolerances:
 - 1. Alignment: Limit offset from true alignment to 1/32 inch where surfaces abut in line, edge to edge, at corners, or where a reveal or protruding element separates aligned surfaces by less than 3 inches; otherwise, limit offset to 1/8 inch.
 - 2. Location and Plane: Limit variation from true location and plane to 1/8 inch in 12 feet but no greater than 1/2 inch over total length.

3.3 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 and inspection reports.
- B. Testing Services: Testing and inspecting of representative areas to determine compliance of installed skylights with specified requirements shall take place as follows and in successive stages as indicated on Drawings. Do not proceed with installation of the next area until test results for previously completed areas show compliance with requirements.
 - 1. ASTM C 1401 recommendations for quality-control procedures.
 - 2. Water Penetration under Static Pressure: Before installation of interior finishes has begun, areas shall be tested according to ASTM E 1105.
 - a. Test Procedures: Test under cyclic static air pressure.
 - b. Water Penetration: None.
 - 3. Water-Spray Test: Before installation of interior finishes has begun, skylights shall be tested according to AAMA 501.2 and shall not evidence water penetration.
- C. Repair or remove work where test results and inspections indicate that it does not comply with specified requirements.
- D. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

END OF SECTION

SECTION 088000

GLAZING

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. Glass and glazing for the following products and applications:

- a. Steel doors, frames and sidelights specified in Section 081110 - HOLLOW METAL DOORS AND FRAMES.
- b. Aluminum frames and sidelights specified in Section 081200 - INTERIOR ALUMINUM FRAMING
- c. Glazed entrances and storefronts specified in Section 084110 - ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS.
- d. Glazed curtain walls specified in Section 084410 - GLAZED ALUMINUM CURTAIN WALLS.
- e. Skylights specified in Section 086300 - METAL-FRAMED SKYLIGHTS.
- f. Interior lites.
- g. Unframed mirrors.
- h. Glazing film.

- B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council. Refer to Section 018110, SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.

- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:

- 1. Section 081400 - FLUSH WOOD DOORS for factory glazing.
- 2. Section 085110 - ALUMINUM WINDOWS for factory glazing.

1.3 DEFINITIONS

- A. Manufacturers of Glass Products: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.
- B. Glass Thicknesses: Indicated by thickness designations in millimeters according to ASTM C 1036.

- C. Interspace: Space between lites of an insulating-glass unit that contains dehydrated air or a specified gas.
- D. Deterioration of Coated Glass: Defects developed from normal use that are attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in metallic coating.
- E. Deterioration of Insulating Glass: Failure of hermetic seal under normal use that is attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.
- F. Deterioration of Laminated Glass: Defects developed from normal use that are attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning laminated glass contrary to manufacturer's written instructions. Defects include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.

1.4 PERFORMANCE REQUIREMENTS

- A. General: Provide glazing systems capable of withstanding normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, and installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.
- B. Glass Design: Glass thickness designations indicated are minimums and are for detailing only. Confirm glass thicknesses by analyzing Project loads and in-service conditions. Provide glass lites in the thickness designations indicated for various size openings, but not less than thicknesses and in strengths (annealed or heat treated) required to meet or exceed the following criteria:
 - 1. Glass Thicknesses: Select minimum glass thicknesses to comply with ASTM E 1300, according to the following requirements:
 - a. Specified Design Wind Loads: As required by Code.
 - b. Specified Design Snow Loads for Sloped Glazing: As required by Code.
 - c. Probability of Breakage for Vertical Glazing: 8 lites per 1000 for lites set vertically or not more than 15 degrees off vertical and under wind action.
 - 1) Load Duration: 60 seconds or less.
 - d. Probability of Breakage for Sloped Glazing: 1 lite per 1000 for lites set more than 15 degrees off vertical and under wind and snow action.
 - 1) Load Duration: 30 days.
 - e. Maximum Lateral Deflection: For the following types of glass supported on all 4 edges, provide thickness required that limits center deflection at design wind pressure to 1/50 times the short side length or 1 inch, whichever is less.

- 1) For monolithic-glass lites heat-treated to resist wind loads.
 - 2) For insulating glass.
 - 3) For laminated-glass lites.
- f. Minimum Glass Thickness for Exterior Lites: Not less than 6 mm.
- C. Thermal Movements: Provide glazing that allows for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures acting on glass framing members and glazing components. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.
- D. Thermal and Optical Performance Properties: Provide glass with performance properties specified based on manufacturer's published test data, as determined according to procedures indicated below:
1. For monolithic-glass lites, properties are based on units with lites 6.0 mm thick.
 2. For laminated-glass lites, properties are based on products of construction indicated.
 3. For insulating-glass units, properties are based on units with lites 6.0 mm thick and a nominal 1/2-inch-wide interspace.
 4. Center-of-Glass Values: Based on using LBL-44789 WINDOW 6.3 computer program for the following methodologies:
 - a. U-Factors: NFRC 100 expressed as Btu/ sq. ft. x h x deg F.
 - b. Solar Heat Gain Coefficient: NFRC 200.
 - c. Solar Optical Properties: NFRC 300.

1.5 SUBMITTALS

- A. Product Data: For each glass product and glazing material indicated.
- B. LEED Submittals:
1. Building Product Disclosure and Optimization, Environmental Product Declarations (EPD):
 - a. Option 1: For flat glass and processed glass, submit product-specific Type III EPDs.
 2. Low-Emitting Materials, General Emissions Evaluation: Building products must be tested and determined compliant in accordance with California Department of Public Health (CDPH) Standard Method v1.1–2010.
 - a. For adhesives and sealants, submit test results, including TVOC emissions and VOC content, or GreenGuard Gold certifications.
 - b. For wet-applied products, submit volume used.
- C. Samples: 12-inch- square Samples for each type of glass and glass assembly, glazing sealants.
- D. Glazing Schedule: Use same designations indicated on Drawings for glazed openings in preparing a schedule listing glass types and thicknesses for each size opening and location.

- E. Product Certificates: Signed by manufacturers of glass and glazing products certifying that products furnished comply with requirements.
 - 1. For solar-control low-e-coated glass, provide documentation demonstrating that manufacturer of coated glass is certified by coating manufacturer.
- F. Qualification Data: For installers.
- G. Preconstruction Adhesion and Compatibility Test Report: From glazing sealant manufacturer indicating glazing sealants were tested for adhesion to glass and glazing channel substrates and for compatibility with glass and other glazing materials.
- H. Product Test Reports: For each type of glazing products:
- I. Warranties: Special warranties specified in this Section.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who has completed glazing similar in material, design, and extent to that indicated for this Project; whose work has resulted in glass installations with a record of successful in-service performance..
- B. Source Limitations for Glass: Obtain the following through one source from a single manufacturer for each glass type: clear float glass, laminated glass and insulating glass.
- C. Source Limitations for Glass Sputter-Coated with Solar-Control Low-E Coatings: Where solar-control low-e coatings of a primary glass manufacturer that has established a certified fabricator program is specified, obtain sputter-coated solar-control low-e-coated glass in fabricated units from a manufacturer that is certified by coated-glass manufacturer.
- D. Source Limitations for Glazing Accessories: Obtain glazing accessories through one source from a single manufacturer for each product and installation method indicated.
- E. Elastomeric Glazing Sealant Product Testing: Obtain sealant test results for product test reports in "Submittals" Article from a qualified testing agency based on testing current sealant formulations within a 36-month period.
 - 1. Sealant Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated.
 - 2. Test elastomeric glazing sealants for compliance with requirements specified by reference to ASTM C 920, and where applicable, to other standard test methods.
- F. Preconstruction Adhesion and Compatibility Testing: Submit to elastomeric glazing sealant manufacturers, for testing indicated below, samples of each glazing material type, tape sealant, gasket, glazing accessory, and glass-framing member that will contact or affect elastomeric glazing sealants:
 - 1. Use ASTM C 1087 to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of glazing sealants to glass, tape sealants, gaskets, and glazing channel substrates.
 - 2. Submit not fewer than eight pieces of each type of material, including joint substrates, shims, joint-sealant backings, secondary seals, and miscellaneous materials.

3. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
 4. For materials failing tests, obtain sealant manufacturer's written instructions for corrective measures, including the use of specially formulated primers.
 5. Testing will not be required if elastomeric glazing sealant manufacturers submit data based on previous testing of current sealant products for adhesion to, and compatibility with, glazing materials matching those submitted.
- G. Fire-Protection-Rated Glazing: Listed and labeled by a testing agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on positive-pressure testing according to NFPA 257 or UL 9, including the hose-stream test, and shall comply with NFPA 80.
1. Fire-protection-rated glazing required to have a fire-protection rating of 20 minutes shall be exempt from the hose-stream test, unless required by authorities having jurisdiction.
- H. Safety Glazing Products: Comply with testing requirements in 16 CFR 1201.
1. Subject to compliance with requirements, obtain safety glazing products permanently marked with certification label of the Safety Glazing Certification Council or another certification agency] acceptable to authorities having jurisdiction.
 2. Where glazing units, including Kind FT glass and laminated glass, are specified in Part 2 articles for glazing lites more than 9 sq. ft. in exposed surface area of one side, provide glazing products that comply with Category II materials, for lites 9 sq. ft. or less in exposed surface area of one side, provide glazing products that comply with Category I or II materials, except for hazardous locations where Category II materials are required by 16 CFR 1201 and regulations of authorities having jurisdiction.
- I. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below, unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.
1. GANA Publications: GANA Laminated Division's "Laminated Glass Design Guide" and GANA's "Glazing Manual."
 2. AAMA Publications: AAMA GDSG-1, "Glass Design for Sloped Glazing," and AAMA TIR-A7, "Sloped Glazing Guidelines."
 3. IGMA Publication for Sloped Glazing: IGMA TB-3001, "Sloped Glazing Guidelines."
 4. IGMA Publication for Insulating Glass: SIGMA TM-3000, "Glazing Guidelines for Sealed Insulating Glass Units."
- J. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of the following testing and inspecting agency:
1. Insulating Glass Certification Council.
- K. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
1. Build mockup for types of windows indicated, in locations shown on Drawings.
- L. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Protect glazing materials according to manufacturer's written instructions and as needed to prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.
- B. For insulating-glass units that will be exposed to substantial altitude changes, comply with insulating-glass manufacturer's written recommendations for venting and sealing to avoid hermetic seal ruptures.

1.8 PROJECT CONDITIONS

- A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.
 - 1. Do not install liquid glazing sealants when ambient and substrate temperature conditions are outside limits permitted by glazing sealant manufacturer or below 40 deg F.

1.9 WARRANTY

- A. Manufacturer's Special Warranty for Coated-Glass Products: Manufacturer's standard form, made out to the Owner and signed by coated-glass manufacturer agreeing to replace coated-glass units that deteriorate as defined in "Definitions" Article, f.o.b. the nearest shipping point to Project site, within specified warranty period indicated below.
 - 1. Warranty Period: Ten years from date of Substantial Completion.
- B. Manufacturer's Special Warranty on Laminated Glass: Manufacturer's standard form, made out to the Owner and signed by laminated-glass manufacturer agreeing to replace laminated-glass units that deteriorate as defined in "Definitions" Article, f.o.b. the nearest shipping point to Project site, within specified warranty period indicated below.
 - 1. Warranty Period: Five years from date of Substantial Completion.
- C. Manufacturer's Special Warranty on Insulating Glass: Manufacturer's standard form, made out to the Owner and signed by insulating-glass manufacturer agreeing to replace insulating-glass units that deteriorate as defined in "Definitions" Article, f.o.b. the nearest shipping point to Project site, within specified warranty period indicated below.
 - 1. Warranty Period: Ten years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 INSULATING-GLASS UNITS

- A. Insulating-Glass Units for Vertical Glazing: 1 inch thick (25.0 mm) insulating glass consisting of two lites of 1/4 inch (6 mm) glass, low e coating on the No. 2 surface and argon gas filled. Provide one of the following or equal:
 - 1. Guardian Industries; SN-68.

- a. Visible Light Transmittance: 68 percent.
 - b. Reflectance Visible Light: 10 percent.
 - c. U Value (Winter): 0.25.
 - d. Shading Coefficient: 0.43.
 - e. Solar Heat Gain Coefficient: 0.38.
 2. Viracon; VE1-2M.
 - a. Visible Light Transmittance: 70 percent.
 - b. Reflectance Visible Light: 11 percent.
 - c. U Value (Winter): 0.25.
 - d. Shading Coefficient: 0.43.
 - e. Solar Heat Gain Coefficient: 0.37.
 3. Vitro Architectural Glass (formerly PPG Industries); Solarban 60.
 - a. Visible Light Transmittance: 70 percent.
 - b. Reflectance Visible Light: 11 percent.
 - c. U Value (Winter): 0.29.
 - d. Shading Coefficient: 0.44.
 - e. Solar Heat Gain Coefficient: 0.38.
- B. Ultraclear Insulating-Glass Units for Vertical Glazing: 1 inch thick (25.0 mm) insulating glass consisting of two lites of 1/4 inch (6 mm) thick low-iron ultraclear glass, low e coating on the No. 2 surface, and 1/2 inch (13.2 mm) thick argon gas filled space.
 1. Basis of Design: Viracon; VE13-2M with Starphire.
 - a. Visible Light Transmittance: 73 percent.
 - b. Reflectance Visible Light: 10 percent exterior and 12 percent interior.
 - c. U Value (Winter): 0.25 Btu/(hr x sqft x degree F).
 - d. Shading Coefficient: 0.44.
 - e. Solar Heat Gain Coefficient: 0.39.
 2. Guardian Industries; SunGuard SuperNeutral series with UltraWhite, approved equal.
 3. Vitro Architectural Glass (formerly PPG Industries); Solarban series with Starphire, approved equal.
- C. Insulating-Glass Units for Sloped Glazing (Skylights):
 1. Basis-of-Design Product: Viracon, Vitro, Guardian or equal.
 2. Outdoor Lite: 1/4 inch (6 mm), clear heat-strengthened glass with low-e coating on No. 2 surface.
 3. Indoor Lite: 5/16 inch (8.0 mm), clear laminated glass with minimum 0.060 inch (1.52 mm) interlayer, as required to comply as a Type II safety glass material.
 4. Overall Unit Thickness: 1-1/16 inch (26.5 mm).
 5. Interspace Content: Argon.
- D. Building Product Disclosure and Optimization, Environmental Product Declarations (EPD): Type III EPD.

2.2 GLASS PRODUCTS

- A. Float Glass: ASTM C 1036, Type I, Quality-Q3, Class I (clear) unless otherwise indicated.
 - 1. Building Product Disclosure and Optimization, Environmental Product Declarations (EPD): Type III EPD.
- B. Low-Iron, Ultraclear Float Glass: ASTM C 1036, Type I, Quality-Q3, Class I, complying with other requirements specified and with visible light transmission not less than 91 percent and solar heat gain coefficient not less than 0.87.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. AGC Glass; Krystal Klear.
 - b. Guardian Industries Corp.; Ultrawhite.
 - c. Pilkington North America; Optiwhite.
 - d. Vitro Architectural Glass (formerly PPG Industries); Starphire.
- C. Heat-Treated Float Glass: ASTM C 1048; Type I; Quality-Q3; Class I (clear) unless otherwise indicated; of kind and condition indicated.
 - 1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.
 - 2. For uncoated glass, comply with requirements for Condition A.
 - 3. For coated vision glass, comply with requirements for Condition C (other coated glass).
- D. Coated Float Glass: Pyrolytic and vacuum deposited coatings on glass in conformance with ASTM C 1376.
- E. Pyrolytic-Coated, Self-Cleaning, Low-Maintenance Glass: Clear float glass with a coating on first surface having both photocatalytic and hydrophilic properties that act to loosen dirt and to cause water to sheet evenly over the glass instead of beading.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. AGC Glass; Spotless Ti.
 - b. Cardinal Glass Industries; LoE2 Plus.
 - c. Pilkington North America; Activ.
 - d. Vitro Architectural Glass (formerly PPG Industries); SunClean.
- F. Uncoated Tinted Float Glass: Class 2, complying with other requirements specified.
 - 1. Tint Color: As selected by the Architect.
 - 2. Visible Light Transmittance: As standard with manufacturer.
- G. Tempered Float Glass: ASTM C 1048; Type I (transparent flat glass); Quality-Q3; Kind FT; 1/4 inch thick unless indicated otherwise.
- H. Patterned Glass: ASTM C 1036, Type II (patterned and wired flat glass), Class 1 (clear), Form 3 (patterned); and of quality, finish, and pattern specified.

- I. Laminated Glass: ASTM C 1172, and complying with testing requirements in 16 CFR 1201 for Category II materials, and with other requirements specified. Use materials that have a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after fabrication and installation.
 - 1. Construction for Framed Units: Laminate glass with polyvinyl butyral interlayer to comply with interlayer manufacturer's written recommendations.
 - 2. Construction for Units with Exposed Edges: Laminate glass with cast-in-place and cured-transparent-resin interlayer to comply with interlayer manufacturer's written recommendations.
 - 3. Interlayer Thickness: 0.030 inch (0.76 mm) thick for vertical glazing, 0.060 inch (1.52 mm) thick for sloped glazing.
 - 4. Interlayer Color: Clear unless otherwise indicated.
- J. Low-Iron, Ultraclear Tempered Laminated Glass: ASTM C 1172 / ASTM C 1048, and complying with testing requirements in 16 CFR 1201 for Category II materials, and with other requirements specified. Use materials that have a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after fabrication and installation.
 - 1. Low-Iron Glass: Visible light transmission not less than 91 percent and solar heat gain coefficient not less than 0.87. Subject to compliance with requirements, provide one of the following:
 - a. AGC Glass; Krystal Klear.
 - b. Guardian Industries Corp.; Ultrawhite.
 - c. Pilkington North America; Optiwhite.
 - d. Vitro Architectural Glass (formerly PPG Industries); Starphire.
 - 2. Construction for Framed Units: Laminate glass with polyvinyl butyral interlayer to comply with interlayer manufacturer's written recommendations.
 - 3. Construction for Units with Exposed Edges: Laminate glass with cast-in-place and cured-transparent-resin interlayer to comply with interlayer manufacturer's written recommendations.
 - 4. Interlayer Thickness: 0.030 inch (0.76 mm) thick for vertical glazing, 0.060 inch (1.52 mm) thick for sloped glazing.
 - 5. Interlayer Color: Clear unless otherwise indicated.
- K. Fire-Rated Monolithic Ceramic Glazing Material (**Not for Doors or Locations Requiring Safety Glazing**): Proprietary product in the form of clear flat sheets of 3/16-inch nominal (5.0 mm) thickness weighing 2.5 lb/sq. ft. and as follows:
 - 1. Fire-Protection Rating: As indicated for the fire window in which glazing material is installed, and permanently labeled by a testing and inspecting agency acceptable to authorities having jurisdiction.
 - 2. Products: Subject to compliance with requirements, provide the following:
 - a. Technical Glass Products (TGP); FireLite Premium, polished both sides.
- L. Fire-Rated Laminated Ceramic Glazing Material (**for Doors and Locations Requiring Safety Glazing**): Category II safety glazing product in the form of 2 lites of clear ceramic glazing material laminated together to produce a laminated lite of 5/16-inch nominal (8.0 mm) thickness; polished on both surfaces; weighing 4 lb/sq. ft. and as follows:

1. Fire-Protection Rating: As indicated for the assembly in which glazing material is installed, and permanently labeled by a testing and inspecting agency acceptable to authorities having jurisdiction.
 2. Polished on both surfaces, transparent.
 3. Products: Subject to compliance with requirements, provide one of the following:
 - a. Technical Glass Products (TGP); FireLite Plus.
 - b. Safti First; Pyran Platinum L, (for maximum 90 minute-rated openings).
 - c. Vetrotech Saint-Gobain; SGG Keralite FR-L.
- M. Laminated Glass with Intumescent Interlayers (Temperature-Rise-Rated Doors): Laminated glass made from multiple plies of uncoated, clear float glass; with intumescent interlayers; complying with testing requirements in 16 CFR 1201 for Category II materials.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. InterEdge, Inc., a subsidiary of AGC Glass; Pyrobel.
 - b. Pilkington Group Limited (distributed by Technical Glass Products); PyroStop.
 - c. Vetrotech Saint-Gobain; SGG Contraflam N2 or SGG Swissflam N2.
- N. Insulating-Glass Units, General: Factory-assembled units consisting of sealed lites of glass separated by an argon-filled interspace, and complying with ASTM E2190 and with requirements specified in this Section.
1. Provide Kind HS (heat-strengthened) float glass in place of annealed glass where needed to resist thermal stresses induced by differential shading of individual glass lites and to comply with glass design requirements specified in Part 1 "Performance Requirements" paragraph.
 2. Provide Kind FT (fully tempered) glass lites where safety glass is indicated.
 3. Overall Unit Thickness and Thickness of Each Lite: Dimensions indicated for insulating-glass units are nominal and the overall thicknesses of units are measured perpendicularly from outer surfaces of glass lites at unit's edge.
 4. Sealing System: Dual seal, with primary and secondary sealants as follows:
 - a. Manufacturer's Standard Sealants. Butyl primary and silicone secondary sealants. Secondary sealant shall cover entire spacer bar at IGU perimeter.
 5. Spacer Specifications: Manufacturer's standard spacer material. Spacer corners shall be bent, soldered, or welded. Keyed spacer corners will not be accepted. Spacer may have a mid-span spacer key located at the midpoint of the insulating glass unit head. Where a mid-span spacer key is used, the key must be fully embedded (all sides) in butyl sealant.
- O. Ceramic-Coated Spandrel Glass: ASTM C 1048, Condition B, Type I, Quality-Q3, and complying with other requirements specified.
1. Glass: Clear float.
 2. Ceramic Coating Color: Custom color as selected by the Architect.
- P. Ceramic-Coated Vision Glass: Float glass with ceramic enamel applied by silk-screened process and complying with ASTM C 1048, Condition C (other coated glass), Type I (transparent flat glass), Quality-Q3, Specification No. 95-1-31 in GANA Tempering Division's "Engineering Standards Manual," and other requirements specified.

1. Ceramic Frit Pattern: Custom pattern as selected by the Architect.
2. Ceramic Coating Color: Custom color as selected by the Architect.

Q. Silicone-Coated Spandrel Glass: ASTM C 1048, Condition C, Type I, Quality-Q3, and complying with other requirements specified.

1. Products: Subject to compliance with requirements, provide ICD High Performance Coatings, Opaci-Coat 300; color as selected by Architect from manufacturer's full range.

R. Glass Mirrors, General: ASTM C 1503; manufactured using copper-free, low-lead mirror coating process.

1. Mirror Edge Treatment: Flat polished edge.

S. Glazing Film: Translucent, dimensionally stable, cast PVC film, 2-mil-minimum thickness, with pressure-sensitive, clear adhesive back for adhering to glass and releasable protective backing.

1. Manufacturers: Subject to compliance with requirements, available manufacturer's that may be incorporated into the Work include, but are not limited to, the following:
 - a. Avery Dennison, Graphics.
 - b. FDC Graphic Films, Inc.
 - c. Madico, Inc.
 - d. 3M Scotchcal.
2. Comply with requirements for safety glazing.
3. Use: Suitable for exterior and interior applications.
4. Patterns: As selected by Architect from manufacturer's full range.

2.3 GLAZING SEALANTS

A. General: Provide products of type indicated, complying with the following requirements:

1. Compatibility: Verify glazing sealants that are compatible with one another and with other materials they will contact, including glass products, seals of insulating-glass units, interlayer of laminated glass, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
3. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range.
4. VOC Emissions: Provide sealants in compliance with the 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."
5. VOC Content:
 - a. Structural Glazing Adhesives: 100 g/L.
 - b. Architectural Sealants: 250 g/L.

6. Methylene chloride and perchloroethylene may not be intentionally added to sealants.
- B. Elastomeric Glazing Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied chemically curing sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.
 1. Single-Component Neutral- and Basic-Curing Silicone Glazing Sealants:
 - a. Dow Corning Corporation; 790.
 - b. GE Silicones; SilPruf LM SCS2700.
 - c. Tremco Inc.; Spectrem 1.
- C. Glazing Sealants for Fire-Resistive Glazing Products: Identical to products used in test assemblies to obtain fire-protection rating.

2.4 GLAZING TAPES

- A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based elastomeric tape with a solids content of 100 percent; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; packaged on rolls with a release paper backing; and complying with ASTM C 1281 and AAMA 800 for project conditions.
- B. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; packaged on rolls with release liner protecting adhesive; and complying with AAMA 800 for the following types:
 1. Type 1, for glazing applications in which tape acts as the primary sealant.
 2. Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

2.5 MISCELLANEOUS GLAZING MATERIALS

- A. General: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.
- B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.
- C. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.
- D. Spacers: Elastomeric blocks or continuous extrusions with a Shore, Type A durometer hardness required by glass manufacturer to maintain glass lites in place for installation indicated.
- E. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).
- F. Perimeter Insulation for Fire-Resistive Glazing: Identical to product used in test assembly to obtain fire-resistance rating.

- G. Mirror Mastic: An adhesive setting compound, asbestos-free, produced specifically for setting mirrors and certified by both mirror manufacturer and mastic manufacturer as compatible with glass coating and substrates on which mirrors will be installed.
 - 1. VOC Emissions: Provide adhesives in compliance with the 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. VOC Content: 250 g/L or less.
 - 3. Methylene chloride and perchloroethylene may not be intentionally added to adhesives.
 - 4. Do not use adhesives that contain urea formaldehyde.
- H. Mirror Hardware, Top and Bottom Aluminum J-Channels: Aluminum extrusions with a return deep enough to produce a glazing channel to accommodate mirrors of thickness indicated and in lengths required to cover bottom and top edges of each mirror in a single piece.

2.6 FABRICATION OF GLAZING UNITS

- A. Fabricate glazing units in sizes required to glaze openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.
- B. Clean-cut or flat-grind vertical edges of butt-glazed monolithic lites in a manner that produces square edges with slight kerfs at junctions with outdoor and indoor faces.
- C. Grind smooth and polish exposed glass edges and corners.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine framing glazing, with Installer present, for compliance with the following:
 - 1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
 - 2. Presence and functioning of weep system.
 - 3. Minimum required face or edge clearances.
 - 4. Effective sealing between joints of glass-framing members.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.

3.3 GLAZING, GENERAL

- A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.
- B. Glazing channel dimensions, as indicated on Drawings, provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances. Adjust as required by Project conditions during installation.
- C. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.
- D. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction sealant-substrate testing.
- E. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.
- F. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.
- G. Provide spacers for glass lites where length plus width is larger than 50 inches as follows:
 - 1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
 - 2. Provide 1/8-inch minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.
- H. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.
- I. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.
- J. Wall-Mounted Mirrors: Install mirrors with mastic and mirror hardware. Attach mirror hardware securely to mounting surfaces with mechanical fasteners installed with anchors or inserts as applicable. Install fasteners so heads do not impose point loads on backs of mirrors.
- K. Glazing Film: Apply squarely aligned to glass edges, uniformly smooth, and free from tears, air bubbles, wrinkles, and rough edges, in single sheet completely overlaying the back face of clean glass, according to manufacturer's written instructions, including surface preparation and application temperature limitations.

3.4 TAPE GLAZING

- A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.
- B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.
- C. Cover vertical framing joints by applying tapes to heads and sills first and then to jambs. Cover horizontal framing joints by applying tapes to jambs and then to heads and sills.
- D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.
- E. Do not remove release paper from tape until just before each glazing unit is installed.
- F. Center glass lites in openings on setting blocks and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.

3.5 SEALANT GLAZING (WET)

- A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.
- B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.
- C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

3.6 CLEANING AND PROTECTION

- A. Protect exterior glass from damage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels, and clean surfaces.
- B. Protect glass from contact with contaminating substances resulting from construction operations, including weld splatter. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended by glass manufacturer.
- C. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains; remove as recommended in writing by glass manufacturer.
- D. Remove and replace glass that is broken, chipped, cracked, or abraded or that is damaged from natural causes, accidents, and vandalism, during construction period.

KALIN MASTER
City, ST

Architect
Date

END OF SECTION

SECTION 089000

LOUVERS AND VENTS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Fixed extruded-aluminum louvers and frames.
- B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council. Refer to Section 018110, SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 079200 - JOINT SEALANTS for sealants installed in perimeter joints between louver frames and adjoining construction.
 - 2. Division 23 - HEATING, VENTILATING AND AIR CONDITIONING for louvers that are a part of mechanical equipment.

1.3 DEFINITIONS

- A. Louver Terminology: Definitions of terms for metal louvers contained in AMCA 501 apply to this Section unless otherwise defined in this Section or in referenced standards.
- B. Drainable-Blade Louver: Louver with blades having gutters that collect water and drain it to channels in jambs and mullions, which carry it to bottom of unit and away from opening.

1.4 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide louvers capable of withstanding the effects of gravity loads and wind loads and stresses within limits and under conditions indicated without permanent deformation of louver components, noise or metal fatigue caused by louver blade rattle or flutter, or permanent damage to fasteners and anchors. Wind pressures shall be considered to act on vertical projection of louvers. Loads as required by Code.
- B. Seismic Performance: Provide louvers capable of withstanding the effects of earthquake motions as required by code.

- C. Thermal Movements: Provide louvers 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 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.

1.5 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. LEED Submittals:
 - 1. Building Product Disclosure and Optimization, Material Ingredients:
 - a. Option 1, Material Ingredient Reporting: For factory-applied metal finishes, submit Declare product labels.
- C. Shop Drawings: For louvers and accessories. Include plans, elevations, sections, details, and attachments to other Work. Show blade profiles, angles, and spacing.
 - 1. For installed louvers indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
 - 2. Include sill, jambs, and head details showing the integration with adjacent air and water barriers.
 - 3. Include details of the continuous sill pan with upturned back and end dams. Note on drawings how continuity will be maintained at the sill pan corners.
- D. Samples for Verification: For each type of metal finish required.
- E. Qualification Data: For professional engineer.
- F. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency or by manufacturer and witnessed by a qualified testing agency, for each type of louver.

1.6 QUALITY ASSURANCE

- A. Source Limitations: Obtain louvers and vents through one source from a single manufacturer where indicated to be of same type, design, or factory-applied color finish.
- B. Welding: Qualify procedures and personnel according to the following:
 - 1. AWS D1.2, "Structural Welding Code--Aluminum."
- C. SMACNA Standard: Comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" for fabrication, construction details, and installation procedures.

1.7 PROJECT CONDITIONS

- A. Field Measurements: Verify louver 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 louvers without field measurements. Coordinate construction to ensure that actual opening dimensions correspond to established dimensions.

PART 2 - PRODUCTS

2.1 FIXED, EXTRUDED-ALUMINUM LOUVERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Airolite Company, LLC.
 - 2. American Warming and Ventilating.
 - 3. Construction Specialties, Inc.
 - 4. Industrial Louvers, Inc.
- B. Horizontal Storm-Resistant Louvers:
 - 1. Louver Depth: As indicated on the Drawings.
 - 2. Frame and Blade Nominal Thickness: As required to comply with structural performance requirements, but not less than 0.080 inch.
 - 3. Performance Requirements: AMCA 550, **required in Massachusetts through the 2015 IMC Code.**
 - 4. AMCA Seal: Mark units with AMCA Certified Ratings Seal.
 - 5. Free Area: Comply with requirements indicated on the Drawings.
- C. General: Provide screen at each exterior louver. Secure screens to louver frames with stainless-steel machine screws, spaced a maximum of 6 inches from each corner and at 12 inches o.c. Fabricate frames with mitered corners to louver sizes indicated.
 - 1. Screen Location for Fixed Louvers: Interior face.
 - 2. Screening Type: Bird screening, aluminum, 1/2-inch-square mesh, 0.063-inch wire
- D. Insulated, Blank-off Panels: Laminated metal-faced panels consisting of insulating core surfaced on back and front with metal sheets.
 - 1. Thickness: 1 inch.
 - 2. Metal Facing Sheets: Aluminum sheet, not less than 0.032-inch nominal thickness.
 - 3. Insulating Core: Rigid insulation board.
 - 4. Seal perimeter joints between panel faces and louver frames with 1/8-by-1-inch PVC compression gaskets.
 - 5. Panel Finish: Same finish applied to louvers.

2.2 ALUMINUM FINISHES

- A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
- C. High-Performance Organic Finish (3-Coat Fluoropolymer): AA-C12C40R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: conversion coating; Organic Coating: manufacturer's standard 3-coat, thermocured system consisting of specially formulated inhibitive primer, fluoropolymer color coat, and clear fluoropolymer topcoat, with both color coat and clear topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight). Coatings shall be fluorosurfactant free Kynar 500 by Arkema or fluorosurfactant-compliant Hylar 5000 by Solvay; or equal. 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 manufacturer's full range.
- D. High-Performance Organic Finish (2-Coat Fluoropolymer): AA-C12C40R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: conversion coating; Organic Coating: manufacturer's standard 2-coat, thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color coat, with color coat containing not less than 70 percent polyvinylidene fluoride resin by weight). Coatings shall be fluorosurfactant free Kynar 500 by Arkema or fluorosurfactant-compliant Hylar 5000 by Solvay; or equal. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with AAMA 2605 and with coating and resin manufacturers' written instructions.
 - 1. Available Products: Sherwin-Williams Coil Coatings; Valspar Fluoropon Pure; or approved equal.
 - 2. Building Product Disclosure and Optimization, Material Ingredients: Declare product label.
 - 3. Color and Gloss: As selected by Architect from manufacturer's full range.
- E. Powder-Coat Finish: 100% FEVE fluoropolymer powder, meeting or exceeding AAMA 2605 for exterior systems and AAMA 2603 for Interior systems. Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish. Powder coating shall be TGIC-free.
 - 1. Color and Gloss: As selected by Architect from manufacturer's full range.
- F. Color Anodic Finish: AAMA 611, AA-M12C22A42/A44, Class I, 0.018 mm or thicker.
 - 1. Color and Gloss: As selected by Architect from manufacturer's full range.
- G. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.
- H. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable only if they are within the range of approved Samples, or shall not exceed $DE^*a^*b^*$ of 2.0 from a single control sample. Noticeable variations in the same piece are not acceptable.'

2.3 MATERIALS

- A. Aluminum Extrusions: ASTM B 221, alloy 6063-T5 or T-52.
- B. Aluminum Sheet: ASTM B 209, alloy 3003 or 5005 with temper as required for forming, or as otherwise recommended by metal producer for required finish.
- C. Fasteners: Of same basic metal and alloy as fastened metal or 300 Series stainless steel, unless otherwise indicated. Do not use metals that are incompatible with joined materials.
- D. Postinstalled Fasteners for Concrete and Masonry: Torque-controlled expansion anchors, made from stainless-steel components, with capability to sustain, without failure, a load equal to 4 times the loads imposed, for concrete, or 6 times the load imposed, for masonry, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.
- E. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

2.4 FABRICATION, GENERAL

- A. Assemble louvers in factory to minimize field splicing and assembly. Disassemble units as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.
- B. Maintain equal louver blade spacing, including separation between blades and frames at head and sill, to produce uniform appearance.
- C. Fabricate frames, including integral sills, to fit in openings of sizes indicated, with allowances made for fabrication and installation tolerances, adjoining material tolerances, and perimeter sealant joints.
- D. Integral sills shall include a continuous sill pan with back and end dams. Water that runs off the louver shall be collected in the sill pan and drained away from the building.
- E. Include supports, anchorages, and accessories required for complete assembly.
- F. Provide vertical mullions of type and at spacings indicated, but not more than recommended by manufacturer, or 72 inches o.c., whichever is less.
 - 1. Fully Recessed Mullions: Provide mullions fully recessed behind louver blades. Where length of louver exceeds fabrication and handling limitations, fabricate with close-fitting blade splices designed to permit expansion and contraction.
- G. Join frame members to each other and to fixed louver blades with fillet welds concealed from view, unless otherwise indicated or size of louver assembly makes bolted connections between frame members necessary.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and openings, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.
 - 1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Coordinate setting drawings, diagrams, templates, instructions, and directions for installation of anchorages that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to Project site.

3.3 INSTALLATION

- A. Locate and place louvers and vents level, plumb, and at indicated alignment with adjacent work.
- B. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weathertight connection.
- C. Form closely fitted joints with exposed connections accurately located and secured.
- D. Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.
- E. Repair finishes damaged by cutting, welding, soldering, and grinding. Restore finishes so no evidence remains of corrective work. Return items that cannot be refinished in the field to the factory, make required alterations, and refinish entire unit or provide new units.
- F. Protect galvanized and nonferrous-metal surfaces from corrosion or galvanic action by applying a heavy coating of bituminous paint on surfaces that will be in contact with concrete, masonry, or dissimilar metals.
- G. Install concealed gaskets, flashings, joint fillers, and insulation as louver installation progresses, where weathertight louver joints are required. Comply with Section 079200 - JOINT SEALANTS for sealants applied during louver installation.

3.4 ADJUSTING AND CLEANING

- A. Clean exposed surfaces of louvers and vents that are not protected by temporary covering, to remove fingerprints and soil during construction period. Do not let soil accumulate until final cleaning.
- B. Before final inspection, clean exposed surfaces with water and a mild soap or detergent not harmful to finishes. Thoroughly rinse surfaces and dry.
- C. Restore louvers and vents damaged during installation and construction so no evidence remains of corrective work. If results of restoration are unsuccessful, as determined by Architect, remove damaged units and replace with new units.

1. Touch up minor abrasions in finishes with air-dried coating that matches color and gloss of, and is compatible with, factory-applied finish coating.

END OF SECTION

SECTION 090001

LATHING AND PLASTERING

(Filed Sub-Bid Required)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

- B. Time, Manner and Requirements for Submitting Sub-Bids:

1. Sub-bids for work under this Section shall be for the complete work and shall be filed in a sealed envelope with the _____ at a time and place as stipulated in the "NOTICE TO CONTRACTORS".

The following should appear on the upper left hand corner of the envelope:

NAME OF SUB-BIDDER: (Insert name of sub-bidder)

MASS. STATE PROJECT: ((Insert project number from top of page))

SUB-BID FOR SECTION: 090001 – LATHING AND PLASTERING

2. Each sub-bid submitted for work under this Section shall be on forms furnished by the _____ as required by Section 44F of Chapter 149 of the General Laws, as amended. Sub-bid forms may be obtained at the office of the _____, or may be obtained by written or telephone request; telephone _____.
3. Sub-bids filed with the _____ shall be accompanied by BID BOND or CASH or CERTIFIED CHECK or TREASURER'S CHECK or CASHIER'S CHECK issued by a responsible bank or trust company payable to the _____ in the amount of five percent of the sub-bid. A sub-bid accompanied by any other form of bid deposit than those specified will be rejected.

- C. Sub Sub-Bid Requirements: (None required under this Section.)

- D. Reference Drawings: The Work of this Filed Sub-Bid is shown on the following Contract Drawings: *to be inserted with final documents.*

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. All Work of Section 092400 - PORTLAND CEMENT PLASTERING

2. All Work of Section 092409 - PLASTER PATCHING AND REPAIRS

END OF SECTION

SECTION 090002

TILE

(Filed Sub-Bid Required)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

- B. Time, Manner and Requirements for Submitting Sub-Bids:

1. Sub-bids for work under this Section shall be for the complete work and shall be filed in a sealed envelope with the _____ at a time and place as stipulated in the "NOTICE TO CONTRACTORS".

The following should appear on the upper left hand corner of the envelope:

NAME OF SUB-BIDDER: (Insert name of sub-bidder)

MASS. STATE PROJECT: ((Insert project number from top of page))

SUB-BID FOR SECTION: 090002 - TILE

2. Each sub-bid submitted for work under this Section shall be on forms furnished by the _____ as required by Section 44F of Chapter 149 of the General Laws, as amended. Sub-bid forms may be obtained at the office of the _____, or may be obtained by written or telephone request; telephone _____.
3. Sub-bids filed with the _____ shall be accompanied by BID BOND or CASH or CERTIFIED CHECK or TREASURER'S CHECK or CASHIER'S CHECK issued by a responsible bank or trust company payable to the _____ in the amount of five percent of the sub-bid. A sub-bid accompanied by any other form of bid deposit than those specified will be rejected.

- C. Sub Sub-Bid Requirements: (None required under this Section.)

- D. Reference Drawings: The Work of this Filed Sub-Bid is shown on the following Contract Drawings: *to be inserted with final documents.*

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. All Work of Section 093000 - TILING

END OF SECTION

SECTION 090003

ACOUSTICAL TILE

(Filed Sub-Bid Required)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

B. Time, Manner and Requirements for Submitting Sub-Bids:

1. Sub-bids for work under this Section shall be for the complete work and shall be filed in a sealed envelope with the _____ at a time and place as stipulated in the "NOTICE TO CONTRACTORS".

The following should appear on the upper left hand corner of the envelope:

NAME OF SUB-BIDDER: (Insert name of sub-bidder)

MASS. STATE PROJECT: ((Insert project number from top of page))

SUB-BID FOR SECTION: 090003 – ACOUSTICAL TILE

2. Each sub-bid submitted for work under this Section shall be on forms furnished by the _____ as required by Section 44F of Chapter 149 of the General Laws, as amended. Sub-bid forms may be obtained at the office of the _____, or may be obtained by written or telephone request; telephone _____.
3. Sub-bids filed with the _____ shall be accompanied by BID BOND or CASH or CERTIFIED CHECK or TREASURER'S CHECK or CASHIER'S CHECK issued by a responsible bank or trust company payable to the _____ in the amount of five percent of the sub-bid. A sub-bid accompanied by any other form of bid deposit than those specified will be rejected.

C. Sub Sub-Bid Requirements: (None required under this Section.)

D. Reference Drawings: The Work of this Filed Sub-Bid is shown on the following Contract Drawings: *to be inserted with final documents.*

1.2 DESCRIPTION OF WORK

A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. All Work of Section 095100 - ACOUSTICAL CEILINGS

END OF SECTION

SECTION 090005

RESILIENT FLOORS

(Filed Sub-Bid Required)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

- B. Time, Manner and Requirements for Submitting Sub-Bids:

1. Sub-bids for work under this Section shall be for the complete work and shall be filed in a sealed envelope with the _____ at a time and place as stipulated in the "NOTICE TO CONTRACTORS".

The following should appear on the upper left hand corner of the envelope:

NAME OF SUB-BIDDER: (Insert name of sub-bidder)

MASS. STATE PROJECT: ((Insert project number from top of page))

SUB-BID FOR SECTION: 090005 – RESILIENT FLOORS

2. Each sub-bid submitted for work under this Section shall be on forms furnished by the _____ as required by Section 44F of Chapter 149 of the General Laws, as amended. Sub-bid forms may be obtained at the office of the _____, or may be obtained by written or telephone request; telephone _____.
3. Sub-bids filed with the _____ shall be accompanied by BID BOND or CASH or CERTIFIED CHECK or TREASURER'S CHECK or CASHIER'S CHECK issued by a responsible bank or trust company payable to the _____ in the amount of five percent of the sub-bid. A sub-bid accompanied by any other form of bid deposit than those specified will be rejected.

- C. Sub Sub-Bid Requirements: (None required under this Section.)

- D. Reference Drawings: The Work of this Filed Sub-Bid is shown on the following Contract Drawings: *to be inserted with final documents.*

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. All Work of Section 096510 - RESILIENT FLOORING AND ACCESSORIES

2. All Work of Section 096513 - RESILIENT BASE AND ACCESSORIES
3. All Work of Section 096516 - RESILIENT SHEET FLOORING
4. All Work of Section 096519 - RESILIENT TILE FLOORING
5. All Work of Section 096530 - STATIC-CONTROL RESILIENT FLOORING
6. All Work of Section 096560 - RESILIENT ATHLETIC FLOORING

END OF SECTION

SECTION 090007

PAINTING

(Filed Sub-Bid Required)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

- B. Time, Manner and Requirements for Submitting Sub-Bids:

1. Sub-bids for work under this Section shall be for the complete work and shall be filed in a sealed envelope with the _____ at a time and place as stipulated in the "NOTICE TO CONTRACTORS".

The following should appear on the upper left hand corner of the envelope:

NAME OF SUB-BIDDER: (Insert name of sub-bidder)

MASS. STATE PROJECT: ((Insert project number from top of page))

SUB-BID FOR SECTION: 090007 – PAINTING

2. Each sub-bid submitted for work under this Section shall be on forms furnished by the _____ as required by Section 44F of Chapter 149 of the General Laws, as amended. Sub-bid forms may be obtained at the office of the _____, or may be obtained by written or telephone request; telephone _____.
3. Sub-bids filed with the _____ shall be accompanied by BID BOND or CASH or CERTIFIED CHECK or TREASURER'S CHECK or CASHIER'S CHECK issued by a responsible bank or trust company payable to the _____ in the amount of five percent of the sub-bid. A sub-bid accompanied by any other form of bid deposit than those specified will be rejected.

- C. Sub Sub-Bid Requirements: (None required under this Section.)

- D. Reference Drawings: The Work of this Filed Sub-Bid is shown on the following Contract Drawings: *to be inserted with final documents*.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. All Work of Section 099000 - PAINTING AND COATING

END OF SECTION

SECTION 092110

GYPSUM BOARD ASSEMBLIES

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Interior gypsum wallboard.
 - 2. Tile backing panels.
 - 3. Acoustic insulation (sound attenuation batts) in gypsum wallboard assemblies.
 - 4. Non-load-bearing steel framing, including angles in partial-height partitions.
 - 5. Installation of access panels.
 - 6. Marking and identification for fire- and smoke-partitions.
- B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council. Refer to Section 018110 - SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 054000 - COLD-FORMED METAL FRAMING for load-bearing steel framing.
 - 2. Section 061000 - ROUGH CARPENTRY for plywood backing panels.
 - 3. Section 061600 - SHEATHING for gypsum sheathing at exterior assemblies.
 - 4. Section 083110 - ACCESS DOORS AND FRAMES for furnishing access doors and frames in gypsum board assemblies.
 - 5. Section 092120 - GYPSUM BOARD SHAFT WALL ASSEMBLIES for framing, gypsum panels, other components of shaft wall assemblies, and finishing gypsum board shaft wall assemblies.
 - 6. Section 093000 - TILING for joint compound at cementitious tile backing panels.

1.3 PERFORMANCE REQUIREMENTS

- A. Structural Performance:
 - 1. Design framing system to maintain clearances at openings, to allow for construction tolerances, and to accommodate live load deflection of primary building structure.
 - 2. Provide metal framing engineered to meet code requirements, project requirements, required heights, and the following deflection criteria. For gypsum board assemblies

GYPSUM BOARD ASSEMBLIES

without applied rigid finishes L/240; for gypsum board assemblies with applied rigid finishes such as tile, stone, wood paneling L/360. Lateral load 5 psf except at shafts. Lateral load at shafts shall be required based on analysis of equipment and systems using shafts.

3. Provide fire stop tracks capable of withstanding deflection within limits and under conditions indicated.

- B. Marking and Identification for Fire- and Smoke-Partitions: Fire walls, fire barriers, fire partitions, smoke barriers, smoke partitions and other walls required to have protected openings or penetrations shall be effectively and permanently identified with signs or stenciling. Such identification shall:

1. Be located in accessible concealed floor, floor-ceiling or attic spaces; and
2. Locate within 15 feet of end of each wall and repeat at intervals not exceeding 30 feet measured horizontally along the wall or partition; and
3. Include lettering not less than 3 inches in height with a minimum 3/8 inch stroke in contrasting color, incorporating the suggested wording: "FIRE AND/OR SMOKE BARRIER - PROTECT ALL OPENINGS," or other wording.
4. Exception: Walls in Group R-2 occupancies that do not have a removable decorative ceiling allowing access to the concealed space.

1.4 SUBMITTALS

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

- B. LEED Submittals:

1. Building Product Disclosure and Optimization, Environmental Product Declarations (EPD).
 - a. Option 1: For gypsum board and metal framing, submit product-specific Type III EPDs.
2. Building Product Disclosure and Optimization, Sourcing of Raw Materials:
 - a. General: For credit achievement calculation, submit location of products sourced (extracted, manufactured, and purchased), indicating number of miles from the project site.
 - b. Option 1: For gypsum board, submit corporate sustainability reports (CSR).
 - c. Option 2, Leadership Extraction Practices:
 - 1) Extended Producer Responsibility: For gypsum board, submit evidence of reclamation and recycling programs.
 - 2) Recycled Content: Submit percentages by weight of postconsumer and preconsumer recycled content for products having recycled content. Include statement indicating costs for each product having recycled content.
3. Building Product Disclosure and Optimization, Material Ingredients:
 - a. Option 1, Material Ingredient Reporting: For gypsum boards and acoustical insulation, submit Health Product Declarations (HPD) or Declare product labels.

4. Low-Emitting Materials, General Emissions Evaluation: Building products must be tested and determined compliant in accordance with California Department of Public Health (CDPH) Standard Method v1.1–2010.
 - a. For adhesives and sealants, submit test results, including TVOC emissions and VOC content.
 - b. For gypsum board, acoustic insulation, and joint compounds, submit GreenGuard Gold certification.
 - c. For wet-applied products, submit volume used.
- C. Shop Drawings: If materials and systems other than those specified and those indicated on the Drawings are proposed for use, submit shop drawings signed and sealed by a structural engineer licensed in the jurisdiction of the project certifying proposed systems meet code and project requirements. and specified deflection criteria.
- D. Samples: Full-size Sample in 12-inch-long length for each trim accessory indicated.

1.5 QUALITY ASSURANCE

- 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. 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.
 - b. Each texture finish indicated.
 2. Apply or install final decoration indicated, including painting and wallcoverings, on exposed surfaces for review of mockups.
 3. Simulate finished lighting conditions for review of mockups.
 4. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 STORAGE AND HANDLING

- A. Store materials inside under cover and keep them dry and protected against damage from weather, condensation, direct sunlight, construction traffic, and other causes. Stack panels flat to prevent sagging.

1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.

- B. Do not install interior products 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 NON-LOAD-BEARING STEEL FRAMING, GENERAL

- A. Framing Members, General: Comply with ASTM C 754 for conditions indicated.
 - 1. Steel Sheet Components: Comply with ASTM C 645 requirements for metal, unless otherwise indicated.
 - 2. Protective Coating: Manufacturer's standard corrosion-resistant zinc coating, unless otherwise indicated.
 - 3. Recycled Content: Use minimum recycled content of 25%.

2.2 SUSPENSION SYSTEM COMPONENTS

- A. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.0625-inch-diameter wire, or double strand of 0.0475-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.
- C. Wire Hangers: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.162-inch diameter.
- D. Carrying Channels: Cold-rolled, commercial-steel sheet with a base-metal thickness of 0.0538 inch and minimum 1/2-inch-wide flanges with depth as required for span and loading and indicated on Drawings.
- E. Furring Channels (Furring Members): 0.0538-inch bare-steel thickness, with minimum 1/2-inch-wide flanges, 3/4 inch deep.
- F. Grid Suspension System for Ceilings: ASTM C 645, direct-hung system composed of main beams and cross-furring members that interlock.
 - 1. Available Products: Subject to compliance with requirements, 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 Furring System.
 - c. USG Corporation; Drywall Suspension System.
2. Performance Requirements: Ceiling support system shall support a live load of 6 psf minimum at L/240.

2.3 STEEL FRAMING FOR FRAMED ASSEMBLIES

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. California Expanded Metals Co. (CEMCO).
 2. EB Metal U.S.
 3. Marino\WARE.
 4. Studco Building Systems.
- B. Steel Studs and Runners: ASTM C 645.
1. Minimum Base-Steel (Uncoated) Thickness: 0.0296 inches (20 gage).
 2. Minimum Base-Steel (Uncoated) Thickness: 0.0269 inches (22 gage) (0.0190 to 0.0220 inches for embossed steel members depending on width).
 3. Minimum Base-Steel (Uncoated) Thickness: 0.0179 inches (25 gage) (0.0147 to 0.0155 inches for embossed steel members depending on width).
 4. Dimpled studs meeting performance values for equivalent standard studs are acceptable.
- C. Slip-Type Head Joints: Where indicated, provide one of the following:
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 / Deflection Clip: 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.
- a. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
- 1) Brady Innovations; Sliptrack Systems.
 - 2) California Expanded Metals Co. (CEMCO); CST Slotted Tracks.
 - 3) Clark Dietrich Building Systems; MaxTrak Slotted Deflection Track.
 - 4) Steel Network Inc. (The); VertiTrack VT Series.
- D. Fire Stop 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 compatible with studs and in width to accommodate depth of studs.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - a. California Expanded Metals Co. (CEMCO); FAS-TRK 1000 Slotted Tracks.
 - b. Clark Dietrich Building Systems; BlazeFrame Fire Stop Deflection Track.
 - c. Fire Trak Corp.; Fire Trak attached to studs with Fire Trak Slip Clip.
 - d. GCPAT; FlameSafe FlowTrack System.
- E. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.
 1. Minimum Base-Metal Thickness: 0.0312 inch (20 gauge).
- F. Cold-Rolled Channel Bridging: 0.0538-inch bare-steel thickness, with minimum 1/2-inch- wide flanges.
 1. Depth: 1-1/2 inches.
 2. Clip Angle: Not less than 1-1/2 by 1-1/2 inches, 0.068-inch-thick, galvanized steel.
- G. Hat-Shaped, Rigid Furring Channels: ASTM C 645.
 1. Minimum Base-Metal Thickness: 0.0312 inch (20 gauge).
 2. Depth: 1-1/2 inches.
- H. Resilient Furring Channels: 1/2-inch-deep, steel sheet members designed to reduce sound transmission. Strictly comply with manufacturer's installation instruction.
 1. Basis-of-Design: ClarkDietrich RC Deluxe, asymmetrical configuration.
- I. Resilient Sound Isolation Clips: Provide galvanized steel and resilient material sound-isolation clips, equal to the following:
 1. Kinetics Noise Control Co.; IsoMax.
 2. PAC International, Inc.; RSIC-1.
 3. Pliteq, Inc.; GenieClip.
 4. Studco Building Systems; Resilmount A237R.
- J. Spring Isolation Hangers: Provide galvanized and coated spring hanger system, equal to the following:
 1. Kinetics Noise Control Co.; ICW for wood framing, ICC for metal framing.
 2. PAC International, Inc.; RSIC--SI-CRC Pro Series.
- K. Z-Shaped Furring: With slotted or nonslotted web, face flange of 1-1/4 inches wall attachment flange of 7/8 inch, minimum bare-metal thickness of 0.0179 inch, and depth required to fit insulation thickness indicated.
- L. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.
- M. Isolation Strip at Exterior Walls: Adhesive-backed, closed-cell foam strips that allow fastener penetration without foam displacement, 1/8 inch thick, in width to suit steel stud size.

2.4 INTERIOR GYPSUM BOARD

- 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. CertainTeed Gypsum, Inc.
 2. Georgia-Pacific (G-P) Gypsum.
 3. National Gypsum Company.
 4. United States Gypsum Company (USG).
- B. Gypsum Wallboard: ASTM C 1396.
1. Available Products: USG; SHEETROCK EcoSmart Panels.
 2. Thickness: 1/2 inch and 5/8 inch as indicated.
 3. Long Edges: Tapered.
 4. Building Product Disclosure and Optimization, Environmental Product Declarations (EPD): Type III EPD.
 5. Low-Emitting Materials, General Emissions Evaluation: GreenGuard Gold certification.
- C. Gypsum Wallboard, Fire-Resistant Type X: ASTM C 1396.
1. Available Products: USG; SHEETROCK EcoSmart Panels Firecode X.
 2. Thickness: 5/8 inch.
 3. Long Edges: Tapered.
 4. Building Product Disclosure and Optimization, Environmental Product Declarations (EPD): Type III EPD.
 5. Building Product Disclosure and Optimization, Material Ingredients: Health Product Declaration (HPD) or Declare product labels.
 6. Low-Emitting Materials, General Emissions Evaluation: GreenGuard Gold certification.
- D. Moisture- and Mold-Resistant Gypsum Board: ASTM C 1396. With moisture- and mold-resistant core and paper surfaces.
1. Core: 5/8 inch, Type X.
 2. Long Edges: Tapered.
 3. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.
 4. Building Product Disclosure and Optimization, Environmental Product Declarations (EPD): Type III EPD.
 5. Building Product Disclosure and Optimization, Material Ingredients: Declare product labels.
 6. Low-Emitting Materials, General Emissions Evaluation: GreenGuard Gold certification.
- E. Sound-Dampening Type: QuietRock ES Type X Standard Sound Damped Gypsum Board.
- F. Abuse-Resistant Gypsum Panels: ASTM C 1629. Manufactured to produce greater resistance to surface indentation and through-penetration (impact resistance) than standard, regular-type and Type X gypsum board; 5/8 inch, Type X, long edges tapered.
- G. Impact-Resistant Gypsum Wallboard, Level 2: Sheetrock Brand Mold Tough VHI Firecode X by USG, ToughRock Fireguard X Mold-Guard Abuse-Resistant Gypsum Board by Georgia-Pacific, or Gold Bond Hi-Impact XP Gypsum Board by National Gypsum.

2.5 TILE BACKING PANELS

- A. Cementitious Tile Backing Units: ANSI A118.9 and ASTM C 1288 or 1325, with manufacturer's standard edges.
 - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Custom Building Products; Wonderboard and Wonderboard Lite.
 - b. FinPan, Inc.; Util-A-Crete Concrete Backer Board.
 - 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.

2.6 TRIM ACCESSORIES

- A. Interior Trim: ASTM C 1047.
 - 1. Material: Galvanized or aluminum-coated steel sheet or rolled zinc, with flanges for mechanical fastening, unless otherwise indicated.
 - 2. Shapes:
 - a. Cornerbead.
 - b. Bullnose bead.
 - c. LC-Bead: J-shaped; exposed long flange receives joint compound.
 - d. Expansion (control) joint. For control joints in fire rated walls provide Cemco FAS 093X fire-rated control joint or equal.
 - e. Curved-Edge Cornerbead: With notched or flexible flanges.
- B. Aluminum Trim: Extruded accessories of profiles and dimensions indicated.
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Fry Reglet Corp.
 - b. Gordon, Inc.
 - c. Pittcon Industries.
 - 2. Aluminum: Alloy and temper with not less than the strength and durability properties of ASTM B 221, Alloy 6063-T5.
 - 3. Finish: Corrosion-resistant primer compatible with joint compound and finish materials specified.

2.7 JOINT TREATMENT MATERIALS

- A. General: Comply with ASTM C 475/C 475M.
- B. Joint Tape:

1. Interior Gypsum Wallboard: Paper.
 2. Tile Backing Panels: As recommended by panel manufacturer.
- C. Joint Compound for Interior Gypsum Wallboard: 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 compound.
 3. Fill Coat: For second coat, use setting-type, sandable topping compound.
 4. Finish Coat: For third coat, use setting-type, sandable topping compound.
 5. Skim Coat: For final coat of Level 5 finish, use setting-type, sandable topping compound.
- D. Joint Compound for Tile Backing Panels:
1. Cementitious Backing Units: Thinset, nonsag mortar, as recommended by backing unit manufacturer. Refer to Section 093000 - TILING.
 2. Water-Resistant Gypsum Backing Board: Use setting-type taping compound and setting-type, sandable topping compound.

2.8 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.
- B. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.
1. Low-Emitting Materials: Provide adhesives in compliance with the 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. VOC Content: 50 g/L or less.
 3. Methylene chloride and perchloroethylene may not be intentionally added to adhesives.
 4. Do not use adhesives that contain urea formaldehyde.
- C. 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 tile backing units, use screws of type and size recommended by panel manufacturer.
 3. For fastening abuse-resistant gypsum panels, use Type S 'high-low' screws.
 4. For fastening impact-resistant gypsum panels, use Type S 'high-low' screws.
- D. Acoustic Insulation, Sound Attenuation (Batts) Blankets: ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.

1. Available Products: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. CertainTeed Corporation; NoiseReducer.
 - b. Johns Manville; Unfaced Formaldehyde-Free Fiber Glass Insulation.
 - c. Knauf Insulation; EcoBatt.
 - d. Owens Corning; PINK Next Gen Fiberglass Sound Attenuation Batts (SAB).
 - e. Owens Corning; Thermafiber SAFB FF.
 - f. Rockwool (formerly Roxul); AFB evo.
 2. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.
 3. Building Product Disclosure and Optimization, Environmental Product Declarations (EPD).
 4. Recycled Content: Use minimum recycled content of 25%.
 5. Building Product Disclosure and Optimization, Material Ingredients: Health Product Declaration (HPD) or Declare product labels.
 6. Low-Emitting Materials, General Emissions Evaluation: GreenGuard Gold certification.
- E. Acoustical Sealant: Manufacturer's standard nondrying, nonhardening, nonskinning, nonstaining, gunnable, joint sealant, recommended for sealing interior concealed joints to reduce airborne sound transmission.
1. Available Products, for Concealed and Exposed Joints: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Pecora Corp.; AC-20 FTR Acoustical and Insulation Sealant.
 - b. Specified Technologies, Inc.; Smoke N Sound Acoustical Sealant.
 - c. USG; SHEETROCK Acoustical Sealant.
 2. Available Products, for Concealed Joints Only: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. OSI (a division of Henkel); Pro-Series SC-175.
 - b. Pecora Corp.; BA-98.
 - c. Tremco, Inc.; Tremco Acoustical/Curtainwall Sealant.
 3. Low-Emitting Materials: Provide sealants in compliance with the 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."
 4. VOC Content, Architectural Sealants: 250 g/L or less.
 5. Methylene chloride and perchloroethylene may not be intentionally added to sealants.
- 2.9 IDENTIFICATION LABELS FOR FIRE- AND SMOKE-PARTITIONS
- A. Identification Labels: Self-adhesive signs, to comply with applicable local Code.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Fire Wall Signs, Inc.
 - b. Marking & Identification Tape (mnitape.com).
 - c. My Safety Sign.
 - d. Safety Supply Warehouse.
2. Text: "FIRE AND SMOKE BARRIER - PROTECT ALL OPENINGS".

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames and framing, 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 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. 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 SUSPENSION SYSTEMS

- A. Install suspension system components in sizes and spacings indicated on Drawings, but not less than those required by referenced installation standards for assembly types and other assembly components indicated.
- 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. Flat Hangers: Secure to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices and fasteners that are secure and appropriate for structure and hanger, and in a manner that will not cause hangers to deteriorate or otherwise fail.
 - 5. Do not attach hangers to steel roof deck.
 - 6. Do not attach hangers to permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.
 - 7. Do not attach hangers to rolled-in hanger tabs of composite steel floor deck.
 - 8. Do not connect or suspend steel framing from ducts, pipes, or conduit.
- D. Fire-Resistance-Rated Assemblies: Wire tie furring channels to supports.
- 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.

3.5 INSTALLING FRAMED ASSEMBLIES

- A. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.
- B. Install studs so flanges within framing system point in same direction.
- C. 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 doorframes; install runner track section (for cripple studs) at head and secure to jamb studs.
 - a. Install two studs at each jamb, unless otherwise indicated.
 - b. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch clearance from jamb stud to allow for installation of control joint in finished assembly.
 - c. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.
 - 3. Other Framed Openings: Frame openings other than door openings the same as required for door openings, unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.
 - 4. Fire-Resistance-Rated Partitions: Install framing to comply with fire-resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.
 - a. Firestop Track: Where indicated, 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 not less than 2 studs at ends of arcs, place studs 6 inches o.c.
- D. Direct Furring: Attach to concrete or masonry with stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.
- E. Z-Furring Members:

1. Erect insulation vertically and hold in place with Z-furring members spaced 24 inches o.c.
2. Except at exterior corners, securely attach narrow flanges of furring members to wall with concrete stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.
3. At exterior corners, attach wide flange of furring members to wall with short flange extending beyond corner; on adjacent wall surface, screw-attach short flange of furring channel to web of attached channel. At interior corners, space second member no more than 12 inches from corner and cut insulation to fit.

3.6 APPLYING AND FINISHING PANELS, GENERAL

- A. Comply with ASTM C 840.
- B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.
- C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.
- D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.
- E. Form control and expansion joints with space between edges of adjoining gypsum panels.
- F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.
 1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. in area.
 2. Fit gypsum panels around ducts, pipes, and conduits.
 3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch- wide joints to install sealant.
- G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments, except floors. Provide 1/4- to 1/2-inch- wide spaces at these locations, and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.
- H. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

3.7 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 to minimize end joints.

3. On Z-furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.
4. Fastening Methods: Apply gypsum panels to supports with steel drill screws.

B. Multilayer Application:

1. On ceilings, apply gypsum board indicated for base layers before applying base layers on walls/partitions; apply face layers in same sequence. Apply base layers at right angles to framing members and offset face-layer joints 1 framing member, 16 inches minimum, from parallel base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly.
2. On partitions/walls, apply gypsum board indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face-layer joints offset at least one stud or furring member with base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.
3. On Z-furring members, apply base layer vertically (parallel to framing) and face layer either vertically (parallel to framing) or horizontally (perpendicular to framing) with vertical joints offset at least one furring member. Locate edge joints of base layer over furring members.
4. Fastening Methods: Fasten base layers and face layers separately to supports with screws.

C. Laminating to Substrate: Where gypsum panels are indicated as directly adhered to a substrate (other than studs, joists, furring members, or base layer of gypsum board), comply with gypsum board manufacturer's written recommendations and temporarily brace or fasten gypsum panels until fastening adhesive has set.

D. Curved Surfaces:

1. Install panels horizontally (perpendicular to supports) and unbroken, to extent possible, across curved surface plus 12-inch-long straight sections at ends of curves and tangent to them.
2. For double-layer construction, fasten base layer to studs with screws 16 inches o.c. Center gypsum board face layer over joints in base layer, and fasten to studs with screws spaced 12 inches o.c.

3.8 APPLYING TILE BACKING PANELS

- A. Cementitious Tile Backing Units: ANSI A108.1, at locations indicated to receive tile, with joints treated to comply with ANSI A108.11.
- B. Water-Resistant Backing Board: Install at areas not subject to wetting and elsewhere as indicated with 1/4-inch gap where panels abut other construction or penetrations.
- C. Where tile backing panels abut other types of panels in same plane, shim surfaces to produce a uniform plane across panel surfaces.

3.9 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.
- 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. Curved-Edge Cornerbead: Use at curved openings.
- D. Aluminum Trim: Install in locations indicated on Drawings.

3.10 FINISHING GYPSUM BOARD

- A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.
- B. Prefill open joints, rounded or beveled edges, and damaged surface areas.
- C. Apply joint tape over gypsum board joints, except those with trim having flanges not intended for tape.
- D. Gypsum Board Finish Levels: Comply with GA-214. Finish panels to levels indicated below:
 - 1. Level 1: Ceiling plenum areas and concealed areas not exposed to view.
 - 2. Level 2: Panels that are substrate for tile.
 - 3. Level 3: Not Used.
 - 4. Level 4: Panel surfaces that will be exposed to view (typical panels).
 - 5. Level 5: Where indicated on Drawings; includes areas to receive dry erase coatings, wall graphics, and wallcoverings.
- E. Cementitious Tile Backing Units: Finish according to manufacturer's written instructions.

3.11 INSTALLING IDENTIFICATION FOR FIRE- AND SMOKE-PARTITIONS

- A. Marking and Identification for Fire- and Smoke-Partitions: Permanently install as required by Code.

3.12 PROTECTION

- A. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.
- B. Remove and replace panels that are wet, moisture damaged, or exhibit mold growth. Repair of damaged panels in place is not acceptable.

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

SECTION 092120

GYPSUM BOARD SHAFT WALL ASSEMBLIES

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Gypsum board shaft wall assemblies.
 - 2. Marking and identification for fire- and smoke-partitions.
- B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council. Refer to Section 018110 - SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 083110 - ACCESS DOORS AND FRAMES for installation in gypsum board assemblies.
 - 2. Section 092110 - GYPSUM BOARD ASSEMBLIES for non-shaft-wall gypsum board assemblies.
 - 3. Section 092110 - GYPSUM BOARD ASSEMBLIES for applying and finishing panels in gypsum board assemblies.

1.3 DEFINITIONS

- A. Gypsum Board Construction Terminology: Refer to ASTM C 11 for definitions of terms for gypsum board construction not defined in this Section or in other referenced standards.

1.4 PERFORMANCE REQUIREMENTS

- A. Structural Performance:
 - 1. Provide gypsum board shaft wall assemblies capable of withstanding the full air-pressure loads indicated for maximum heights of partitions without failing and while maintaining an airtight and smoke-tight seal. Evidence of failure includes deflections exceeding limits indicated, bending stresses causing studs to break or to distort, and end-reaction shear causing track (runners) to bend or to shear and studs to become crippled.

2. Provide gypsum board shaft wall assemblies for horizontal duct enclosures capable of spanning distances indicated within deflection limits indicated.
- B. Marking and Identification for Fire- and Smoke-Partitions: Fire walls, fire barriers, fire partitions, smoke barriers, smoke partitions and other walls required to have protected openings or penetrations shall be effectively and permanently identified with signs or stenciling. Such identification shall:
1. Be located in accessible concealed floor, floor-ceiling or attic spaces; and
 2. Locate within 15 feet of end of each wall and repeat at intervals not exceeding 30 feet measured horizontally along the wall or partition; and
 3. Include lettering not less than 3 inches in height with a minimum 3/8 inch stroke in contrasting color, incorporating the suggested wording: "FIRE AND/OR SMOKE BARRIER - PROTECT ALL OPENINGS," or other wording.

1.5 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. LEED Submittals:
1. Building Product Disclosure and Optimization, Environmental Product Declarations (EPD).
 - a. Option 1: For gypsum board and metal framing, submit product-specific Type III EPDs.
 2. Building Product Disclosure and Optimization, Sourcing of Raw Materials:
 - a. General: For credit achievement calculation, submit location of products sourced (extracted, manufactured, and purchased), indicating number of miles from the project site.
 - b. Option 1: For gypsum board, submit corporate sustainability reports (CSR).
 - c. Option 2, Leadership Extraction Practices:
 - 1) Extended Producer Responsibility: For gypsum board, submit evidence of reclamation and recycling programs.
 - 2) Recycled Content: Submit percentages by weight of postconsumer and preconsumer recycled content for products having recycled content. Include statement indicating costs for each product having recycled content.
 3. Building Product Disclosure and Optimization, Material Ingredients:
 - a. Option 1, Material Ingredient Reporting: For gypsum boards and acoustical insulation, submit Health Product Declarations (HPD) or Declare product labels.
 4. Low-Emitting Materials, General Emissions Evaluation: Building products must be tested and determined compliant in accordance with California Department of Public Health (CDPH) Standard Method v1.1–2010.
 - a. For adhesives and sealants, submit test results, including TVOC emissions and VOC content.

- b. For gypsum board, acoustic insulation, and joint compounds, submit GreenGuard Gold certification.
 - c. For wet-applied products, submit volume used.
- C. Fire-Test-Response Reports: From a qualified independent testing and inspecting agency substantiating each gypsum board shaft wall assembly's required fire-resistance rating.
 - 1. Include data substantiating that elevator entrances and other items that penetrate each gypsum board shaft wall assembly do not negate fire-resistance rating.

1.6 QUALITY ASSURANCE

- A. Fire-Resistance-Rated Assemblies: Provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing and inspecting agency acceptable to authorities having jurisdiction.
 - 1. Fire-Resistance-Rated Assemblies: Indicated by design designations from FM's "Approval Guide, Building Products," UL's "Fire Resistance Directory," or ITS's "Directory of Listed Products."
- B. STC-Rated Assemblies: For gypsum board shaft wall assemblies indicated to have STC ratings, provide assembly materials and construction complying with requirements of assemblies whose STC ratings were determined according to ASTM E 90 and classified according to ASTM E 413 by a qualified independent testing agency.
- C. Preinstallation Conference: Conduct conference at Project site to comply with requirements of Division 01. Review methods and procedures for installing work related to gypsum board shaft wall assemblies including, but not limited to, the following:
 - 1. Fasteners proposed for anchoring steel framing to building structure.
 - 2. Sprayed fire-resistive materials applied to structural framing.
 - 3. Elevator equipment, including hoistway doors, elevator call buttons, and elevator floor indicators.
 - 4. Wiring devices in shaft wall assemblies.
 - 5. Doors and other items penetrating shaft wall assemblies.
 - 6. Items supported by shaft wall-assembly framing.
 - 7. Mechanical work enclosed within shaft wall assemblies.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in original packages, containers, and bundles bearing brand name and identification of manufacturer or supplier.
- B. Store materials inside under cover and keep them dry and protected against damage from weather, direct sunlight, surface contamination, corrosion, construction traffic, and other causes. Stack gypsum panels flat on leveled supports off the ground to prevent sagging.

1.8 PROJECT CONDITIONS

- A. Comply with requirements for environmental conditions, room temperatures, and ventilation specified in Section 092110 - GYPSUM BOARD ASSEMBLIES.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. CertainTeed Gypsum, Inc.
 2. National Gypsum Company.
 3. United States Gypsum Company (USG).

2.2 ASSEMBLY MATERIALS

- A. General: Provide materials and components complying with requirements of fire-resistance-rated assemblies indicated.
1. Provide panels in maximum lengths available to eliminate or minimize end-to-end butt joints.
 2. Provide auxiliary materials complying with gypsum board shaft wall assembly manufacturer's written recommendations.
- B. Steel Framing: ASTM C 645.
1. Protective Coating: ASTM A 653/A 653M, G40, hot-dip galvanized coating.
- C. Gypsum Liner Panels: Manufacturer's proprietary liner panels in 1-inch thickness and with moisture-resistant paper faces.
- D. Gypsum Wallboard: ASTM C 1396, core type as required by fire-resistance-rated assembly indicated.
- E. Accessories: Cornerbead, edge trim, and control joints of material and shapes specified in Section 092110 - GYPSUM BOARD ASSEMBLIES comply with gypsum board shaft wall assembly manufacturer's written recommendations for application indicated.
- F. Gypsum Wallboard Joint-Treatment Materials: ASTM C 475 and as specified in Section 092110 - GYPSUM BOARD ASSEMBLIES.
- G. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.
- H. Track (Runner) Fasteners: Power-driven fasteners of size and material required to withstand loading conditions imposed on shaft wall assemblies without exceeding allowable design stress of track, fasteners, or structural substrates in which anchors are embedded.
1. Powder-Actuated Fasteners: Provide powder-actuated fasteners with capability to sustain, without failure, a load equal to 10 times that imposed by shaft wall assemblies, as determined by testing conducted by a qualified independent testing agency according to ASTM E 1190.
 2. Postinstalled Expansion Anchors: Where indicated, provide expansion anchors with capability to sustain, without failure, a load equal to 5 times that imposed by shaft wall assemblies, as determined by testing conducted by a qualified independent testing agency according to ASTM E 488.

- I. Laminating Adhesive: Comply with requirements of Section 092110 - GYPSUM BOARD ASSEMBLIES.
- J. Acoustic Insulation, Sound Attenuation (Batts) Blankets: Comply with requirements of Section 092110 - GYPSUM BOARD ASSEMBLIES.
- K. Acoustical Sealant: Comply with requirements of Section 092110 - GYPSUM BOARD ASSEMBLIES.

2.3 GYPSUM BOARD SHAFT WALL

- A. Basis-of-Design Product: As indicated on Drawings by design designation of a qualified testing and inspecting agency.
- B. Sustained Air-Pressure Loads: 5 lbf/sq. ft.
- C. Deflection Limit: L/240.
- D. Studs: Manufacturer's standard profile for repetitive members and corner and end members and for fire-resistance-rated assembly indicated.
 - 1. Depth: As indicated.
 - 2. Minimum Base Metal Thickness: Manufacturer's standard thicknesses that comply with structural performance requirements for stud depth indicated.
- E. Track (Runner): Manufacturer's standard J-profile track with long-leg length as standard with manufacturer, but at least 2 inches in depth matching studs.
 - 1. Minimum Base Metal Thickness: Manufacturer's standard thicknesses that comply with structural performance requirements for stud depth indicated.
- F. Jamb Struts: Manufacturer's standard J-profile strut with long-leg length of 3 inches, in depth matching studs, and not less than 0.0341 inch thick.
- G. Room-Side and Shaft-Side Finish: As indicated.
- H. STC Rating: As indicated.
- I. Cavity Insulation: Sound attenuation blankets.

2.4 IDENTIFICATION LABELS FOR FIRE- AND SMOKE-PARTITIONS

- A. Identification Labels: Self-adhesive signs, to comply with applicable local Code.
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Fire Wall Signs, Inc.
 - b. Marking & Identification Tape (mnitape.com).
 - c. My Safety Sign.
 - d. Safety Supply Warehouse.

2. Text: "FIRE AND SMOKE BARRIER-PROTECT ALL OPENINGS"

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates to which gypsum board shaft wall assemblies attach or abut, with Installer present, including hollow-metal frames, elevator hoistway doorframes, cast-in anchors, and structural framing. Examine for compliance with requirements for installation tolerances and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Sprayed Fire-Resistive Materials: Coordinate with gypsum shaft wall assemblies so both elements of Work remain complete and undamaged. Patch or replace sprayed fire-resistive materials removed or damaged during installation of shaft wall assemblies.
- 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

- A. General: Install gypsum board shaft wall assemblies to comply with requirements of fire-resistance-rated assemblies indicated, manufacturer's written installation instructions, and the following:
1. ASTM C 754 for installing steel framing and gypsum shaft wallboard.
- B. Do not bridge building expansion joints with shaft wall assemblies; frame both sides of joints with furring and other support.
- C. Install supplementary framing in gypsum board shaft wall assemblies around openings and as required for blocking, bracing, and support of gravity and pullout loads of fixtures, equipment, services, heavy trim, furnishings, and similar items that cannot be supported directly by shaft wall assembly framing.
1. At elevator hoistway doorframes, provide jamb struts on each side of doorframe.
 2. Where handrails directly attach to gypsum board shaft wall assemblies, provide galvanized steel reinforcing strip with 0.0312-inch minimum thickness of base (uncoated) metal, accurately positioned and secured behind at least 1 face-layer panel.

- D. Integrate stair hanger rods with gypsum board shaft wall assemblies by locating cavity of assemblies where required to enclose rods.
- E. At penetrations in shaft wall, maintain fire-resistance rating of shaft wall assembly by installing supplementary steel framing around perimeter of penetration and fire protection behind boxes containing wiring devices, elevator call buttons, elevator floor indicators, and similar items.
- F. Isolate gypsum finish panels from building structure to prevent cracking of finish panels while maintaining continuity of fire-rated construction.
- G. Install control joints to maintain fire-resistance rating of assemblies.
- H. Seal gypsum board shaft walls with acoustical sealant at perimeter of each assembly where it abuts other work and at joints and penetrations within each assembly. Install acoustical sealant to withstand dislocation by air-pressure differential between shaft and external spaces; maintain an airtight and smoke-tight seal; and comply with manufacturer's written instructions or ASTM C 919, whichever is more stringent.

3.4 FINISHING GYPSUM BOARD SHAFT WALL ASSEMBLIES

- A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.
- B. Prefill open joints, rounded or beveled edges, and damaged surface areas.
- C. Apply joint tape over gypsum board joints, except those with trim having flanges not intended for tape.
- D. Gypsum Board Finish Levels: Finish panels to levels indicated below:
 - 1. Level 1: Ceiling plenum areas and concealed areas not exposed to view.
 - 2. Level 2: Panels that are substrate for tile.
 - 3. Level 4: Panel surfaces that will be exposed to view (typical panels).
 - 4. Level 5: Where indicated on Drawings.

3.5 INSTALLING IDENTIFICATION FOR FIRE- AND SMOKE-PARTITIONS

- A. Marking and Identification for Fire- and Smoke-Partitions: Permanently install as required by Code.

3.6 PROTECTION

- A. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.
- B. Remove and replace panels that are wet, moisture damaged, or exhibit mold growth. Repair of damaged panels in place is not acceptable.
 - 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

SECTION 092400

PORTLAND CEMENT PLASTERING

(PART OF WORK OF SECTION 090001 - LATHING AND PLASTERING, FILED SUB-BID REQUIRED)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Portland cement plasterwork on metal lath.
- B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council. Refer to Section 018110, SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 092110 - GYPSUM BOARD ASSEMBLIES for new gypsum wall board and accessories.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. LEED Submittals:
 - 1. Credit EQ 4.1: Manufacturers' product data for interior sealants and sealant primers, including printed statement of VOC content.
- C. Shop Drawings: Show locations and installation of control and expansion joints including plans, elevations, sections, details of components, and attachments to other work.
- D. Samples for Verification: For each type of factory-prepared finish coat indicated; 12 by 12 inches, and prepared on rigid backing.

1.4 QUALITY ASSURANCE

- A. Fire-Resistance Ratings: Where indicated, provide portland cement plaster assemblies identical to those of assemblies tested for fire resistance per ASTM E 119 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.
- B. Mockups: Before plastering, 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 each type of finish indicated.
 - 2. For interior plasterwork, simulate finished lighting conditions for review of mockups.
 - 3. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store materials inside under cover and keep them dry and protected against damage from weather, direct sunlight, surface contamination, corrosion, construction traffic, and other causes.

1.6 PROJECT CONDITIONS

- A. Comply with ASTM C 926 requirements.
- B. Exterior Plasterwork:
 - 1. Apply and cure plaster to prevent plaster drying out during curing period. Use procedures required by climatic conditions, including moist curing, providing coverings, and providing barriers to deflect sunlight and wind.
 - 2. Apply plaster when ambient temperature is greater than 40 deg F.
- C. Factory-Prepared Finishes: Comply with manufacturer's written recommendations for environmental conditions for applying finishes.

PART 2 - PRODUCTS

2.1 METAL LATH

- A. Expanded-Metal Lath: ASTM C 847 with ASTM A 653, G60, hot-dip galvanized zinc coating.
 - 1. Manufacturers: Subject to compliance with requirements, [provide products by one of the following] [available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. Alabama Metal Industries Corporation; a Gibraltar Industries Company.
 - b. CEMCO, California Expanded Metal Products.
 - c. ClarkDietrich Building Systems.
 - 2. Diamond-Mesh Lath: Self-furring, 2.5 lb/sq. yd.

2.2 ACCESSORIES

- A. General: Comply with ASTM C 1063 and coordinate depth of trim and accessories with thicknesses and number of plaster coats required.
- B. Metal Accessories:
 - 1. Manufacturers: Subject to compliance with requirements, [provide products by one of the following] [available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. Alabama Metal Industries Corporation; a Gibraltar Industries company.
 - b. CEMCO.
 - c. Clark Western Building Systems.
 - d. Dietrich Metal Framing; a Worthington Industries company.
 - 2. Foundation Weep Screed: Fabricated from hot-dip galvanized-steel sheet, ASTM A 653, G60 zinc coating.
 - 3. External-Corner Reinforcement: Fabricated from metal lath with ASTM A 653, G60, hot-dip galvanized zinc coating.
 - 4. Cornerbeads: Fabricated from zinc-coated (galvanized) steel.
 - 5. Control Joints: Fabricated from zinc-coated (galvanized) steel; one-piece-type, folded pair of unperforated screeds in M-shaped configuration; with perforated flanges and removable protective tape on plaster face of control joint.
 - 6. Expansion Joints: Fabricated from zinc-coated (galvanized) steel; folded pair of unperforated screeds in M-shaped configuration; with expanded flanges.

2.3 MISCELLANEOUS MATERIALS

- A. Water for Mixing: Potable and free of substances capable of affecting plaster set or of damaging plaster, lath, or accessories.
- B. Fiber for Base Coat: Alkaline-resistant glass or polypropylene fibers, 1/2 inch long, free of contaminants, manufactured for use in portland cement plaster.
- C. Bonding Compound: ASTM C 932.
- D. Steel Drill Screws: For metal-to-metal fastening, ASTM C 1002 or ASTM C 954, as required by thickness of metal being fastened; with pan head that is suitable for application; in lengths required to achieve penetration through joined materials of no fewer than three exposed threads.
- E. Fasteners for Attaching Metal Lath to Substrates: Complying with ASTM C 1063.
- F. Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, not less than 0.0475-inch diameter, unless otherwise indicated.

2.4 PLASTER MATERIALS

- A. Portland Cement: ASTM C 150, Type I.
- B. Lime: ASTM C 206, Type S; or ASTM C 207, Type S.

- C. Sand Aggregate: ASTM C 897.
- D. Acrylic-Based Finish Coatings: Factory-mixed acrylic-emulsion coating systems, formulated with colorfast mineral pigments and fine aggregates; for use over portland cement plaster base coats. Include manufacturer's recommended primers and sealing topcoats for acrylic-based finishes.
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Dryvit Systems, Inc.; Dryvit TAFS.
 - b. Finestone, BASF Wall Systems, Inc.; PebbleTex.
 - c. Sto Corp.; Powerwall Finish.
 - d. SonoWall, BASF Wall Systems, Inc.; StuccoTex Finish.
 - 2. Color: Custom color, as selected by Architect.

2.5 PLASTER MIXES

- A. General: Comply with ASTM C 926 for applications indicated.
 - 1. Fiber Content: Add fiber to base-coat mixes after ingredients have mixed at least two minutes. Comply with fiber manufacturer's written instructions for fiber quantities in mixes, but do not exceed 1 lb of fiber/cu. yd. of cementitious materials.
- B. Base-Coat Mixes for Use over Metal Lath: Scratch and brown coats for three-coat plasterwork as follows:
 - 1. Portland Cement Mixes:
 - a. Scratch Coat: For cementitious material, mix 1 part portland cement and 0 to 3/4 parts lime. Use 2-1/2 to 4 parts aggregate per part of cementitious material.
 - b. Brown Coat: For cementitious material, mix 1 part portland cement and 3/4 to 1-1/2 parts lime. Use 2-1/2 to 4 parts aggregate per part of cementitious material, but not less than volume of aggregate used in scratch coat.
- C. Factory-Prepared Finish-Coat Mixes: For acrylic-based finish coatings, comply with manufacturer's written instructions.

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. Protect adjacent work from soiling, spattering, moisture deterioration, and other harmful effects caused by plastering.
- B. Prepare solid substrates for plaster that are smooth or that do not have the suction capability required to bond with plaster according to ASTM C 926.

3.3 INSTALLATION, GENERAL

- A. Fire-Resistance-Rated Assemblies: Install components according to requirements for design designations from listing organization and publication indicated on Drawings.

3.4 INSTALLING METAL LATH

- A. Expanded-Metal Lath: Install according to ASTM C 1063.
 - 1. On Solid Surfaces, Not Otherwise Furred: Install self-furring, diamond-mesh lath.

3.5 INSTALLING ACCESSORIES

- A. Install according to ASTM C 1063 and at locations indicated on Drawings.
- B. Reinforcement for External Corners:
 - 1. Install lath-type, external-corner reinforcement at exterior locations.
- C. Control Joints: Install control joints in specific locations approved by Architect for visual effect as follows:
 - 1. As required to delineate plasterwork into areas (panels) of the following maximum sizes:
 - a. Horizontal and other Nonvertical Surfaces: 100 sq. ft.
 - 2. At distances between control joints of not greater than 18 feet o.c.
 - 3. As required to delineate plasterwork into areas (panels) with length-to-width ratios of not greater than 2-1/2:1.
 - 4. Where control joints occur in surface of construction directly behind plaster.
 - 5. Where plasterwork areas change dimensions, to delineate rectangular-shaped areas (panels) and to relieve the stress that occurs at the corner formed by the dimension change.

3.6 PLASTER APPLICATION

- A. General: Comply with ASTM C 926.
 - 1. Do not deviate more than plus or minus 1/4 inch in 10 feet from a true plane in finished plaster surfaces, as measured by a 10-foot straightedge placed on surface.
- B. Acrylic-Based Finish Coatings: Apply coating system, including primers, finish coats, and sealing topcoats, according to manufacturer's written instructions.

- C. Concealed Exterior Plasterwork: Where plaster application will be used as a base for adhered finishes, omit finish coat.

3.7 PLASTER REPAIRS

- A. Repair or replace work to eliminate cracks, dents, blisters, buckles, crazing and check cracking, dry outs, efflorescence, sweat outs, and similar defects and where bond to substrate has failed.

3.8 PROTECTION

- A. Remove temporary protection and enclosure of other work. Promptly remove plaster from door frames, windows, and other surfaces not indicated to be plastered. Repair floors, walls, and other surfaces stained, marred, or otherwise damaged during plastering.

END OF SECTION

SECTION 092409

PLASTER PATCHING AND REPAIRS

(Part of Work of Section 090001 - LATHING AND PLASTERING, Filed Sub-Bid Required)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Patching and repair of existing plaster finishes.
- B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council. Refer to Section 018110, SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 092110 - GYPSUM BOARD ASSEMBLIES for new gypsum wall board and accessories.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Show locations and installation of control and expansion joints including plans, elevations, sections, details of components, and attachments to other work.

1.4 QUALITY ASSURANCE

- A. Mockups: Before plastering, 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 each type of finish indicated.
 - 2. For interior plasterwork, simulate finished lighting conditions for review of mockups.
 - 3. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

- B. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store materials inside under cover and keep them dry and protected against damage from weather, direct sunlight, surface contamination, corrosion, construction traffic, and other causes.

1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Comply with ASTM C 843 requirements or gypsum veneer plaster manufacturer's written recommendations, whichever are more stringent.
- B. Room Temperatures: Maintain not less than 55 deg F or more than 80 deg F for 7 days before application of plaster, continuously during application, and after application until plaster is dry.

PART 2 - PRODUCTS

2.1 PLASTER

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. G-P Gypsum.
 - 2. National Gypsum Company.
 - 3. USG Corporation.

2.2 METAL LATH

- A. Expanded-Metal Lath: ASTM C 847 with ASTM A 653, G60, hot-dip galvanized zinc coating.
 - 1. Manufacturers: Subject to compliance with requirements, [provide products by one of the following] [available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. Alabama Metal Industries Corporation; a Gibraltar Industries Company.
 - b. CEMCO, California Expanded Metal Products.
 - c. ClarkDietrich Building Systems.
 - 2. Striplath: Fabricated from expanded-metal lath with ASTM A 653/A 653M, G60, hot-dip galvanized zinc coating.

2.3 ACCESSORIES

- A. General: Coordinate depth of trim and accessories with thicknesses and number of plaster coats required. Provide materials that comply with referenced product standards and manufacturer's written recommendations.
- B. Standard Trim: ASTM C 1047, provided or approved by manufacturer for use in plaster applications indicated.

1. Material: Galvanized or aluminum-coated steel sheet or rolled zinc.
2. Shapes: To match existing and as approved by the Architect.

C. Bonding Agent or Compound: ASTM C 631.

D. 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.

E. Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, not less than 0.0475-inch diameter, unless otherwise indicated.

F. Joint Reinforcing Materials and Tapes: Comply with joint strength requirements in ASTM C 587 and with plaster manufacturer's written recommendations for each application indicated.

2.4 PLASTER MATERIALS

A. Portland Cement: ASTM C 150, Type I.

B. Lime: ASTM C 206, Type S; or ASTM C 207, Type S.

C. Sand Aggregate: ASTM C 897 or ASTM C 35.

D. Water: Potable, clean and free from deleterious amount of oils, salts, alkali, organic matter, and other harmful materials.

2.5 PLASTER MIXES

A. General: Mechanically mix plaster materials to comply with ASTM C 842 and ASTM C 843 and with plaster manufacturer's written recommendations.

B. Factory-Prepared Finish-Coat Plaster Mixes: For factory-prepared finish coatings, comply with manufacturer's written instructions. Mix to match existing for each coat.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and substrates, with Installer present, 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. Protect adjacent work from soiling, spattering, moisture deterioration, and other harmful effects caused by plastering.
- B. Cut back existing damaged plaster and lath as required. Attach new strapping to existing substrates as required.

3.3 INSTALLING METAL LATH

- A. Expanded-Metal Lath: Install according to ASTM C 841 or ASTM C 1063.

3.4 INSTALLING ACCESSORIES

- A. Install according to ASTM C 841 and ASTM C 1063 and at locations indicated on Drawings.
- B. Control Joints: Install control joints in specific locations, as approved by Architect, and as follows:
 - 1. To match existing control joints.
 - 2. For visual effect.
 - 3. To prevent future plaster failures.
 - 4. Where control joints occur in surface of construction directly behind plaster.
 - 5. Where plasterwork areas change dimensions, to delineate rectangular-shaped areas (panels) and to relieve the stress that occurs at the corner formed by the dimension change.

3.5 PLASTER APPLICATION

- A. General: Comply with ASTM C 842.
 - 1. Do not deviate more than plus or minus 1/4 inch in 10 feet from a true plane in finished plaster surfaces, as measured by a 10-foot straightedge placed on surface.
- B. Factory-Prepared Finish Coatings: Apply coating system, including primers, finish coats, and sealing topcoats, according to manufacturer's written instructions.
- C. Finish Texture: Match existing, per approved mock-ups.

3.6 PLASTER REPAIRS

- A. Repair or replace work to eliminate cracks, dents, blisters, buckles, crazing and check cracking, dry outs, efflorescence, sweat outs, and similar defects and where bond to substrate has failed.

3.7 PROTECTION

- A. Remove temporary protection and enclosure of other work. Promptly remove plaster from door frames, windows, and other surfaces not indicated to be plastered. Repair floors, walls, and other surfaces stained, marred, or otherwise damaged during plastering.

END OF SECTION

SECTION 093000

TILING

(Part of Work of Section 090002 - TILE, Filed Sub-Bid Required)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Floor, wall, and base tiles.
 - 2. Setting materials and accessories.
 - 3. Surface preparation.
- B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council. Refer to Section 018110 - SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 033000 - CAST-IN-PLACE CONCRETE for monolithic slab finishes specified for tile substrates.
 - 2. Section 079200 - JOINT SEALANTS for sealing of joints between dissimilar materials.
 - 3. Section 083110 - ACCESS DOORS AND FRAMES for installation in tile.
 - 4. Section 092110 - GYPSUM BOARD ASSEMBLIES for tile backer units.

1.3 DEFINITIONS

- A. Module Size: Actual tile size plus joint width indicated.
- B. Face Size: Actual tile size, excluding spacer lugs.

1.4 PERFORMANCE REQUIREMENTS

- A. Wet Dynamic Coefficient of Friction: For flooring exposed as a walking surface, provide products with the following values as determined by testing identical products per ANSI/ NFSI B101.3 - 2012 Test Method for Measuring Wet DCOF of Common Hard-Surface Floor Materials, or ANSI 326.3 - American National Standard Test Method for Measuring Dynamic

Coefficient of Friction of Hard Surface Materials - 2017. Testing by other methods or earlier editions of the specified test method is not acceptable.

1. Wet Dynamic Coefficient of Friction: Not less than 0.43.

1.5 SUBMITTALS

- A. Product Data: For each type of product.
- B. LEED Submittals:
 1. Building Product Disclosure and Optimization, Environmental Product Declarations (EPD):
 - a. Option 1: For ceramic tiles, mortars, and grouts, submit industry-wide EPDs.
 2. Building Product Disclosure and Optimization, Material Ingredients:
 - a. Option 1, Material Ingredient Reporting: For membranes and grouts, submit Health Product Declarations (HPD).
 3. Low-Emitting Materials, General Emissions Evaluation: Building products must be tested and determined compliant in accordance with California Department of Public Health (CDPH) Standard Method v1.1–2010.
 - a. For adhesives and sealants, submit test results, including TVOC emissions and VOC content.
 - b. For waterproofing membranes, submit GreenGuard Gold certification.
 - c. For wet-applied products, submit volume used.
- C. 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.
 1. For feature spaces including lobbies, reception areas, corridors, food service areas and similar spaces provide layout drawings based on measured as-building conditions.
- D. Samples for Verification:
 1. Assembled samples with grouted joints for each type and composition of tile and for each color and finish required, at least 12 inches square and mounted on rigid panel. Use grout of type and in color or colors approved for completed work.
 2. Full-size units of each type of trim and accessory for each color and finish required.
 3. Stone Thresholds: 6-inch lengths.
 4. Metal Edge Strips: 6-inch lengths.
- E. Qualification Data: For Installer.
- F. Material Test Reports: For each tile setting product.

1.6 QUALITY ASSURANCE

- A. Source Limitations for Tile: Obtain tile of same type and color or finish from one source or producer.
 - 1. Obtain tile from same production run and of consistent quality in appearance and physical properties for each contiguous area.
- B. Source Limitations for Setting Materials: Obtain ingredients of a uniform quality for each membrane, mortar, adhesive, and grout component from a single 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 through one source from a single manufacturer for each product:
 - 1. Stone thresholds.
 - 2. Metal edge strips.
- D. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01.

1.7 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 requirement in ANSI A137.1 for labeling sealed 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 avoided.
- D. Store liquid additives in unopened containers and protected from freezing.

1.8 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.

1.9 WARRANTY

- A. Tiling Contractor's Warranty: The tiling subcontractor shall supply Owner with a minimum two-year workmanship warranty for each tile area. In the event any work related to the tiling and setting materials is found to be defective within two years of substantial completion, the tiling contractor shall remove and replace such at no additional cost to the Owner. The tiling subcontractor's warranty obligation shall run directly to the Owner, and a copy the tiling signed warranty shall be sent to the tiling system's manufacturer.
 - 1. The duration of the tiling subcontractor's two-year warranty shall run concurrent with the tiling system's manufacturer's 25-year warranty.

- B. Tiling Systems Manufacturer's Warranty: The tiling systems manufacturer shall guarantee installed tile areas to be in a fully bonded, uncracked, flat, and watertight condition, for a period of 25 years, from the date of final acceptance of the tiling system. The warranty shall be a 25-year no dollar limit (NDL), non-prorated total system labor and material warranty. Total system warranty shall include tiling materials, related components and accessories including, but not limited to the substrate board, waterproofing and crack suppression membranes, mortars, grouts, adhesives, transition materials, and floor drain assemblies.

PART 2 - PRODUCTS

2.1 BASIS-OF-DESIGN

- A. Basis-of-Design Products: Refer to the Finish Schedule on the Drawings.

2.2 PRODUCTS, GENERAL

- A. ANSI Ceramic Tile Standard: Provide Standard-grade tile that complies with ANSI A137.1 for types, compositions, and other characteristics indicated.
 - 1. For facial dimensions of tile, comply with requirements relating to tile sizes specified in Part 1 "Definitions" Article.
 - 2. Large Format Tiles are defined as more than 12 inches in any nominal dimension.
 - 3. Building Product Disclosure and Optimization, Environmental Product Declarations (EPD): Type III EPD for ceramic tiles.
- B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI A108.02, ANSI standards referenced in other Part 2 articles, ANSI standards referenced by TCNA installation methods specified in tile installation schedules, and other requirements specified.

2.3 TILE PRODUCTS

- A. Factory Blending: For tile exhibiting color variations within ranges selected during Sample submittals, 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.
- B. Mounting: For factory-mounted tile, provide back- or edge-mounted tile assemblies as standard with manufacturer, unless otherwise indicated.
- C. Tile Trim Units: Matching characteristics of adjoining flat tile and coordinated with sizes and coursing of adjoining flat tile where applicable. Provide shapes selected from manufacturer's standard shapes.

2.4 THRESHOLDS AND EDGE STRIPS

- A. Thresholds: Fabricate to sizes and profiles indicated or required to provide transition between adjacent floor finishes.
 - 1. Bevel edges at 1:2 slope, with lower edge of bevel aligned with or up to 1/16 inch above adjacent floor surface. Finish bevel to match top surface of threshold. Limit height of threshold to 1/2 inch or less above adjacent floor surface.

- B. Marble Thresholds: ASTM C 503/C 503M, with a minimum abrasion resistance of 10 according to ASTM C 1353 or ASTM C 241/C 241M and with honed finish.
 - 1. Description: Uniform, fine- to medium-grained white stone with gray veining.
- C. Metal Edge Strips: Angle or L-shape, height to match tile and setting-bed thickness, metallic or combination of metal and resilient base, designed specifically for flooring applications.
 - 1. Basis of Design: Schluter Systems.
 - 2. Material: ASTM B 221, extruded aluminum, with clear anodized satin finish.
 - 3. Material: ASTM A 666, stainless steel, 300 series, with No. 4 satin finish.

2.5 SETTING MATERIALS

- 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. Custom Building Products.
 - 2. Laticrete International, Inc.
 - 3. MAPEI Corporation.
- B. Trowelable Underlayments and Patching Compounds: Latex-modified, portland cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.
 - 1. Basis of Design: MAPEI; Mapecem Quickpatch.
- C. Waterproof Membrane: 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.
- D. Fabric-Reinforced, Fluid-Applied Waterproofing and Crack Suppression Membrane: System consisting of liquid-latex rubber or elastomeric polymer and continuous fabric reinforcement.
 - 1. Available Products: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Custom Building Products; 9240 Waterproofing and Anti-Fracture Membrane.
 - b. Laticrete; Hydro Ban.
 - c. MAPEI; Mapelastic AquaDefense.
 - 2. Building Product Disclosure and Optimization, Material Ingredients: Health Product Declaration (HPD) or Declare product labels.
 - 3. Low-Emitting Materials, General Emissions Evaluation: Provide membranes in compliance with the 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."
 - a. VOC Content, Waterproofing Sealer: 100 g/L or less.
 - b. GreenGuard Gold certification.

- E. Portland Cement Mortar (Thickset) Installation Materials: ANSI A108.02.
1. Cleavage Membrane: Asphalt felt, ASTM D 226, Type I (No. 15); or polyethylene sheeting, ASTM D 4397, 4.0 mils thick.
 2. Building Product Disclosure and Optimization, Environmental Product Declarations (EPD): Type III EPD for mortar.
- F. Latex-Portland Cement Mortar (Thin Set): ANSI A118.4.
1. Provide prepackaged, dry-mortar mix combined with liquid-latex additive at Project site.
 2. For wall applications, provide nonsagging mortar.
 - a. For glass tile wall applications, provide white color mortar.
 3. Building Product Disclosure and Optimization, Environmental Product Declarations (EPD): Type III EPD for mortar.
- G. Tile Grout, Cementitious Type: ANSI A118.7, liquid-latex form for addition to prepackaged dry-grout mix.
1. Available Products: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Custom Building Products; Polyblend.
 - b. Laticrete; Permacolor Select.
 - c. MAPEI; Keracolor.
 2. Cementitious Grout Types:
 - a. Unsanded grout mixture for joints 1/8 inch and narrower.
 - b. Sanded grout mixture for joints 1/8 inch and wider.
 3. Color: To be selected by Architect from manufacturer's full range.
 4. Building Product Disclosure and Optimization, Environmental Product Declarations (EPD): Type III EPD for grout.
 5. Building Product Disclosure and Optimization, Material Ingredients: Health Product Declaration (HPD) or Declare product labels.
 6. Low-Emitting Materials, General Emissions Evaluation: Provide membranes in compliance with the 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."
 - a. VOC Content, Ceramic Tile Adhesives: 65 g/L or less.
 - b. GreenGuard Gold certification.
- H. Tile Grout, Epoxy Type: ANSI A118.3, chemical resistant, water cleanable, tile grouting epoxy.
1. Available Products: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

- a. Custom Building Products; CEG-IG.
 - b. Laticrete; SpectraLock Pro.
 - c. MAPEI; Kerapoxy.
 - 2. Color: To be selected by Architect from manufacturer's full range.
 - 3. Building Product Disclosure and Optimization, Material Ingredients: Health Product Declaration (HPD) or Declare product labels.
 - 4. Low-Emitting Materials, General Emissions Evaluation: Provide membranes in compliance with the 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."
 - a. VOC Content, Ceramic Tile Adhesives: 65 g/L or less.
 - b. GreenGuard Gold certification.
 - I. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.
 - J. Grout Sealer: Manufacturer's standard silicone product for sealing grout joints that does not change color or appearance of grout.
- 2.6 ELASTOMERIC SEALANTS
- A. Joint Sealants: Refer to Section 079200 - JOINT SEALANTS.
 - B. Colors: Provide colors of exposed sealants to match colors of grout in tile adjoining sealed joints, unless otherwise indicated.
- 2.7 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 oil, waxy films, and curing compounds; and within flatness tolerances required by referenced ANSI A108 Series of tile installation standards for installations indicated.

2. 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 before installing tile.
3. 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. Remove coatings, including curing compounds and other substances that contain soap, wax, oil, or silicone, that are incompatible with tile-setting materials.
- B. Provide concrete substrates for tile floors that comply with flatness tolerances specified in referenced ANSI A108 Series of tile installation standards.
 1. Fill cracks, holes, and depressions with trowelable leveling and patching compound according to tile-setting material manufacturer's written instructions. Use product specifically recommended by tile-setting material manufacturer.
 2. Remove protrusions, bumps, and ridges by sanding or grinding.
- C. Where indicated, prepare substrates to receive waterproofing by applying a reinforced mortar bed that complies with ANSI A108.1A and is sloped 1/4 inch per foot toward drains.
- D. Blending: For tile exhibiting color variations within ranges selected during Sample submittals, 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 TILING INSTALLATION, GENERAL

- A. ANSI Tile Installation Standards: Comply with parts of ANSI A108 Series "Specifications for Installation of Ceramic Tile" that apply to types of setting and grouting materials and to methods indicated in ceramic tile installation schedules.
- B. Comply with TCNA's "Handbook for Ceramic, Glass, and Stone Tile Installation" for TCNA installation methods specified in tile installation schedules. Comply with parts of the ANSI A108 series "Specifications for Installation of Ceramic Tile" that are referenced in TCNA installation methods, specified in tile installation schedules, and apply to types of setting and grouting materials used.
- C. 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.
- D. 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.
- E. Jointing Pattern: Lay tile in grid pattern, unless otherwise indicated. Align joints when adjoining tiles on floor, base, walls, and trim are same size. Lay out tile work and center tile fields in both

directions in each space or on each wall area. Adjust to minimize tile cutting. Provide uniform joint widths, 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.
- F. Lay out tile wainscots to dimensions indicated or to next full tile beyond dimensions indicated.
- G. Expansion Joints: Locate expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.
1. Where joints occur in concrete substrates, locate joints in tile surfaces directly above them.
 2. Prepare joints and apply sealants to comply with requirements in Section 079200 - JOINT SEALANTS.
- H. Stone Thresholds: Install stone thresholds at locations indicated; set in same type of setting bed as abutting field tile, unless otherwise indicated.
1. At locations where mortar bed (thickset) would otherwise be exposed above adjacent floor finishes, set thresholds in mortar (thinset).
 2. Do not extend membranes under thresholds set in mortar. Fill joints between such thresholds and adjoining tile set on membrane with elastomeric sealant.
- I. Metal Edge Strips: Install at locations indicated or where exposed edge of tile flooring meets carpet, wood, or other flooring that finishes flush with top of tile.
- J. Floor Sealer: Apply floor sealer to grout joints according to floor-sealer manufacturer's written instructions. As soon as floor sealer has penetrated grout joints, remove excess sealer and sealer from tile faces by wiping with soft cloth.

3.4 MEMBRANE INSTALLATION

- A. Install waterproofing to comply with ANSI A108.13 and manufacturer's written instructions to produce waterproof membrane of uniform thickness bonded securely to substrate.
- B. Install crack-suppression membrane to comply ANSI A108.17 and manufacturer's written instructions to produce membrane of uniform thickness bonded securely to substrate.
- C. Do not install tile over membrane until membrane has cured and been tested to determine that it is watertight.

3.5 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 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 that is acceptable to tile and grout manufacturer. Trap and remove coating to prevent it from clogging drains.

- B. When recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear.
- C. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed. After seven days, cover areas subject to construction traffic with heavy cardboard.
- D. Before final inspection, remove protective coverings and rinse neutral cleaner from tile surfaces.

3.6 TILE INSTALLATION SCHEDULE

- A. This schedule refers to Tile Installation Methods specified in the TCNA Manual.
- B. Floor Tile Over Concrete, Typical: TCNA F113 and ANSI A108.5.
 1. Tile Type: Refer to Finish Schedule.
 2. Mortar: Thinset.
 3. Grout: Polymer-modified unsanded grout.
 4. Joint Width: 1/16 inch.
- C. Floor Tile Over Concrete, at Commercial Kitchen and Servery Areas: TCNA F115 and ANSI A108.5.
 1. Tile Type: Refer to Finish Schedule.
 2. Mortar: Thinset.
 3. Grout: Epoxy.
 4. Joint Width: 1/8 inch.
- D. Floor Tile Over Waterproof Membrane and Concrete, at Toilet Rooms: TCNA F122 and ANSI A108.5.
 1. Tile Type: Refer to Finish Schedule.
 2. Mortar: Thinset.
 3. Grout: Polymer-modified unsanded grout.
 4. Joint Width: 1/16 inch.
- E. Wall Tile, Typical Over Cementitious Backer-Board: TCNA W244C and ANSI A108.5.
 1. Tile Type: Refer to Finish Schedule.
 2. Mortar: Thinset.
 3. Grout: Polymer-modified unsanded grout.
 4. Joint Width: 1/16 inch.
- F. Wall Tile Over Waterproof Membrane and Cementitious Backer-Board, at Bathtubs and Showers: TCNA B420 and ANSI A108.5.

1. Tile Type: Refer to Finish Schedule.
2. Mortar: Thinset.
3. Grout: Polymer-modified unsanded grout.
4. Joint Width: 1/16 inch.

END OF SECTION

SECTION 095100

ACOUSTICAL CEILINGS

(Part of Work of Section 090003 - ACOUSTICAL TILE, Filed Sub-Bid Required)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Acoustical ceiling tiles and panels.
 - 2. Suspension systems, grid systems and ceiling hangers.
 - 3. Acoustical sealant at edge moldings at acoustical ceilings.
- B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council. Refer to Section 018110, SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 092110 - GYPSUM BOARD ASSEMBLIES for gypsum board ceilings and soffits.
 - 2. Division 21 - FIRE SUPPRESSION for fire-suppression components located in ceilings.
 - 3. Division 23 - HEATING, VENTILATING AND AIR CONDITIONING for air handling and distribution components located in ceilings.
 - 4. Division 26 - ELECTRICAL for light fixture and alarm system components located in ceilings.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. LEED Submittals:
 - 1. Building Product Disclosure and Optimization, Environmental Product Declarations (EPD):
 - a. Option 1: For acoustic ceilings, submit product-specific Type III EPDs.
 - 2. Building Product Disclosure and Optimization, Sourcing of Raw Materials:

- a. General: For credit achievement calculation, submit location of products sourced (extracted, manufactured, and purchased), indicating number of miles from the project site.
 - b. Option 1: For acoustic ceilings, submit corporate sustainability reports (CSR).
 - c. Option 2, Leadership Extraction Practices:
 - 1) Extended Producer Responsibility: For acoustic ceilings, submit evidence of reclamation and recycling programs.
 - 2) Recycled Content: Submit percentages by weight of postconsumer and preconsumer recycled content for products having recycled content. Include statement indicating costs for each product having recycled content.
- 3. Building Product Disclosure and Optimization, Material Ingredients:
 - a. Option 1, Material Ingredient Reporting: For acoustic ceilings, submit Health Product Declarations (HPD) or Declare product labels.
- 4. Low-Emitting Materials, General Emissions Evaluation: Building products must be tested and determined compliant in accordance with California Department of Public Health (CDPH) Standard Method v1.1–2010.
 - a. For sealants, submit test results, including TVOC emissions and VOC content.
 - b. For acoustic ceilings, submit GreenGuard Gold certification.
 - c. For wet-applied products, submit volume used.
- C. Coordination Drawings: Reflected ceiling plans drawn to scale and coordinating penetrations and ceiling-mounted items. Show the following:
 - 1. Ceiling suspension members.
 - 2. Method of attaching hangers to building structure. Furnish layouts for cast-in-place anchors, clips, and other ceiling attachment devices whose installation is specified in other Sections.
 - 3. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
 - 4. Minimum Drawing Scale: 1/4 inch = 1 foot.
- 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 12 inch long Samples of each type, finish, and color.
- E. Asbestos Certification: Manufacturer's written certification that acoustical ceiling products contain no asbestos (0.0000%). Product labels indicating that it is the user's responsibility to test the products for asbestos are unacceptable and sufficient cause for rejection of the product on site.
- F. Maintenance Data: For finishes to include in maintenance manuals.

1.4 QUALITY ASSURANCE

A. Source Limitations:

1. Acoustical Ceiling Panels: Obtain each type through one source from a single manufacturer.
2. Suspension Systems: Obtain each type through one source from a single manufacturer.
3. Seismic Performance: Acoustical ceiling shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

B. Fire-Test-Response Characteristics: Provide acoustical panel ceilings that comply with the following requirements:

1. Fire-Resistance Characteristics: Where indicated, provide acoustical panel ceilings identical to those of assemblies tested for fire resistance per ASTM E 119 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.
2. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory" or from the listings of another testing and inspecting agency.
3. Identify materials with appropriate markings of applicable testing and inspecting agency.
4. Surface-Burning Characteristics: Provide acoustical panels complying with ASTM E 1264 for Class A materials as determined by testing identical products per ASTM E 84.

C. Mockups: Build mockups to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution.

1. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

D. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01.

1.5 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.

1.6 PROJECT 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.

1.7 COORDINATION

- A. Coordinate layout and installation of acoustical panels and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

PART 2 - PRODUCTS

2.1 BASIS-OF-DESIGN

- A. Basis-of-Design Products: Refer to the Finish Schedule on the Drawings.

2.2 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Armstrong Ceilings.
 - 2. CertainTeed Ceilings.
 - 3. USG.
- B. Sustainable Design Performance Requirements:
 - 1. Building Product Disclosure and Optimization, Environmental Product Declarations (EPD): Type III EPD.
 - 2. Building Product Disclosure and Optimization, Material Ingredients: Health Product Declaration (HPD) or Declare product labels.
 - 3. Low-Emitting Materials, General Emissions Evaluation: GreenGuard Gold certification.

2.3 ACOUSTICAL PANELS, GENERAL

- A. Acoustical Ceiling Type (ACT-1): General office use and as indicated.
 - 1. Manufacturer and Model Number:
 - a. USG, Mars ClimaPlus No. 86985.
 - b. CertainTeed Ceilings, Symphony M. 1222F-OVT-1.
 - c. Armstrong, Ultima No. 1912.
 - 2. Panel Size: 24 inches by 24 inches by 3/4 inch.
 - a. Panel Mounting: Revealed edge.
 - b. Noise Reduction Coefficient (NRC): Not less than 0.70.
 - c. Ceiling Attenuation Class (CAC): Not less than 35.
 - d. Color: White.
 - e. Grid Material: Painted steel.
 - f. Grid Face Width: 9/16 inch.

- B. Acoustical Ceiling Type ACT-2: General office use and as indicated.
 - 1. Manufacturer and Model Number:

- a. Certainteed Ceilings, Ecophon Focus A.
 - b. USG, Halcyon ClimaPlus.
 - c. Armstrong, Optima Open Plan.
 - 2. Panel Size: As indicated.
 - a. Panel Edges: Square.
 - b. NRC: 0.85 or better.
 - c. Grid Material: Painted steel.
 - C. Acoustical Ceiling Type ACT-3: **Commercial kitchens, garages** and as indicated.
 - 1. Manufacturer and Model Number:
 - a. USG, Sheetrock Brand Gypsum Lay-In No. 3260.
 - b. Certainteed Ceilings, Vinylrock No. 1142-CRF-1.
 - c. National Gypsum Gridstone 2X2.
 - 2. Panel Size: 24 inches by 24 inches by 1/2 inch.
 - a. Panel Mounting: Flush with grid.
 - b. Ceiling Attenuation Class (CAC): Not less than 35.
 - c. Color: White.
 - d. Grid Material: Painted steel with aluminum cap.
 - e. Grid Face Width: 15/16 inch.
 - D. Acoustical Ceiling Type ACT-4: Fissured Mineral.
 - 1. Manufacturer and Model Number:
 - a. Armstrong, Fine Fissured High Acoustics No. 1714.
 - b. Certainteed Ceilings, Fine Fissured High NRC, HHF-457 HNRC.
 - c. USG, Radar Climaplus High CAC, High NRC
 - 2. Panel Size: 24 inches by 24 inches by 5/8 inch.
 - a. Panel Mounting: Flush with grid.
 - b. Ceiling Attenuation Class (CAC): Not less than 35.
 - c. Noise Reduction (NRC): Not be less than 0.70.
 - d. Light Reflectance: Not be less than 82%.
 - e. Mold and Mildew: Complying with ASTM D 3273.
 - f. Moisture Resistant of Non-Directional Fissures: Complying with ASTM E 1264.
 - g. Color: White.
 - h. Grid Material: Painted steel with aluminum cap.
 - i. Grid Face Width: 15/16 inch.
- 2.4 METAL SUSPENSION SYSTEMS
- 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.

1. Structural Classification: Intermediate-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. Color: White, prefinished.
 6. Grid Face Width: As specified with ACT type.
 7. Recycled Content: Use minimum recycled content of 25%.
- B. Attachment Devices: Size for five times the design load indicated in ASTM C 635, Table 1, "Direct Hung," unless otherwise indicated.
1. Anchors in Concrete: Anchors 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 per ASTM E 488 or ASTM E 1512 as applicable, conducted by a qualified testing and inspecting agency; zinc-plated for Class SC1 service.
 - a. 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 per 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.
 - a. Size: Select wire diameter so its stress at three times hanger design load (ASTM C 635, Table 1, "Direct Hung") will be less than yield stress of wire, but provide not less than 0.106 diameter wire.
- D. Hold-Down Clips: At vestibules and areas subject to wind uplift, provide manufacturer's standard hold-down clips spaced 24 inches on all cross tees.

2.5 METAL EDGE MOLDINGS AND TRIM

- A. 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 fit acoustical panel edge details and suspension systems indicated; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension system runners.
1. For lay-in panels with reveal edge details, provide stepped edge molding that forms reveal of same depth and width as that formed between edge of panel and flange at exposed suspension member.
 2. For circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.
 3. For narrow-face suspension systems, provide suspension system and manufacturer's standard edge moldings that match width and configuration of exposed runners.
- B. Suspension Trim: Subject to compliance with requirements, provide one of the following:

1. Armstrong World Industries, Inc.; Axiom.
2. CertainTeed Ceilings; Approved equal.
3. USG Interiors, Inc.; Compasso.

2.6 ACOUSTICAL SEALANT

- A. Acoustical Sealant, for Concealed Joints: Manufacturer's standard nondrying, nonhardening, nonskinning, nonstaining, gunnable, joint sealant, recommended for sealing interior concealed joints to reduce airborne sound transmission.
1. Available Products: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. OSI (a division of Henkel); Pro-Series SC-175.
 - b. Pecora Corp.; AC-20 FTR Acoustical and Insulation Sealant.
 - c. Pecora Corp.; BA-98.
 - d. Specified Technologies, Inc. (STI); Smoke N Sound Acoustical Sealant.
 - e. USG; SHEETROCK Acoustical Sealant.
 2. Low-Emitting Materials: Provide adhesives and sealants in compliance with the 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."
 3. VOC Content, Architectural Sealants: 250 g/L or less.
 4. Methylene chloride and perchloroethylene may not be intentionally added to sealants.

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. 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 per manufacturer's written instructions and Cisca's "Ceiling Systems Handbook."
- B. Suspend ceiling hangers from building's structural members and as follows:

1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
 2. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
 3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.
 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. 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.
 6. Do not attach hangers to steel deck tabs.
 7. Space hangers not more than 48 o.c. along each member supported directly from hangers, unless otherwise indicated; provide hangers not more than 8 inches from ends of each member.
- C. 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.
- D. Install suspension system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.
- E. 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. 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.
 2. 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.

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

SECTION 096400

WOOD FLOORING

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Field-finished wood flooring.
 - 2. Factory-finished wood flooring.
- B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council. Refer to Section 018110 - SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 033000 - CAST-IN-PLACE CONCRETE for substrate.
 - 2. Section 064020 - INTERIOR ARCHITECTURAL WOODWORK for wood base.

1.3 PERFORMANCE REQUIREMENTS

- A. Wet Dynamic Coefficient of Friction: For flooring exposed as a walking surface, provide products with the following values as determined by testing identical products per ANSI/ NFSI B101.3 - 2012 Test Method for Measuring Wet DCOF of Common Hard-Surface Floor Materials, or ANSI 326.3 - American National Standard Test Method for Measuring Dynamic Coefficient of Friction of Hard Surface Materials - 2017. Testing by other methods or earlier editions of the specified test method is not acceptable.
 - 1. Wet Dynamic Coefficient of Friction: Not less than 0.43.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. LEED Submittals:
 - 1. Building Product Disclosure and Optimization, Sourcing of Raw Materials:

- a. General: For credit achievement calculation, submit location of products sourced (extracted, manufactured, and purchased), indicating number of miles from the project site.
 - b. Option 2, Leadership Extraction Practices:
 - 1) Wood Products: Wood products must be certified by the Forest Stewardship Council or USGBC-approved equivalent. Products meeting wood products criteria are valued at 100% of their cost for the purposes of credit achievement calculation.
 - 2. Low-Emitting Materials, General Emissions Evaluation: Building products must be tested and determined compliant in accordance with California Department of Public Health (CDPH) Standard Method v1.1–2010, using the applicable exposure scenario.
 - a. For wood composite materials, submit test results, including TVOC emissions.
 - b. For floor coatings, submit VOC content and GreenGuard Gold certification.
 - c. For wet-applied products, submit volume used.
 - C. Shop Drawings: Show installation details including location and layout of each type of wood flooring and accessory.
 - D. Samples for Verification: For each type of wood flooring and accessory, with stain color and finish required, approximately 12 inches long and of same thickness and material indicated for the Work and showing the full range of normal color and texture variations expected.
- 1.5 QUALITY ASSURANCE
- A. Source Limitations: For field-finished wood flooring, obtain each species, grade, and cut of wood from one source with resources to provide materials and products of consistent quality in appearance and physical properties.
 - B. **Athletic Flooring:** Comply with applicable MFMA grading rules for species, grade, and cut.
 - 1. Certification: Provide flooring that carries MFMA mark on each bundle or piece.
 - C. **Other Flooring:** Comply with applicable National Wood Flooring Association (NWFA, formerly NOFMA) grading rules for species, grade, and cut.
 - D. Mockups: Install mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 - 1. To set quality standards for installation, install mockup of floor area as shown on Drawings.
 - 2. To set quality standards for sanding and application of field finishes, prepare finish mockup of floor area as shown on Drawings.
 - 3. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.
- 1.6 DELIVERY, STORAGE, AND HANDLING
- A. Deliver wood flooring materials in unopened cartons or bundles.

- B. Protect wood flooring from exposure to moisture. Do not deliver wood flooring until after concrete, masonry, plaster, ceramic tile, and similar wet work is complete and dry.
- C. Store wood flooring materials in a dry, warm, ventilated, weathertight location.

1.7 PROJECT CONDITIONS

- A. Conditioning period begins not less than seven days before wood flooring installation, is continuous through installation, and continues not less than seven days after wood flooring installation.
 - 1. Environmental Conditioning: Maintain an ambient temperature between 65 and 75 deg F and relative humidity planned for building occupants in spaces to receive wood flooring during the conditioning period.
 - 2. Wood Flooring Conditioning: Move wood flooring into spaces where it will be installed, no later than the beginning of the conditioning period.
 - a. Do not install flooring until it adjusts to relative humidity of, and is at same temperature as, space where it is to be installed.
 - b. Open sealed packages to allow wood flooring to acclimatize immediately on moving flooring into spaces in which it will be installed.
- B. After conditioning period, maintain relative humidity and ambient temperature planned for building occupants.
- C. Install factory-finished wood flooring after other finishing operations, including painting, have been completed.

1.8 EXTRA MATERIALS (ATTIC STOCK)

- A. Furnish extra materials described below, before installation begins, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Wood Flooring: Equal to 2 percent of amount installed for each type of wood flooring indicated.
 - 2. Stair Treads: One tread for each stair width.

PART 2 - PRODUCTS

2.1 BASIS-OF-DESIGN

- A. Basis-of-Design Products: Refer to the Finish Schedule on the Drawings.

2.2 FIELD-FINISHED WOOD FLOORING

- A. Certified Wood: Materials shall be produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship."
 - 1. Salvaged and reclaimed wood is excluded from certified wood requirements.

- B. Solid-Wood Flooring: Kiln dried to 6 to 9 percent maximum moisture content, tongue and groove and end matched, and with backs channeled.
 - 1. Available Manufacturers: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Carlisle Wide Plank Floors.
 - b. Harris Tarkett Wood Floors.
 - c. Kentucky Wood Floors.
 - 2. Species: **Maple**, as selected by the Architect.
 - 3. Grade: Select & Better
 - 4. Cut: Quarter/rift sawn.
 - 5. Thickness: 25/32 inch.
 - 6. Face Width: 2-1/4 in.
 - 7. Length: Random-length strips complying with applicable grading rules.
- C. Wood Filler: Compatible with finish system components and recommended by filler and finish manufacturers for use indicated. If required to match approved Samples, provide pigmented filler.

2.3 FACTORY-FINISHED WOOD FLOORING

- A. Certified Wood: Materials shall be produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship."
 - 1. Salvaged and reclaimed wood is excluded from certified wood requirements.
- B. Composite Wood, General: CARB II compliant or made with binder containing no added formaldehyde (NAF).
- C. Engineered-Wood Flooring: HPVA EF, except bonding agent contains no urea formaldehyde.
 - 1. Available Manufacturers: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Anderson Hardwood Floors.
 - b. Armstrong World Industries, Inc.
 - c. EcoTimber.
 - d. Gammapar.
 - e. Mannington Mills, Inc.
 - f. Tarkett.
 - 2. Species: Maple.
 - 3. Grade: Grade A.
 - 4. Thickness: 3/8 inch
 - 5. Construction: Three ply.
 - 6. Face Width: 3 inches.
 - 7. Length: Manufacturer's standard.
 - 8. Edge Style: Square.
 - 9. Finish: UV urethane or acrylic impregnated.

- a. Color: As selected by Architect from manufacturer's full range.

2.4 ACCESSORY MATERIALS

- A. Wood Subfloor: As specified in Section 061000 - ROUGH CARPENTRY.
- B. Vapor Retarder: ASTM D 4397, fluid-applied membrane, to be selected by Architect.
- C. Trowelable Leveling and Patching Compound: Latex-modified, hydraulic-cement-based formulation approved by wood flooring manufacturer.
- D. Wood Flooring Adhesive: As recommended by flooring and adhesive manufacturers for application indicated.
 - 1. Low-Emitting Materials: Provide adhesives in compliance with the 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. VOC Content: Not more than 100 g/L.
 - 3. Do not use adhesives that contain urea formaldehyde.
 - 4. Methylene chloride and perchloroethylene may not be intentionally added to adhesives.
- E. Fasteners: Non-corrosive type, as recommended by manufacturer, but not less than that recommended in NWFA's "Installation Guidelines: Wood Flooring."
- F. Cork Expansion Strip: Composition cork strip.
- G. Metal Edge Strips: Angle or L-shape, height to match flooring thickness, metallic or combination of metal and PVC or neoprene base, designed specifically for wood flooring applications; extruded aluminum exposed-edge material, with clear anodized satin finish.
 - 1. Available Manufacturer: Schluter Systems.
- H. Trim: In same species and grade as wood flooring, unless otherwise indicated.
 - 1. Threshold: Tapered on each side and routed at bottom of one side to accommodate wood flooring.
 - 2. Reducer Strip: 2 inches wide, tapered on 1 side, and in thickness matching wood flooring.
- I. Cleaning Materials: Provide low-emitting cleaning solutions as recommended by NOFMA.

2.5 FIELD FINISH MATERIALS

- A. Wood Finish: Provide UV resistant sealer and water-based polyurethane finish system.
 - 1. Low-Emitting Materials: Provide wood finish in compliance with the 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."
 - a. VOC Content Limits:

- 1) Clear Wood Finish, Varnish: 350 g/L.
 - 2) Clear Wood Finish, Sanding Sealer: 350 g/L.
 - 3) Clear Wood Finish, Lacquer: 550 g/L.
 - b. Methylene chloride and perchloroethylene may not be intentionally added to paints and coatings.
2. Sanding Sealer (Waterborne): For clear, transparent look.
 - a. Basic Coatings; Hydroline Sealer.
 - b. Bona US; NordicSeal.
 - 1) Low-Emitting Materials, General Emissions Evaluation: GreenGuard Gold certification.
 - c. Vermont Natural Coatings; PolyWhey 3000 Wood Floor Sealer.
3. Wood Stain: Not used.
4. Wood Coating, Clear Polyurethane Finish:
 - a. Basic Coatings; StreetShoe NXT, matte finish.
 - b. Bona US; BonaTraffic HD, Commercial Matte finish.
 - 1) Low-Emitting Materials, General Emissions Evaluation: GreenGuard Gold certification.
 - c. Vermont Natural Coatings; PolyWhey 3500 Wood Floor Finish, matte finish.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas and conditions, with Installer present, for compliance with requirements for maximum moisture content, installation tolerances, and other conditions affecting performance of wood flooring.
 1. Verify that substrates comply with tolerances and other requirements specified in other Sections.
 2. For adhesively applied wood flooring, verify that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.
 3. Proceed with installation only after unsatisfactory conditions have been corrected.
- B. Substrate Moisture Testing, General: Perform tests recommended by manufacturer or, if none, comply with applicable recommendations in NWFA/NOFMA's "Installation Guidelines: Wood Flooring."
 1. Proceed with installation only after substrates pass testing.
- C. Concrete Moisture Testing: Perform anhydrous calcium chloride test per ASTM F 1869, as follows:

1. Perform tests so that each test area does not exceed 200 sq. ft. and perform not less than 2 tests in each installation area with test areas evenly spaced in installation area.
2. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.
3. Perform alkalinity and adhesion tests recommended in writing by manufacturer or, if none, according to NWFA's "Installation Guidelines: Wood Flooring." Proceed with installation only after substrates pass testing.

3.2 PREPARATION

- A. Grind high spots and fill low spots on concrete substrates to produce a maximum 1/8-inch deviation in any direction when checked with a 10-foot straight edge.
 1. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, and depressions in substrates.
- B. Remove coatings, including curing compounds, and other substances on substrates that are incompatible with installation adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
- C. Broom or vacuum clean substrates to be covered immediately before product installation. After cleaning, examine substrates for moisture, alkaline salts, carbonation, or dust. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 INSTALLATION

- A. **Comply with flooring manufacturer's written installation instructions, but not less than applicable recommendations in MFMA's "Installation Guidelines: Wood Flooring" for Athletic Flooring or NWFA/NOFMA's "Installing Hardwood Flooring", 1997 edition, for other flooring.**
- B. Engineered-Wood Flooring: Set in adhesive.
- C. Wood Subfloor: Install according to requirements in Section 061000 - ROUGH CARPENTRY.
- D. Provide expansion space at walls and other obstructions and terminations of flooring of not less than 3/4 inch.
- E. Vapor Retarder:
 1. Wood Flooring Nailed to Concrete: Install flooring over a layer of fluid applied vapor retarder product, turned up behind baseboards.

3.4 FIELD FINISHING

- A. Machine-sand flooring to remove offsets, ridges, cups, and sanding-machine marks that would be noticeable after finishing. Vacuum and tack with a clean cloth immediately before applying finish.
 1. Comply with applicable recommendations in NWFA/NOFMA's "Installing Hardwood Flooring", 1997 edition.
- B. Fill and repair wood flooring seams and defects.

- C. Cover and protect wood flooring before finishing.
- D. Apply floor-finish materials in number of coats recommended by finish manufacturer for application indicated, but not less than one coat of floor sealer and three finish coats.
 - 1. For water-based finishes, use finishing methods recommended by finish manufacturer to minimize grain raise.
 - 2. First Coat: Apply sanding sealer.
 - 3. Second Coat: Apply sanding sealer, if recommended by manufacturer. Sand lightly.
 - a. Apply stains to achieve an even color distribution matching approved Samples.
 - 4. Third, Fourth and Fifth Coat: Apply polyurethane finish. Sand lightly between coats.
- E. Do not cover wood flooring after finishing until finish reaches full cure, and not before seven days after applying last finish coat.

3.5 PROTECTION

- A. Protect installed wood flooring during remainder of construction period with covering of heavy kraft paper or other suitable material. Do not use plastic sheet or film that might cause condensation.
 - 1. Do not move heavy and sharp objects directly over kraft-paper-covered wood flooring. Protect flooring with plywood or hardboard panels to prevent damage from storing or moving objects over flooring.

END OF SECTION

SECTION 096460

WOOD ATHLETIC FLOORING

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Wood athletic flooring assemblies.
 - 2. Field finishing of work of this Section, including striping and line work as indicated.
- B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council. Refer to Section 018110, SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 033000 - CAST-IN-PLACE CONCRETE for substrate.
 - 2. Section 116620 - ATHLETIC EQUIPMENT for floor plate and sleeve assemblies.

1.3 PERFORMANCE REQUIREMENTS

- A. Wet Dynamic Coefficient of Friction: For flooring exposed as a walking surface, provide products with the following values as determined by testing identical products per ANSI/ NFSI B101.3 - 2012 Test Method for Measuring Wet DCOF of Common Hard-Surface Floor Materials, or ANSI 326.3 - American National Standard Test Method for Measuring Dynamic Coefficient of Friction of Hard Surface Materials - 2017. Testing by other methods or earlier editions of the specified test method is not acceptable.
 - 1. Wet Dynamic Coefficient of Friction: Not less than 0.43.

1.4 SUBMITTALS

- A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for wood sports-floor assemblies.
- B. Shop Drawings: Show installation details including location and layout of each type of floor assembly and accessory. Include the following:

1. Expansion provisions and trim details.
 2. Layout, colors, widths, and dimensions of game lines and markers.
 3. Locations of floor inserts for athletic equipment installed through flooring assembly.
- C. Samples for Verification: For each type of wood flooring and accessory, with stain color and finish required, approximately 12 inches long and of same thickness and material indicated for the Work.
1. Include sample sets showing the full range of normal color and texture variations expected in wood flooring.
 2. Include sample sets showing finishes and game-line paint and marker paint colors applied to wood flooring.
- D. LEED Submittal:
1. Product Data for Credit EQ 4.1: For interior adhesives and sealants applied inside the weatherproofing system and applied on-site, including printed statement of VOC content.
 2. **Laboratory Test Reports for Credit IEQ 4.1: For interior adhesives, sealants and sealant primers, documentation indicating that products comply with the testing and product requirements of the California Department of Health Services' (now the Department of Public Health) "*Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers*", including 2004 Addenda.**
 3. Product Data for Credit EQ 4.2: For interior paints and coatings applied inside the weatherproofing system and applied on-site, including printed statement of VOC content.
 4. **Laboratory Test Reports for Credit IEQ 4.2: For interior paint and coating products, documentation indicating that products comply with the testing and product requirements of the California Department of Health Services' (now the Department of Public Health) "*Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers*", including 2004 Addenda.**
 5. Credit EQ 4.4: Manufacturer's product data for each composite wood product and adhesive used indicating that the product contains no added urea formaldehyde.
 6. **Laboratory Test Reports for Credit IEQ 4.4: For composite-wood products, documentation indicating that products comply with the testing and product requirements of the California Department of Health Services' (now the Department of Public Health) "*Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers*", including 2004 Addenda.**
 7. Credit MR 7: Chain-of-custody certificates signed by manufacturers certifying that products specified to be made from certified wood comply with forest certification requirements. Include evidence that mill is certified for chain-of-custody by an FSC-accredited certification body.
 - a. Include statement indicating costs for each certified wood product.
- E. Qualification Data: For Installer.
- F. Maintenance Data: For wood sports-floor assemblies and finish systems to include in maintenance manuals.

1.5 QUALITY ASSURANCE

- A. Source Limitations: For field-finished wood flooring, obtain each species, grade, and cut of wood from one source with resources to provide materials and products of consistent quality in appearance and physical properties.
- B. Installer Qualifications: An experienced installer who has completed wood sports-floor assembly installations similar in material, design, and extent to that indicated for this Project and whose work has resulted in installations with a record of successful in-service performance.
 - 1. Installer responsibilities include installation and field finishing of sports-floor assembly components and accessories, and application of game lines and markers.
- C. Maple Flooring: Comply with applicable MFMA grading rules for species, grade, and cut.
- D. Mockups: Install mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 - 1. To set quality standards for installation, install mockup of floor area as shown on Drawings.
 - 2. To set quality standards for sanding and application of field finishes, prepare finish mockup of floor area as shown on Drawings.
 - 3. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver wood flooring materials in unopened cartons or bundles.
- B. Protect wood flooring from exposure to moisture. Do not deliver wood flooring until after concrete, masonry, plaster, ceramic tile, and similar wet work is complete and dry.
- C. Store wood flooring materials in a dry, warm, ventilated, weathertight location.

1.7 PROJECT CONDITIONS

- A. Conditioning period begins not less than seven days before wood flooring installation, is continuous through installation, and continues not less than seven days after wood flooring installation.
 - 1. Environmental Conditioning: Maintain an ambient temperature between 65 and 75 deg F and relative humidity planned for building occupants in spaces to receive wood flooring during the conditioning period.
 - 2. Wood Flooring Conditioning: Move wood flooring into spaces where it will be installed, no later than the beginning of the conditioning period.
 - a. Do not install flooring until it adjusts to relative humidity of, and is at same temperature as, space where it is to be installed.
 - b. Open sealed packages to allow wood flooring to acclimatize immediately on moving flooring into spaces in which it will be installed.

- B. After conditioning period, maintain relative humidity and ambient temperature planned for building occupants.
- C. Install factory-finished wood flooring after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Connor Sports Flooring, Inc.
 - 2. Robbins, Inc.
 - 3. Tarkett Sports.

2.2 WOOD FLOORING

- A. Strip Flooring: Northern hard maple (*Acer saccharum*), kiln dried, random length, tongue and groove, and end matched.
 - 1. Grade: MFMA-RL Second and Better.
 - 2. Cut: Flat.
 - 3. Thickness: 25/32 inch.
 - 4. Face Width: 2-1/4 inches.
 - 5. Backs: Channeled (kerfed) for stress relief.
 - 6. Preservative Treatment: Clear, penetrating, water-repellent wood preservative that protects against mold, mildew, staining, and decay fungi; complying with MFMA's written recommendations and applied by immersion.

2.3 SUBFLOOR SYSTEM

- A. Plywood Underlayment: APA rated, C-D Plugged, exterior glue, tongue and groove, 15/32 inch thick.
- B. Wood Sleepers: Standard grade; 48 inches long; kiln-dried Eastern hemlock, fir, pine, or spruce.
 - 1. Preservative Treatment: Clear, penetrating, water-repellent wood preservative that protects against mold, mildew, staining, and decay fungi; complying with MFMA's written recommendations and applied by immersion.
 - 2. Size: Nominal 2 by 3 inches.
 - 3. Sleeper Anchors: Manufacturer's standard, but not less than steel drive pins recommended by anchor manufacturer to achieve minimum 900-lbf pullout strength.
 - 4. Sleeper Shims: In size and type recommended in writing by flooring manufacturer for application indicated.
- C. Resilient Pads: With air voids for resiliency and installed at manufacturer's standard spacing for product designation indicated above.
 - 1. Type: Recycled rubber or thermoplastic rubber.

- D. Acoustical Underlayment: 6 mm thick rubber sheet underlayment, equal to Sound Shark.

2.4 ACCESSORY MATERIALS

- A. Vapor Retarder: ASTM D 4397, polyethylene sheet not less than 6 mils thick.
- B. Resilient Wall Base: Molded, vented, rubber or vinyl cove base; 4 by 3 by 48 inches; with premolded outside corners.
 - 1. Color: Black.
- C. Fasteners: Type and size recommended by manufacturer, but not less than those recommended by MFMA for application indicated.
- D. Trowelable Leveling and Patching Compound: Latex-modified, hydraulic-cement-based formulation approved by sports-floor manufacturer.
- E. Adhesives: Manufacturer's standard for application indicated.
 - 1. Concrete Primers: Manufacturer's standard for application indicated.
 - 2. Use adhesive and primer, if any, that have a VOC content of 100 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- F. Floor-Finish System: System of compatible components recommended in writing by flooring manufacturer and MFMA approved.
 - 1. Type: MFMA Group 5, Water Based Finishes; polyurethane.
 - 2. Floor-Sealer Formulation: Pliable, penetrating type.
 - 3. Finish-Coat Formulation: Formulated for gloss finish and multicoat application.
 - 4. Game-Line and Marker Paint: Industrial enamel compatible with finish coats and recommended in writing by manufacturers of finish coats, and paint for this use.
 - 5. VOC content: Provide products that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
 - a. Floor Sealers and Finish Coats: VOC content of not more than 350 g/L.
 - b. Game-Line and Marker Paint: VOC content of not more than 150 g/L.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas and conditions, with Installer present, for compliance with requirements for maximum moisture content, installation tolerances, and other conditions affecting performance of wood flooring.
 - 1. Verify that substrates comply with tolerances and other requirements specified in other Sections.
 - 2. For adhesively applied wood flooring, verify that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.
 - 3. Proceed with installation only after unsatisfactory conditions have been corrected.

- B. Substrate Moisture Testing, General: Perform tests recommended by manufacturer or, if none, comply with applicable recommendations in NWFA's "Installation Guidelines: Wood Flooring."
 - 1. Proceed with installation only after substrates pass testing.
- C. Concrete Moisture Testing: Perform anhydrous calcium chloride test per ASTM F 1869, as follows:
 - 1. Perform tests so that each test area does not exceed 200 sq. ft. and perform not less than 2 tests in each installation area with test areas evenly spaced in installation area.
 - 2. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.
 - 3. Perform alkalinity and adhesion tests recommended in writing by manufacturer or, if none, according to NWFA's "Installation Guidelines: Wood Flooring." Proceed with installation only after substrates pass testing.

3.2 PREPARATION

- A. Grind high spots and fill low spots on concrete substrates to produce a maximum 1/8-inch deviation in any direction when checked with a 10-foot straight edge.
 - 1. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, and depressions in substrates.
- B. Remove coatings, including curing compounds, and other substances on substrates that are incompatible with installation adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
- C. Broom or vacuum clean substrates to be covered immediately before product installation. After cleaning, examine substrates for moisture, alkaline salts, carbonation, or dust. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 INSTALLATION

- A. General: Comply with sports-floor assembly manufacturer's written instructions, but not less than written recommendations of MFMA applicable to flooring type indicated.
- B. Pattern: Lay flooring parallel with long dimension of space to be floored, unless otherwise indicated.
- C. Expansion Spaces: Provide as indicated, but not less than that required by manufacturer's written instructions and MFMA's written recommendations at walls and other obstructions, and at interruptions and terminations of flooring.
 - 1. Cover expansion spaces with base molding, trim, and saddles, as indicated on Drawings.
- D. Vapor Retarder: Install with joints lapped a minimum of 6 inches and sealed.
- E. Underlayment: Install perpendicular to direction of flooring, staggering end joints in adjacent rows.
- F. Sleepers:

1. Install perpendicular to direction of flooring, staggering end joints a minimum of 24 inches,
2. Space at spacing recommended by manufacturer for system components indicated.
3. Anchor predrilled sleepers through resilient pads.

G. Strip Flooring: Mechanically fasten perpendicular to supports.

H. Installation Tolerances: 1/8 inch in 10 feet of variance from level.

3.4 SANDING AND FINISHING

- A. Follow applicable recommendations in MFMA's "Industry Recommendations for Sanding, Sealing, Court Lining, Finishing, and Resurfacing of Maple Gym Floors."
- B. Allow installed flooring to acclimate to ambient conditions for at least 10 days before sanding.
- C. Machine sand with coarse, medium, and fine grades of sandpaper to achieve a level, smooth, uniform surface without ridges or cups. Remove sanding dust by tack or vacuum.
- D. Finish: Apply seal and finish coats of finish system according to finish manufacturer's written instructions. Provide not less than four coats total and not less than two finish coats.
 1. Water-Based Finishes: Use finishing methods recommended by finish manufacturer to reduce grain raise and sidebonding effect.
 2. Game Lines and Markers: Apply game-line and marker paint between final seal coat and first finish coat according to paint manufacturer's written instructions.
 - a. Mask flooring at game lines and markers, and apply paint to produce lines and markers with sharp edges.
 - b. Where game lines cross, break minor game line at intersection; do not overlap lines.
 - c. Apply game lines and markers in widths and colors according to requirements indicated on Drawings.
 - d. Apply finish coats after game-line and marker paint is fully cured.

3.5 PROTECTION

- A. Protect sports floors during remainder of construction period to allow finish to cure and to ensure that flooring and finish are without damage or deterioration at time of Substantial Completion.
 1. Do not cover sports floors after finishing until finish reaches full cure, and not before seven days after applying last finish coat.
 2. Do not move heavy and sharp objects directly over sports floors. Protect fully cured floor finishes and surfaces with plywood or hardboard panels to prevent damage from storing or moving objects over sports floors.

END OF SECTION

SECTION 096510

RESILIENT FLOORING AND ACCESSORIES

(Part of Work of Section 090005 - RESILIENT FLOORS, Filed Sub-Bid Required)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Resilient flooring.
 - 2. Resilient wall base and accessories.
 - 3. Resilient stair accessories.
 - 4. Substrate preparation for resilient flooring and accessories.
 - 5. High-performance adhesive suitable for RH and pH measured in substrate.
- B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council. Refer to Section 018110, SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.

1.3 PERFORMANCE REQUIREMENTS

- A. Wet Dynamic Coefficient of Friction: For flooring exposed as a walking surface, provide products with the following values as determined by testing identical products per ANSI/ NFSI B101.3 - 2012 Test Method for Measuring Wet DCOF of Common Hard-Surface Floor Materials, or ANSI 326.3 - American National Standard Test Method for Measuring Dynamic Coefficient of Friction of Hard Surface Materials - 2017. Testing by other methods or earlier editions of the specified test method is not acceptable.
 - 1. Wet Dynamic Coefficient of Friction: Not less than 0.43.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. LEED Submittals:
 - 1. Low-Emitting Materials, General Emissions Evaluation: Building products must be tested and determined compliant in accordance with California Department of Public Health (CDPH) Standard Method v1.1-2010.

RESILIENT FLOORING AND ACCESSORIES

- a. For resilient flooring, submit VOC content and FloorScore certification.
 - b. For adhesives, submit test results, including TVOC emissions and VOC content.
 - c. For wet-applied products, submit volume used.
 - C. Shop Drawings: For each type of floor covering. Include floor covering layouts, locations of seams, edges, columns, doorways, enclosing partitions, built-in furniture, cabinets, and cutouts.
 - 1. Show details of special patterns.
 - D. Samples for Verification: Full-size units of each color and pattern of resilient flooring required.
 - 1. Resilient Wall Base and Accessories: Manufacturer's standard-size Samples, but not less than 12 inches long, of each resilient product color and pattern required.
 - 2. For heat-welding bead, manufacturer's standard-size Samples, but not less than 9 inches long, of each color required.
 - E. Seam Samples for Sheet Flooring: For seamless-installation technique indicated and for each floor covering product, color, and pattern required; with seam running lengthwise and in center of 6-by-9-inch. Sample applied to a rigid backing and prepared by Installer for this Project.
 - F. Maintenance Data: For resilient products to include in maintenance manuals.
- 1.5 QUALITY ASSURANCE
- A. Fire-Test-Response Characteristics: Provide products identical to those tested for fire-exposure behavior per test method indicated by a testing and inspecting agency acceptable to authorities having jurisdiction.
- 1.6 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. Store tiles on flat surfaces.
- 1.7 PROJECT CONDITIONS
- A. Maintain temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F in spaces to receive floor tile during the following time periods:
 - 1. 48 hours before installation.
 - 2. During installation.
 - 3. 48 hours after installation.
 - B. After postinstallation period, maintain temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.
 - C. Close spaces to traffic during floor covering installation.
 - D. Close spaces to traffic for 48 hours after floor covering installation.
 - E. Install resilient products after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 BASIS-OF-DESIGN

- A. Basis-of-Design Products: Refer to the Finish Schedule on the Drawings.

2.2 RUBBER SHEET FLOORING

- 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. American Biltrite Flooring; AB Pure.
 2. Johnsonite, a division of Tarkett.
 3. Nora Systems, Inc.; Sentic.
- B. Rubber Sheet Flooring: ASTM F 1859, Type I (homogeneous rubber sheet).
1. Thickness: 0.08 inch (2.0 mm) min.
 2. Seaming Method: Manufacturer's recommended.
 3. Style and Colors: As indicated on the Finish Schedule.
 4. Material Ingredients: Cradle to Cradle (C2C) certification or Declare product label. PVC, phthalate-, chlorine-, and halogen-free.
 5. Low-Emitting Materials: FloorScore certification.

2.3 LINOLEUM SHEET FLOOR COVERING

- 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. Forbo Flooring, Inc.
 3. Tarkett Inc.
- B. Linoleum Sheet Flooring: ASTM F 2034, Type I, linoleum sheet with backing.
1. Thickness: 0.18 inch.
 2. Sheet Width: 78 inches.
 3. Seaming Method: Welded.
 4. Style and Colors: As indicated on the Finish Schedule.
 5. Material Ingredients: Cradle to Cradle (C2C) certification or Declare product label. PVC, phthalate-, chlorine-, and halogen-free.
 6. Low-Emitting Materials: FloorScore certification.

2.4 LUXURY VINYL TILE FLOOR COVERING

- 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. Congoleum Corporation.
 3. Mannington Mills, Inc.
 4. Tarkett, Inc.

B. Luxury Vinyl Tile Floor Covering: ASTM F 1700.

1. Thickness: 0.080 inch.
2. Size: 18 by 18 inches.
3. Style and Colors: As indicated on the Finish Schedule.

2.5 RUBBER FLOOR TILE

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. American Biltrite Flooring; AB Pure.
2. Johnsonite, a division of Tarkett.
3. Nora Systems, Inc.

B. Rubber Floor Tile: ASTM F 1344, Class 1, A or B (Rubber Tile).

1. Thickness: 0.125 inch.
2. Size: 24 by 24 inches nominal.
3. Style and Colors: As indicated on the Finish Schedule.
4. Material Ingredients: Cradle to Cradle (C2C) certification or Declare product label. PVC, phthalate-, chlorine-, and halogen-free.
5. Low-Emitting Materials: FloorScore certification.

2.6 VINYL COMPOSITION TILE

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. Congoleum Corporation.
3. Tarkett Inc.

B. Vinyl Composition Tile (VCT): ASTM F 1066.

1. Thickness: 0.125 inch
2. Size: 12 by 12 inches.
3. Style and Colors: As indicated on the Finish Schedule.
4. Environmental Product Declarations (EPD): Type III EPD.
5. Low-Emitting Materials, General Emissions Evaluation: FloorScore certification.

2.7 RESILIENT WALL BASE

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. American Biltrite Flooring; AB Pure.
2. Johnsonite, a division of Tarkett.
3. Nora Systems, Inc.

B. Resilient Wall Base: ASTM F 1861, Type TS (rubber, vulcanized thermoset), Group I (solid, homogeneous). Do not use polyvinyl chloride (PVC).

1. Shape: Straight (toeless) at carpet and coved at concrete and resilient flooring.
2. Minimum Thickness: 0.125 inch.
3. Height: 4 inches.
4. Lengths: Cut lengths 48 inches long or coils in manufacturer's standard length.
5. Outside Corners: Premolded.
6. Inside Corners: Premolded.
7. Surface: Smooth.
8. Style and Colors: As indicated on the Finish Schedule.
9. Material Ingredients: Cradle to Cradle (C2C) certification or Declare product label. PVC, phthalate-, chlorine-, and halogen-free.
10. Low-Emitting Materials: FloorScore certification.

2.8 RESILIENT STAIR 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. American Biltrite Flooring; AB Pure.
 2. Johnsonite, a division of Tarkett.
 3. Nora Systems, Inc.
- B. Resilient Treads and Risers: ASTM F 2169, Rubber, Composition A.
1. Size: Lengths and depths to fit each stair tread in one piece.
 2. Style and Colors: As indicated on the Finish Schedule.
- C. Stringers: Of same thickness as risers, height and length after cutting to fit risers and treads and to cover stair stringers; produced by same manufacturer as treads and recommended by manufacturer for installation with treads.

2.9 RESILIENT MOLDING ACCESSORY

- 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. American Biltrite Flooring; AB Pure.
 2. Johnsonite, a division of Tarkett.
 3. Nora Systems, Inc.
- B. Types Include the Following as Applicable: Cap for cove carpet, cap for cove resilient sheet floor covering, carpet edge for glue-down applications, nosing for carpet, nosing for resilient floor covering, reducer strip for resilient floor covering, joiner for tile and carpet.
1. Material: Rubber.
 2. Profile and Dimensions: As indicated.

2.10 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.

1. Available Products: Mapei; Mapecem Premix.
- B. Adhesives: Water-resistant type recommended by manufacturer to suit resilient products and substrate conditions indicated.
 1. Low-Emitting Materials: Provide adhesives in compliance with the 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."
 - a. VOC Content: 50 g/L or less.
 - b. Methylene chloride and perchloroethylene may not be intentionally added to adhesives. Do not use adhesives that contain urea formaldehyde.
 2. Adhesives, for Resilient Sheet Flooring:
 - a. Available Products: Subject to compliance with requirements, provide one of the following products:
 - 1) Forbo; L885 Adhesive.
 - 2) Forbo; Sustain 885M Adhesive.
 - 3) Forbo; T940 Adhesive.
 - 4) Forbo; V885 Eternal Vinyl Sheet Adhesive.
 3. Adhesives, for Wall Base:
 - a. Available Products: Subject to compliance with requirements, provide one of the following products:
 - 1) Forbo; L910W Wall Adhesive.
 - 2) Johnsonite; 960 Cove Base Adhesive.
- C. Seamless-Installation Accessories:
 1. Heat-Welding Bead: Manufacturer's solid-strand product for heat welding seams.
 - a. Color: Match floor covering.
- D. Integral-Flash-Cove-Base Accessories:
 1. Cove Strip: 1-inch radius provided or approved by manufacturer.
 2. Cap Strip: Provided or approved by manufacturer.
- E. Metal Edge Strips: Extruded aluminum with mill finish of width shown, of height required to protect exposed edges of tiles, 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 installation tolerances, moisture content, and other conditions affecting performance.
 - 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.
 - 2. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prepare substrates according to manufacturer's written recommendations to ensure adhesion of resilient products.
- B. Concrete Substrates: Prepare according to ASTM F 710.
 - 1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
 - 2. Alkalinity and Adhesion Testing: Perform tests recommended by flooring manufacturer. Proceed with installation only after substrate alkalinity falls within a range on pH scale not less than 5 or more than 9 pH, or as otherwise required in writing by manufacturer of flooring.
 - 3. Moisture Vapor Emission Testing:
 - a. Perform anhydrous calcium chloride test, 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, or as otherwise required in writing by manufacturer of flooring.
 - 4. Relative Humidity Testing:
 - a. Perform relative humidity test, ASTM F 2170. Proceed with installation only after substrates have a maximum relative humidity level of 75 percent, or as otherwise required in writing by manufacturer of flooring.
 - 5. Perform tests indicated above and as recommended by flooring manufacturer. Proceed with installation only after substrates pass testing.
- C. 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.
- D. Use trowelable leveling and patching compound to fill cracks, holes, and depressions in substrates.
 - 1. Slope floor where indicated on Drawings.
- E. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.

1. Do not install resilient products until they are same temperature as space where they are to be installed.

- F. Sweep and vacuum clean substrates to be covered by resilient products immediately before installation. After cleaning, examine substrates for moisture, alkaline salts, carbonation, and dust. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 SHEET INSTALLATION

- A. Comply with manufacturer's written instructions for installing floor coverings.
- B. Unroll floor coverings and allow them to stabilize before cutting and fitting.
- C. Lay out floor coverings as follows:
 1. Maintain uniformity of floor covering direction.
 2. Minimize number of seams; place seams in inconspicuous and low-traffic areas, at least 6 inches away from parallel joints in floor covering substrates.
 3. Match edges of floor coverings for color shading at seams.
 4. Avoid cross seams.
- D. Scribe and cut floor coverings to butt neatly and tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, and door frames.
- E. Extend floor coverings into toe spaces, door reveals, closets, and similar openings.
- F. Maintain reference markers, holes, or openings that are in place or marked for future cutting by repeating on floor coverings as marked on substrates. Use chalk or other nonpermanent marking device.
- G. Install floor coverings on covers for telephone and electrical ducts and similar items in installation areas. Maintain overall continuity of color and pattern between pieces of floor coverings installed on covers and adjoining floor covering. Tightly adhere floor covering edges to substrates that abut covers and to cover perimeters.
- H. Adhere floor coverings to 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.
- I. Seamless Installation:
 1. Heat-Welded Seams: Comply with ASTM F 1516. Rout joints and use welding bead to permanently fuse sections into a seamless floor covering. Prepare, weld, and finish seams to produce surfaces flush with adjoining floor covering surfaces.
- J. Integral-Flash-Cove Base: Cove floor coverings up vertical surfaces as indicated on Drawings. Support floor coverings at horizontal and vertical junction by cove strip. Butt at top against cap strip.

3.4 TILE INSTALLATION

- A. Lay out tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.
 - 1. Lay tiles in pattern indicated.
 - 2. **Resilient Athletic Flooring, with Interlocking Edges: Do not use adhesive.**
- B. Match 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.
- C. Scribe, cut, and fit tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, edgings, doorframes, thresholds, and nosings.
- D. Extend tiles into toe spaces, door reveals, closets, and similar openings.
- E. 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, nonstaining marking device.
- F. Install tiles on covers for telephone and electrical ducts and similar items in finished floor areas. Maintain overall continuity of color and pattern with pieces of tile installed on covers. Tightly adhere tile edges to substrates that abut covers and to cover perimeters.
- G. Adhere 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.

3.5 RESILIENT WALL BASE INSTALLATION

- A. Apply wall base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.
- B. Install wall base in lengths as long as practicable without gaps at seams and with tops of adjacent pieces aligned.
- C. Tightly adhere wall base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.
- D. Do not stretch wall base during installation.
- E. On masonry surfaces or other similar irregular substrates, fill voids along top edge of wall base with manufacturer's recommended adhesive filler material.
- F. Premolded Corners: Install premolded corners before installing straight pieces.

3.6 RESILIENT ACCESSORY INSTALLATION

- A. Resilient Stair Accessories:

1. Tightly adhere to substrates throughout length of each piece.
2. For treads installed as separate, equal-length units, install to produce a flush joint between units.

- B. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of floor coverings that would otherwise be exposed.

3.7 CLEANING AND PROTECTION

- A. Perform the following operations immediately after completing resilient product 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.

- a. Do not wash surfaces until after time period recommended by manufacturer.

- B. Protect resilient products from marks, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period. Use protection methods recommended in writing by manufacturer.

1. Do not apply protective floor polish.
2. Cover products installed on horizontal surfaces with undyed, untreated building paper until Substantial Completion.
3. Do not move heavy and sharp objects directly over surfaces. Place hardboard or plywood panels over flooring and under objects while they are being moved. Slide or roll objects over panels without moving panels.

END OF SECTION

SECTION 096710
RESINOUS FLOORING

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Epoxy flooring systems.
- B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council. Refer to Section 018110, SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 079200 - JOINT SEALANTS for sealants installed at joints in resinous flooring systems.

1.3 PERFORMANCE REQUIREMENTS

- A. Wet Dynamic Coefficient of Friction: For flooring exposed as a walking surface, provide products with the following values as determined by testing identical products per ANSI/ NFSI B101.3 - 2012 Test Method for Measuring Wet DCOF of Common Hard-Surface Floor Materials, or ANSI 326.3 - American National Standard Test Method for Measuring Dynamic Coefficient of Friction of Hard Surface Materials - 2017. Testing by other methods or earlier editions of the specified test method is not acceptable.
 - 1. Wet Dynamic Coefficient of Friction: Not less than 0.43.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
 - 1. Include manufacturer's technical data, application instructions, and recommendations for each resinous flooring component required.
- B. LEED Submittals:

1. Low-Emitting Materials, General Emissions Evaluation: Building products must be tested and determined compliant in accordance with California Department of Public Health (CDPH) Standard Method v1.1–2010.
 - a. For fluid-applied flooring, submit test results, including TVOC emissions and VOC content.
 - b. For wet-applied products, submit volume used.
 - C. Shop Drawings: Provide floor plans, to scale matching Architectural Plans, which indicate extent of each different resinous flooring system including system type, color and pattern, degree of slip resistance, and dimensioned locations of control joints and seams where systems meet.
 1. Provide enlarged details, at minimum 3 inch = 1 foot scale, indicating conditions at walls, door frames, pits, curbs, equipment pedestals, etc.
 - D. Samples for Verification: For each resinous flooring system required, 6 inches square, applied to a rigid backing by Installer for this Project.
 - E. Material Certificates: For each resinous flooring component, signed by manufacturer.
 - F. Installer Certificates: Signed by manufacturer certifying that installers comply with specified requirements.
 - G. Maintenance Data: For resinous flooring to include in maintenance manuals.
 - H. Test Results: For field testing of substrate, signed by installer.
- 1.5 QUALITY ASSURANCE
- A. Installer Qualifications: Engage an experienced installer (applicator) who is experienced in applying resinous flooring systems similar in material, design, and extent to those indicated for this Project, whose work has resulted in applications with a record of successful in-service performance, and who is acceptable to resinous flooring manufacturer.
 1. Engage an installer who employs only persons trained and approved by resinous flooring manufacturer for applying resinous flooring systems indicated.
 2. Engage an installer who is certified in writing by resinous flooring manufacturer as qualified to apply resinous flooring systems indicated.
 - B. Source Limitations: Obtain primary resinous flooring materials, including primers, resins, hardening agents, grouting coats, and topcoats, through one source from a single manufacturer. Provide secondary materials, including patching and fill material, joint sealant, and repair materials, of type and from source recommended by manufacturer of primary materials.
 - C. Mockups: Apply mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 1. Apply full-thickness mockups on 48-inch- square floor area selected by Design Professional.
 - a. Include 48-inch length of integral cove base.

2. Simulate finished lighting conditions for Design Professional's review of mockups.
 3. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.
- D. Pre-installation Conference: Prior to installation of flooring, meet at the Project site with the Manufacturer's Representative, the Installer, the Architect, the Owner's Representative and the Owner's Testing Agency. Record discussions and furnish copy to each participant. Topics to be discussed shall include, but not be limited to:
1. Existing and new slab conditions
 2. Owner's Testing Agency results of mandatory testing
 3. Surface preparation
 4. Required room temperatures
 5. Ventilation
 6. Step-by-step application procedures
 7. Curing time and methods
 8. Protection of completed Work
- E. Testing:
1. ASTM E 1907 Standard Guide to Methods of Evaluating Moisture Conditions of Concrete Floors to Receive Resilient Floor Coverings
 - a. ASTM F 1869 Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Sub-floor Using Anhydrous Calcium Chloride
 - b. ASTM D 4263 Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method
 - c. ASTM F 2170 Standard Test Method for Determining Relative Humidity in Concrete Slabs Using in situ Probes
 2. ASTM F 710 Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring
 3. ASTM D 4501 Standard Test Method for Shear Strength of Adhesive Bonds Between Rigid Substrates by the Block-Shear Method
- 1.6 DELIVERY, STORAGE, AND HANDLING
- A. Deliver materials in original packages and containers, with seals unbroken, bearing manufacturer's labels indicating brand name and directions for storage and mixing with other components.
 - B. Store materials to prevent deterioration from moisture, heat, cold, direct sunlight, or other detrimental effects.
- 1.7 PROJECT CONDITIONS
- A. Environmental Limitations: Comply with resinous flooring manufacturer's written instructions for substrate temperature, ambient temperature, moisture, ventilation, and other conditions affecting resinous flooring application.
 1. Maintain ambient air temperature between 65oF and 85oF.

2. Type I Concrete substrate shall be properly cured for a minimum of 30 days. Type III Concrete shall be properly cured for a minimum of 7 days.
 - B. Lighting: Provide permanent lighting or, if permanent lighting is not in place, simulate permanent lighting conditions during resinous flooring application.
 - C. Close spaces to traffic during resinous flooring application and for not less than 24 hours after application, unless manufacturer recommends a longer period.
- 1.8 WARRANTY
- A. Manufacturer shall furnish a single, written warranty covering 100% of the material and labor costs protecting the client from delamination, disbondment, and osmotic/hydrostatic failure for a period of three (3) years from date of installation.

PART 2 - PRODUCTS

2.1 BASIS-OF-DESIGN

- A. Basis-of-Design Products: Refer to the Finish Schedule on the Drawings.

2.2 MANUFACTURERS

- A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 1. Crossfield Products Corp.
 2. Dex-O-Tex.
 3. Koster American Corp.
 4. Stonhard, Inc.
 5. Tnemec Company Inc.
- B. Low-Emitting Materials: Provide adhesives and sealants in compliance with the 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."
- C. VOC Content, Floor Coatings: 100 g/L or less.

2.3 RESINOUS FLOORING SYSTEM

- A. Troweled epoxy mortar with clear epoxy receiving coat, decorative quartz broadcast and clear epoxy sealer coat.
- B. System Characteristics:
 1. Color: As selected by Architect from manufacturer's full range.
 2. Wearing Surface: Textured for slip resistance.
 3. Integral Cove Base: 4 inches high with 1 inch radius.
 4. Overall System Thickness: 3/16 inch (not including osmotic pressure barrier or grout).
 5. VOC: Less than 100 g/l.

- C. Components: Multi-layered trowel applied waterproof flooring surfacing system shall be composed of a primer bondcoat, waterproof membrane, traffic surfacing and finish coats, and shall conform to the following standards:
1. Traffic surface binder and all rubber emulsions shall be compounded with an aqueous synthetic rubber liquid containing no hydrocarbon solvents.
 2. Aggregate for traffic surface coating shall be suitably graded mineral aggregate passing a #20 mesh sieve and retained on a #80 mesh sieve.
 3. Fabric used as reinforcement for waterproof base and floor shall be 7-1/2 oz. woven polypropylene fabric.
 4. Final Finish dressing shall be a single component, water-phase acrylic latex emulsion material, pigmented and of a consistence suitable for roller application.
- D. System Components: Manufacturer's standard components which are compatible with each other and as follows:

2.4 ACCESSORY MATERIALS

- A. Patching and Fill Material: Resinous product of or approved by resinous flooring manufacturer and recommended by manufacturer for application indicated.

PART 3 - EXECUTION

3.1 PREPARATION

- A. General: Prepare and clean substrates according to resinous flooring manufacturer's written instructions for substrate indicated. Provide clean, dry, and neutral Ph substrate for resinous flooring application.
- B. Concrete Substrates: Provide sound concrete surfaces free of laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, and other contaminants incompatible with resinous flooring.
1. Roughen concrete substrates as follows:
 - a. Shot-blast surfaces with an apparatus that abrades the concrete surface, contains the dispensed shot within the apparatus, and recirculates the shot by vacuum pickup.
 - b. Comply with ASTM C 811 requirements, unless manufacturer's written instructions are more stringent.
 2. Repair damaged and deteriorated concrete according to resinous flooring manufacturer's written recommendations.
 3. Verify that concrete substrates are dry.
 - a. Perform anhydrous calcium chloride test, ASTM F 1869. Proceed with application only after substrates have maximum moisture-vapor-emission rate as required by the manufacturer.
 - b. Perform plastic sheet test, ASTM D 4263. Proceed with application only after testing indicates absence of moisture in substrates.

- c. Perform additional moisture tests recommended by manufacturer. Proceed with application only after substrates pass testing.
- 4. Verify that concrete substrates have neutral pH and that resinous flooring will adhere to them. Perform tests recommended by manufacturer. Proceed with application only after substrates pass testing.
- C. Resinous Materials: Mix components and prepare materials according to resinous flooring manufacturer's written instructions.
- D. Use patching and fill material to fill holes and depressions in substrates according to manufacturer's written instructions.
- E. Treat control joints and other nonmoving substrate cracks to prevent cracks from reflecting through resinous flooring according to manufacturer's written recommendations.

3.2 APPLICATION

- A. General: Apply components of resinous flooring system according to manufacturer's written instructions to produce a uniform, monolithic wearing surface of thickness indicated.
 - 1. Coordinate application of components to provide optimum adhesion of resinous flooring system to substrate, and optimum intercoat adhesion.
 - 2. Cure resinous flooring components according to manufacturer's written instructions. Prevent contamination during application and curing processes.
 - 3. At substrate expansion and isolation joints, provide joint in resinous flooring to comply with resinous flooring manufacturer's written recommendations.
 - a. Apply joint sealant to comply with manufacturer's written recommendations.
- B. Apply primer over prepared substrate at manufacturer's recommended spreading rate.
- C. Apply reinforcing membrane to substrate cracks.
- D. Integral Cove Base: Apply cove base mix to wall surfaces before applying flooring. Apply according to manufacturer's written instructions and details including those for taping, mixing, priming, troweling, sanding, and topcoating of cove base. Round internal and external corners.
- E. Apply self-leveling slurry body coat(s) in thickness indicated for flooring system.
 - 1. Broadcast aggregates and, after resin is cured, remove excess aggregates to provide surface texture indicated.
- F. Apply troweled or screeded body coat(s) in thickness indicated for flooring system. Hand or power trowel and grout to fill voids. When cured, sand to remove trowel marks and roughness.
- G. Apply topcoat(s) in number of coats indicated for flooring system and at spreading rates recommended in writing by manufacturer.

3.3 CLEANING AND PROTECTING

- A. Protect resinous flooring from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by resinous flooring manufacturer.

END OF SECTION

SECTION 096800

CARPETING

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Carpet sheet.
 - 2. Carpet tile.
 - 3. Carpet accessories.
 - 4. Substrate preparation for carpet and accessories.
- B. Sustainable Design Intent: Refer to Section 018110 - SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 096510 - RESILIENT FLOORING AND ACCESSORIES for resilient wall base and accessories installed with carpet.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
 - 1. Include manufacturer's written data on physical characteristics, durability, and fade resistance. Include installation recommendations for each type of substrate required.
- B. LEED Submittals:
 - 1. Building Product Disclosure and Optimization, Environmental Product Declarations (EPD):
 - a. Option 1: For carpets, submit product specific Type III EPDs.
 - 2. Building Product Disclosure and Optimization, Sourcing of Raw Materials:
 - a. Option 2, Leadership Extraction Practices:
 - 1) Extended Producer Responsibility: For carpets, submit evidence of reclamation and recycling programs.
 - 2) Recycled Content: For carpet, submit percentages by weight of postconsumer and preconsumer recycled content for products having

recycled content. Include statement indicating costs for each product having recycled content.

3. Building Product Disclosure and Optimization, Material Ingredients:
 - a. Option 1, Material Ingredient Reporting: For carpets, submit Cradle to Cradle (C2C) certifications (v2 Basic or v3 Bronze level) or Health Product Declarations (HPD) or Declare product labels.
 - b. Option 2, Material Ingredient Optimization: For carpets, submit Cradle to Cradle (C2C) certifications (v2 Gold Platinum or v3 Silver Gold Platinum).
 4. Low-Emitting Materials, General Emissions Evaluation: Building products must be tested and determined compliant in accordance with California Department of Public Health (CDPH) Standard Method v1.2-2017.
 - a. For carpets, submit test results, including TVOC emissions and VOC content, or Carpet and Rug Institute (CRI), Green Label Plus certifications.
 - b. For adhesives, submit test results, including TVOC emissions and VOC content, or GreenGuard Gold certifications.
 - c. For wet-applied products, submit volume used.
- C. Shop Drawings: Show the following:
1. Columns, doorways, enclosing walls or partitions, built-in cabinets, and locations where cutouts are required in carpet.
 2. Existing flooring materials to be removed.
 3. Existing flooring materials to remain.
 4. Carpet type, color, and dye lot.
 5. Seam locations, types, and methods.
 6. Type of subfloor.
 7. Type of installation.
 8. Pattern type, repeat size, location, direction, and starting point.
 9. Pile direction.
 10. Type, color, and location of insets and borders.
 11. Type, color, and location of edge, transition, and other accessory strips.
 12. Transition details to other flooring materials.
- D. Samples: For each of the following products and for each color and texture required. Label each Sample with manufacturer's name, material description, color, pattern, and designation indicated on Drawings and in schedules.
1. Sheet Carpet: 12-inch- square Sample.
 - a. Carpet Seam: 6-inch Sample.
 2. Carpet Tile: Full-size Sample.
 3. Exposed Edge, Transition, and other Accessory Stripping: 12-inch-long Samples.
- E. Product Schedule: Use same room and product designations indicated on Drawings and in schedules.
- F. Sample Warranties: For special warranties.
- G. Maintenance Data: For carpet to include in maintenance manuals specified in Division 01. Include the following:

1. Methods for maintaining carpet, including cleaning and stain-removal products and procedures and manufacturer's recommended maintenance schedule.
2. Precautions for cleaning materials and methods that could be detrimental to carpet.

1.4 QUALITY ASSURANCE

- A. Carpeting Standard: Comply with the Carpet and Rug Institute's "CRI Carpet Installation Standard," 2011 edition, formerly CRI 104 "Standard For Installation Specification Of Commercial Carpet."
- B. Installer Qualifications: An experienced installer who is certified by the Floor Covering Installation Board or who can demonstrate compliance with its certification program requirements.
- C. Mockups: Before installing carpet, build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 1. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. General: Comply with CRI Carpet Installation Standard, Section 5, "Storage and Handling."
- B. Deliver carpet in original mill protective covering with mill register numbers and tags attached.

1.6 PROJECT CONDITIONS

- A. General: Comply with CRI Carpet Installation Standard, Section 7, "Site Conditions."
- B. Environmental Limitations: Do not install carpet until wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
- C. Do not install carpet over concrete slabs until slabs have cured and are sufficiently dry to bond with adhesive and concrete slabs have pH range recommended by carpet manufacturer.
- D. Where demountable partitions, equipment, or other items are indicated for installation on top of carpet, install carpet before installing these items.

1.7 WARRANTY

- A. General Warranty: Special warranty specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.
- B. Special Carpet Warranty: Written warranty, signed by carpet manufacturer agreeing to replace carpet that does not comply with requirements or that fails within specified warranty period. Warranty does not include deterioration or failure of carpet due to unusual traffic, failure of substrate, vandalism, or abuse. Failures include, but are not limited to, more than 10 percent loss of face fiber, edge raveling, snags, runs, and delamination.
 1. Warranty Period: Ten years from date of Substantial Completion.

1.8 EXTRA MATERIALS (ATTIC STOCK)

- A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Carpet: Full-width rolls and tiles equal to 5 percent of amount installed for each type indicated, but not less than 10 sq. yd.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Ege Carpets.
 - 2. InterfaceFLOR.
 - 3. J&J Invision Carpet.
 - 4. Milliken & Co.
 - 5. Mohawk Group.
 - 6. Shaw, a Berkshire Hathaway Co.
 - 7. Tandus Centiva, a Tarkett Company.

2.2 CARPET

- A. Carpet Products: Subject to compliance with requirements, provide one of the following:
 - 1. Carpet Types (CPT-#): Refer to Finish Schedule.
 - 2. Building Product Disclosure and Optimization, Environmental Product Declarations (EPD): Product specific Type III EPD.
 - 3. Low-Emitting Materials, General Emissions Evaluation: Carpet and Rug Institute Green Label Plus.
 - 4. Do not permit polyvinyl chloride (PVC) or styrene butadiene rubber (SBR) carpet backing materials.
- B. Performance Characteristics:
 - 1. Critical Radiant Flux Classification: Not less than 0.45 W/sq. cm according to NFPA 253.
 - 2. Smoke Density: Not more than 450, when tested in accordance with ASTM E 662 or NFPA 258.
 - 3. Electrostatic Propensity: Less than 3.5 kV according to AATCC 134.

2.3 INSTALLATION ACCESSORIES

- A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided by or recommended by the carpet manufacturer.
- B. Adhesives: Water-resistant, mildew-resistant, nonstaining type to suit products and subfloor conditions indicated, that complies with flammability requirements for installed carpet and that is recommended by carpet manufacturer.
 - 1. Low-Emitting Materials, General Emissions Evaluation: Provide adhesives in compliance with the 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. VOC Content: Not more than 50 g/L.
 3. Methylene chloride and perchloroethylene may not be intentionally added to adhesives. Do not use adhesives that contain urea formaldehyde.
- C. Adhesive Film, for Carpet Tiles: Pressure sensitive adhesive, applied on one side of a polyester film, recommended by carpet tile manufacturer for releasable installation.
1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. InterfaceFLOR; TacTiles.
 - b. Shaw; LokDots Adhesive.
 - c. Tandus Centiva; TandusTape+
- D. Seaming Adhesive, for Sheet Carpet: Hot-melt adhesive tape or similar product recommended by carpet manufacturer for taping seams and butting cut edges at backing to form secure seams and to prevent pile loss at seams.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet performance. Verify that substrates and conditions are satisfactory for carpet installation and comply with requirements specified.
- B. Examine carpet for type, color, pattern, and potential defects.
- C. Concrete Subfloors: Comply with CRI Carpet Installation Standard, Section 9, "Testing Concrete Substrates." Verify that concrete slabs comply with ASTM F 710 and the following:
 1. Slab substrates are dry and free of curing compounds, sealers, hardeners, and other materials that may interfere with adhesive bond. Determine adhesion and dryness characteristics by performing bond and moisture tests recommended by the carpet manufacturer.
 2. Subfloors are free of cracks, ridges, depressions, scale, and foreign deposits.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. General: Comply with CRI Carpet Installation Standard, Section 7.3, "Site Conditions; Floor Preparation," and carpet manufacturer's written installation instructions for preparing substrates indicated to receive carpet installation.
- B. Concrete Substrates: Prepare according to ASTM F 710.
 1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
 2. Alkalinity and Adhesion Testing: Perform tests recommended by flooring manufacturer. Proceed with installation only after substrate alkalinity falls within a range on pH scale not less than 5 or more than 9 pH, or as otherwise required in writing by manufacturer of flooring.
 3. Moisture Vapor Emission Testing:

- a. Perform anhydrous calcium chloride test, 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, or as otherwise required in writing by manufacturer of flooring.
4. Relative Humidity Testing:
 - a. Perform relative humidity test, ASTM F 2170. Proceed with installation only after substrates have a maximum relative humidity level of 75 percent, or as otherwise required in writing by manufacturer of flooring.
5. Perform tests indicated above and as recommended by flooring manufacturer. Proceed with installation only after substrates pass testing.
- C. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, and depressions in substrates.
- D. Broom and vacuum clean substrates to be covered immediately before installing carpet. After cleaning, examine substrates for moisture, alkaline salts, carbonation, or dust. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 INSTALLATION

- A. Carpet Sheet, Direct-Glue-Down Installation: Comply with CRI Carpet Installation Standard, Section 13, "Direct Glue-Down Installation."
 1. Carpet Sheet, Stair Installation: Comply with CRI Carpet Installation Standard, Section 17, "Carpet on Stairs" for glue-down installation.
 2. Comply with carpet sheet manufacturer's written recommendations for seam locations and direction of carpet; maintain uniformity of carpet direction and lay of pile. At doorways, center seams under the door in closed position.
- B. Carpet Tile: Comply with CRI Carpet Installation Standard, Section 18, "Modular Carpet," and with carpet tile manufacturer's written installation instructions.
 1. Installation Method, for Adhesive: Partial glue down; install periodic tiles with releasable, pressure-sensitive adhesive.
 2. Installation Method, for Adhesive Film: Free lay; apply adhesive film squares at corners of tiles.
 - a. Do not install tiles with adhesive film at stair and ramp locations.
 - b. Do not install tiles with adhesive film over existing carpets.
 3. Installation Method, for No Adhesives: Free lay; press tiles firmly.
 - a. Do not install tiles without adhesive at stair and ramp locations.
 - b. Do not install tiles without adhesive over existing carpets.
 4. Carpet Tile Pattern: As directed by Architect.
 5. Maintain dye lot integrity. Do not mix dye lots in same area.
- C. Install pattern parallel to walls and borders.
- D. Do not bridge building expansion joints with carpet.

- E. Cut and fit carpet to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet manufacturer.
- F. Extend carpet into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.
- G. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on finish flooring as marked on subfloor. Use nonpermanent, nonstaining marking device.

3.4 CLEANING AND PROTECTION

- A. Perform the following operations immediately after installing carpet:
 - 1. Remove excess adhesive, seam sealer, and other surface blemishes using cleaner recommended by carpet manufacturer.
 - 2. Remove yarns that protrude from carpet surface.
 - 3. Vacuum carpet using commercial machine with face-beater element and HEPA filter.
- B. Protect installed carpet to comply with CRI Carpet Installation Standard, Section 20, "Protecting Indoor Installations."
- C. Protect carpet against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet manufacturer.

END OF SECTION

SECTION 098430

SOUND-ABSORBING PANELS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Back-mounted acoustical wall panels.
- B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council. Refer to Section 018110, SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 061000 - ROUGH CARPENTRY for wood blocking.
 - 2. Section 095100 - ACOUSTICAL CEILINGS for acoustical ceiling panels supported by exposed suspension system and tested for noise reduction.

1.3 DEFINITIONS

- A. NRC: Noise reduction coefficient.

1.4 SUBMITTALS

- A. Product Data: For each type of panel edge, core material, and mounting indicated.
- B. LEED Submittals:
 - 1. For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating costs for each product having recycled content.
- C. Shop Drawings: For acoustical wall panels. Include mounting devices and details; details at panel head, base, joints, and corners; and details at ceiling, floor base, and wall intersections. Include elevations showing panel sizes and direction of fabric weave and pattern matching. Indicate panel edge and core materials.

SOUND-ABSORBING PANELS

- D. Coordination Drawings: Show intersections with wall base, electrical receptacles and switches, and other adjacent work.
- E. Samples for Initial Selection: For each type of fabric facing material from acoustical wall panel manufacturer's full range.
- F. Samples for Verification: For the following products. Prepare Samples from same material to be used for the Work.
 - 1. Fabric: Full-width by 36-inch-long Sample from dye lot to be used for the Work, and as follows:
 - a. With specified treatments applied.
 - b. Show complete pattern repeat.
 - c. Mark top and face of fabric.
 - 2. Panel Edge: 12-inch-long Sample showing edge profile, corner, and finish.
 - 3. Core Material: 12-inch-square Sample showing corner.
 - 4. Mounting Device: Full-size Sample.
 - 5. Sample Panels: No larger than 36 by 36 inches. Show joints and mounting methods.
- G. Product Certificates: For each type of acoustical wall panel, signed by product manufacturer.
- H. Qualification Data: For fabricator and testing agency.
- I. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each type of acoustical wall panel.
- J. Maintenance Data: For acoustical wall panels to include in maintenance manuals. Include fabric manufacturers' written cleaning and stain-removal recommendations.
- K. Warranty: Special warranty specified in this Section.

1.5 QUALITY ASSURANCE

- A. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.
- B. Source Limitations: Obtain acoustical wall panels through one source from a single manufacturer.
- C. Fire-Test-Response Characteristics: Provide acoustical wall panels with the following surface-burning characteristics as determined by testing identical products per ASTM E 84 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:
 - 1. Flame-Spread Index: 25 or less.
 - 2. Smoke-Developed Index: 450 or less.
- D. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Comply with fabric and acoustical wall panel manufacturers' written instructions for minimum and maximum temperature and humidity requirements for shipment, storage, and handling.
- B. Deliver materials and panels in unopened bundles and store in a temperature-controlled dry place with adequate air circulation.
- C. Protect panel edges from crushing and impact.

1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install acoustical wall panels 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.
- B. Lighting: Do not install acoustical wall panels until a permanent level of lighting is provided on surfaces to receive acoustical wall panels.
- C. Air-Quality Limitations: Protect acoustical wall panels from exposure to airborne odors, such as tobacco smoke, and install panels under conditions free from odor contamination of ambient air.
- D. Field Measurements: Verify locations of acoustical wall panels by field measurements before fabrication and indicate measurements on Shop Drawings.

1.8 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of acoustical wall panels that fail in performance, materials, or workmanship within specified warranty period.
 - 1. Failure in performance includes, but is not limited to, acoustical performance.
 - 2. Failures in materials include, but are not limited to, fabric sagging, distorting, or releasing from panel edge; or warping of core.
 - 3. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 BASIS-OF-DESIGN PRODUCTS

- A. Basis-of-Design Products: Refer to the Finish Schedule on the Drawings.

2.2 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Decoustics Ltd.
 - 2. Kinetics Noise Control.
 - 3. MBI Products Company.

4. Quiet Concepts, a division of PCI Industries.
5. Sound Concepts.
6. Wall Technology, an Owens Corning Company.

2.3 CORE MATERIALS

- A. Glass-Fiber Board: ASTM C 612, Type IA or Types IA and IB; density as specified, unfaced, dimensionally stable, molded rigid board, with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively.

1. Nominal Core Density: 4 to 7 lb/cu. ft.

2.4 BACK-MOUNTED, EDGE-REINFORCED ACOUSTICAL WALL PANELS WITH GLASS-FIBER BOARD CORE

- A. Panel Construction: Manufacturer's standard panel construction consisting of facing material laminated to front face, edges, and back border of dimensionally stable, rigid glass-fiber board core; with edges chemically hardened to reinforce panel perimeter against warpage and damage.

1. Nominal Core Thickness: 1 inch
2. Overall System NRC: Not less than 0.80, for Type A mounting per ASTM E 795.
3. Panel Width: As indicated on Drawings
4. Panel Height: Fabricated height as indicated on Drawings.
5. Panel Edge Detail: Square.
6. Corner Detail: Square to form continuous profile to match edge detail.

- B. Facing Material: Fabric from same dye lot; color and pattern as selected by Architect from manufacturer's full range.

1. Manufacturer: As indicated on the Finish Schedule.

- C. Back-Mounting Devices: Concealed on backside of panel, recommended to support weight of panel, and as follows:

1. As recommended by manufacturer.

2.5 FABRICATION

- A. Sound-Absorption Performance: Provide acoustical wall panels with minimum NRCs indicated, as determined by testing per ASTM C 423 for mounting type specified.

- B. Acoustical Wall Panels: Panel construction consisting of facing material adhered to[face,] edges and back border of dimensionally stable core; with rigid edges to reinforce panel perimeter against warpage and damage.

1. Glass-Fiber Board: Resin harden areas of core for attachment of mounting devices.

- C. Fabric Facing: Stretched straight, on the grain, tight, square, and free from puckers, ripples, wrinkles, sags, blisters, seams, adhesive, or other foreign matter. Applied with visible surfaces fully covered.

1. Where square corners are indicated, tailor corners.
2. Where radius or other nonsquare corners are indicated, attach facing material so there are no seams or gathering of material.
3. Where fabrics with directional or repeating patterns or directional weave are indicated, mark fabric top and attach fabric in same direction so pattern or weave matches in adjacent panels.

D. Dimensional Tolerances of Finished Units: Plus or minus 1/16 inch for the following:

1. Thickness.
2. Edge straightness.
3. Overall length and width.
4. Squareness from corner to corner.
5. Chords, radii, and diameters.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine fabric, substrates, blocking, and conditions, with Installer present, for compliance with requirements, installation tolerances, and other conditions affecting performance of acoustical wall panels.

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

3.2 INSTALLATION

- A. Install acoustical wall panels in locations indicated with vertical surfaces and edges plumb, top edges level and in alignment with other panels, faces flush, and scribed to fit adjoining work accurately at borders and at penetrations.
- B. Comply with acoustical wall panel manufacturer's written instructions for installation of panels using type of concealed mounting accessories indicated or, if not indicated, as recommended by manufacturer. Anchor panels securely to supporting substrate.
- C. Match and level fabric pattern and grain among adjacent panels.
- D. Installation Tolerances: As follows:
1. Variation from Level and Plumb: Plus or minus 1/16 inch.
 2. Variation of Panel Joints from Hairline: Not more than 1/16 inch wide.

3.3 CLEANING

- A. Clip loose threads; remove pills and extraneous materials.
- B. Clean panels with fabric facing, on completion of installation, to remove dust and other foreign materials according to manufacturer's written instructions.

3.4 PROTECTION

- A. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, to ensure that acoustical wall panels are without damage or deterioration at time of Substantial Completion.
- B. Replace acoustical wall panels that cannot be cleaned and repaired, in a manner approved by Architect, before time of Substantial Completion.

END OF SECTION

SECTION 099000

PAINTING AND COATING

(Part of Work of Section 090007 - PAINTING, Filed Sub-Bid Required)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Field painting of exposed interior items and surfaces.
 - 2. Field painting of exposed exterior items and surfaces.
 - 3. Surface preparation for painting.
- B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council. Refer to Section 018110, SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 051200 - STRUCTURAL STEEL FRAMING for shop priming structural steel.
 - 2. Section 055000 - METAL FABRICATIONS for shop priming ferrous metal.
 - 3. Section 055100 - METAL STAIRS AND RAILINGS for shop priming ferrous metal.
 - 4. Section 064020 - INTERIOR ARCHITECTURAL WOODWORK for shop priming interior architectural woodwork.
 - 5. Section 074610 - FIBER-CEMENT SIDING for factory priming siding and trim.
 - 6. Section 078100 - APPLIED FIREPROOFING for intumescent fire-resistive coatings.
 - 7. Section 081110 - HOLLOW METAL DOORS AND FRAMES for factory priming steel doors and frames.
 - 8. Section 081400 - FLUSH WOOD DOORS for factory finishing.
 - 9. Section 092110 - GYPSUM BOARD ASSEMBLIES for surface preparation of gypsum board.

1.3 DEFINITIONS AND EXTENT

- A. General: Standard coating terms defined in ASTM D 16 apply to this Section.
 - 1. Flat refers to a lusterless or matte finish with a gloss range below 15 when measured at an 85-degree meter.

2. Eggshell refers to low-sheen finish with a gloss range between 20 and 35 when measured at a 60-degree meter.
 3. Semigloss refers to medium-sheen finish with a gloss range between 35 and 70 when measured at a 60-degree meter.
 4. Full gloss refers to high-sheen finish with a gloss range more than 70 when measured at a 60-degree meter.
- B. This Section includes surface preparation and field painting of exposed exterior and interior items and surfaces.
1. Surface preparation, priming, and finish coats specified in this Section are in addition to shop priming and surface treatment specified in other Sections.
- C. Paint exposed surfaces, except where these Specifications indicate that the surface or material is not to be painted or is to remain natural. If an item or a surface is not specifically mentioned, paint the item or surface the same as similar adjacent materials or surfaces. If a color of finish is not indicated, Architect will select from standard colors and finishes available.
1. Painting includes field painting of exposed bare and covered pipes and ducts (including color coding), hangers, exposed steel and iron supports, and surfaces of mechanical and electrical equipment that do not have a factory-applied final finish.
- D. Do NOT paint prefinished items, concealed surfaces, finished metal surfaces, operating parts, and labels.
1. Prefinished items include the following factory-finished components:
 - a. Architectural woodwork.
 - b. Acoustical wall panels.
 - c. Toilet enclosures.
 - d. Metal lockers.
 - e. Kitchen appliances.
 - f. Elevator entrance doors and frames.
 - g. Elevator equipment.
 - h. Finished mechanical and electrical equipment.
 - i. Light fixtures.
 2. Concealed surfaces include walls or ceilings in the following generally inaccessible spaces:
 - a. Foundation spaces.
 - b. Furred areas.
 - c. Ceiling plenums.
 - d. Utility tunnels.
 - e. Pipe spaces.
 - f. Duct shafts.
 - g. Elevator shafts.
 3. Finished metal surfaces include the following:
 - a. Anodized aluminum.
 - b. Stainless steel.

- c. Chromium plate.
 - d. Copper and copper alloys.
 - e. Bronze and brass.
- 4. Operating parts include moving parts of operating equipment and the following:
 - a. Valve and damper operators.
 - b. Linkages.
 - c. Sensing devices.
 - d. Motor and fan shafts.
- 5. Labels: Do not paint over UL, FMG, or other code-required labels or equipment name, identification, performance rating, or nomenclature plates.

1.4 SUBMITTALS

- A. Product Data: For each paint system indicated. Include block fillers and primers.
 - 1. Material List: An inclusive list of required coating materials. Indicate each material and cross-reference specific coating, finish system, and application. Identify each material by manufacturer's catalog number and general classification.
 - a. Disclose material ingredients by name and Chemical Abstract Service (CAS) Registry Number.
 - 2. Manufacturer's Information: Manufacturer's technical information, including label analysis and instructions for handling, storing, and applying each coating material.
- B. LEED Submittals:
 - 1. Building Product Disclosure and Optimization, Environmental Product Declarations (EPD):
 - a. Option 1: For paints, submit industry-wide EPDs and product-specific Type III EPDs.
 - 2. Building Product Disclosure and Optimization, Material Ingredients:
 - a. Option 1, Material Ingredient Reporting: For paints, submit Cradle to Cradle (C2C) certifications, Health Product Declarations (HPD), or Declare product labels.
 - 3. Low-Emitting Materials, General Emissions Evaluation: Building products must be tested and determined compliant in accordance with California Department of Public Health (CDPH) Standard Method v1.1–2010, using the applicable exposure scenario.
 - a. For field-applied paints and coatings, submit test results, including TVOC emissions and VOC content.
 - b. For paints, submit GreenGuard Gold or SCS Indoor Advantage Gold certifications.
 - c. For wet-applied products, submit volume used.
- C. Samples for Verification: For each color and material to be applied, with texture to simulate actual conditions, on representative Samples of the actual substrate.

1. Provide stepped Samples, defining each separate coat, including block fillers and primers. Use representative colors when preparing Samples for review. Resubmit until required sheen, color, and texture are achieved.
2. Provide a list of materials and applications for each coat of each Sample. Label each Sample for location and application.
3. Submit two 8 inch by 12 inch Samples for each type of finish coating for Architect's review of color and texture only.

D. Qualification Data: For Applicator.

1.5 QUALITY ASSURANCE

- A. Applicator Qualifications: A firm or individual experienced in applying paints and coatings similar in material, design, and extent to those indicated for this Project, whose work has resulted in applications with a record of successful in-service performance.
- B. Source Limitations: Obtain block fillers and primers for each coating system from the same manufacturer as the finish coats.
- C. Mockups: Provide a full-coat benchmark finish sample for each type of coating and substrate required. Comply with procedures specified in PDCA P5. Duplicate finish of approved sample Submittals.
 1. Architect will select one room or surface to represent surfaces and conditions for application of each type of coating and substrate.
 - a. Wall Surfaces: Provide samples on at least 100 sq. ft.
 - b. Small Areas and Items: Architect will designate items or areas required.
 2. Apply benchmark samples, according to requirements for the completed Work, after permanent lighting and other environmental services have been activated. Provide required sheen, color, and texture on each surface.
 - a. After finishes are accepted, Architect will use the room or surface to evaluate coating systems of a similar nature.
 3. Final approval of colors will be from benchmark samples.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to Project site in manufacturer's original, unopened packages and containers bearing manufacturer's name and label and the following information:
 1. Product name or title of material.
 2. Product description (generic classification or binder type).
 3. Manufacturer's stock number and date of manufacture.
 4. Contents by volume, for pigment and vehicle constituents.
 5. Thinning instructions.
 6. Application instructions.
 7. Color name and number.
 8. VOC content.

- B. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45 deg F. Maintain storage containers in a clean condition, free of foreign materials and residue.
 - 1. Protect from freezing. Keep storage area neat and orderly. Remove oily rags and waste daily.

1.7 PROJECT CONDITIONS

- A. Apply waterborne paints only when temperatures of surfaces to be painted and surrounding air are between 50 and 90 deg F.
- B. Apply solvent-thinned paints only when temperatures of surfaces to be painted and surrounding air are between 45 and 95 deg F.
- C. Do not apply paint in snow, rain, fog, or mist; or when relative humidity exceeds 85 percent; or at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.
 - 1. Painting may continue during inclement weather if surfaces and areas to be painted are enclosed and heated within temperature limits specified by manufacturer during application and drying periods.

1.8 EXTRA MATERIALS

- 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. Paint: Furnish four unopened gallons of each type of paint and coating work, in color and gloss as used for the Project.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work are listed in the Finish Schedule at the end of this Section.

2.2 PAINT MATERIALS, GENERAL

- A. Material Compatibility: Provide block fillers, primers, and finish-coat materials that are compatible with one another and with the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
- B. Material Quality: Provide manufacturer's best-quality paint material of the various coating types specified that are factory formulated and recommended by manufacturer for application indicated. Paint-material containers not displaying manufacturer's product identification will not be acceptable.
 - 1. Proprietary Names: Use of manufacturer's proprietary product names to designate colors or materials is not intended to imply that products named are required to be used to the

exclusion of equivalent products of other manufacturers. Furnish manufacturer's material data and certificates of performance for proposed substitutions.

- C. Paint Colors (PT-#): Refer to the Finish Schedule on the Drawings.
- D. VOC Content for Interior Paints and Coatings: Products shall comply with VOC limits of authorities having jurisdiction and, for interior paints and coatings applied at Project site, the following VOC limits, exclusive of colorants added to a tint base, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 1. Flat Paints and Coatings: 50 g/L (SCAQMD and CARB).
 - 2. Nonflat Paints and Coatings: 50 g/L (SCAQMD) or 100 g/L (CARB).
 - 3. Nonflat, High Gloss Paints and Coatings: 50 g/L (SCAQMD) or 150 g/L (CARB).
 - 4. Dry-Fog Coatings: 50 g/L (SCAQMD) or 150 g/L (CARB).
 - 5. Primers, Sealers, and Undercoaters: 100 g/L.
 - 6. Anticorrosive and Antirust Paints Applied to Ferrous Metals (Industrial Maintenance and Rust Preventative Coatings): 100 g/L (SCAQMD) or 250 g/L (CARB).
 - 7. Zinc-Rich Industrial Maintenance Primers: 100 g/L (SCAQMD) or 340 g/L (CARB).
 - 8. Pretreatment Wash Primers: 420 g/L.
 - 9. Floor Coatings: 50 g/L (SCAQMD) or 100 g/L (CARB).
 - 10. Shellacs, Clear: 730 g/L.
 - 11. Shellacs, Pigmented: 550 g/L.
 - 12. Clear Wood Finishes: 275 g/L.
 - 13. Stains, Exterior: 100 g/L (SCAQMD) or 250 g/L (CARB).
 - 14. Stains, Interior: 250 g/L.
- E. 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."

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements for paint application.
 - 1. Proceed with paint application only after unsatisfactory conditions have been corrected and surfaces receiving paint are thoroughly dry.
 - 2. Start of painting will be construed as Applicator's acceptance of surfaces and conditions within a particular area.
- B. Coordination of Work: Review other Sections in which primers are provided to ensure compatibility of the total system for various substrates. On request, furnish information on characteristics of finish materials to ensure use of compatible primers.
 - 1. Notify Architect about anticipated problems when using the materials specified over substrates primed by others.

3.2 PREPARATION

- A. General: Remove hardware and hardware accessories, plates, machined surfaces, lighting fixtures, and similar items already installed that are not to be painted. If removal is impractical or impossible because of size or weight of the item, provide surface-applied protection before surface preparation and painting.
 - 1. After completing painting operations in each space or area, reinstall items removed using workers skilled in the trades involved.
- B. Cleaning: Before applying paint or other surface treatments, clean substrates of substances that could impair bond of the various coatings. Remove oil and grease before cleaning.
 - 1. Schedule cleaning and painting so dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.
- C. Surface Preparation: Clean and prepare surfaces to be painted according to manufacturer's written instructions and technical bulletins for each particular substrate condition and as specified.
 - 1. Provide barrier coats over incompatible primers or remove and reprime.
 - 2. Cementitious Materials: Prepare concrete, concrete unit masonry, cement plaster, and mineral-fiber-reinforced cement panel surfaces to be painted. Remove efflorescence, chalk, dust, dirt, grease, oils, and release agents. Roughen as required to remove glaze. If hardeners or sealers have been used to improve curing, use mechanical methods of surface preparation.
 - a. Use abrasive blast-cleaning methods if recommended by paint manufacturer.
 - b. Determine alkalinity and moisture content of surfaces by performing appropriate tests. If surfaces are sufficiently alkaline to cause the finish paint to blister and burn, correct this condition before application. Do not paint surfaces if moisture content exceeds that permitted in manufacturer's written instructions.
 - c. Clean concrete floors to be painted with a 5 percent solution of muriatic acid or other etching cleaner. Flush the floor with clean water to remove acid, neutralize with ammonia, rinse, allow to dry, and vacuum before painting.
 - 3. Wood: Clean surfaces of dirt, oil, and other foreign substances with scrapers, mineral spirits, and sandpaper, as required. Sand surfaces exposed to view smooth and dust off.
 - a. Scrape and clean small, dry, seasoned knots, and apply a thin coat of white shellac or other recommended knot sealer before applying primer. After priming, fill holes and imperfections in finish surfaces with putty or plastic wood filler. Sand smooth when dried.
 - b. Prime, stain, or seal wood to be painted immediately on delivery. Prime edges, ends, faces, undersides, and back sides of wood, including cabinets, counters, cases, and paneling.
 - c. If transparent finish is required, backprime with spar varnish.
 - d. Backprime paneling on interior partitions where masonry, plaster, or other wet wall construction occurs on back side.
 - e. Seal tops, bottoms, and cutouts of unprimed wood doors with a heavy coat of varnish or sealer immediately on delivery.

4. Ferrous Metals: Clean ungalvanized ferrous-metal surfaces that have not been shop coated; remove oil, grease, dirt, loose mill scale, and other foreign substances. Use solvent or mechanical cleaning methods that comply with SSPC's recommendations.
 - a. Exterior Exposed Steel: Clean steel surfaces in accordance with SSPC-SP 6/NACE No. 3 Commercial Blast Cleaning. Abrasive blast cleaned surfaces shall exhibit a uniform, angular profile of 1.5-3.0 mils. Prime cleaned surfaces within 8 hours and prior to surface rusting.
 - b. Interior Exposed Steel, in Humid Environments: Clean steel surfaces in accordance with SSPC-SP 6/NACE No. 3 Commercial Blast Cleaning. Abrasive blast cleaned surfaces shall exhibit a uniform, angular profile of 1.5-3.0 mils. Prime cleaned surfaces within 8 hours and prior to surface rusting.
 - c. Interior Exposed Steel, in Dry Environments: Clean steel surfaces in accordance with SSPC-SP2 or SP3 Hand or Power Tool Cleaning.
 5. Galvanized Surfaces: Clean galvanized surfaces in accordance with SSPC-SP16 Brush off Blast Cleaning of Galvanized Steel and NonFerrous Metals, to achieve a minimum 1 mil anchor profile.
- D. Material Preparation: Mix and prepare paint materials according to manufacturer's written instructions.
1. Maintain containers used in mixing and applying paint in a clean condition, free of foreign materials and residue.
 2. Stir material before application to produce a mixture of uniform density. Stir as required during application. Do not stir surface film into material. If necessary, remove surface film and strain material before using.
 3. Use only thinners approved by paint manufacturer and only within recommended limits.
- E. Tinting: Tint each undercoat a lighter shade to simplify identification of each coat when multiple coats of same material are applied. Tint undercoats to match the color of the finish coat, but provide sufficient differences in shade of undercoats to distinguish each separate coat.

3.3 APPLICATION

- A. General: Apply paint according to manufacturer's written instructions. Use applicators and techniques best suited for substrate and type of material being applied.
1. Paint colors, surface treatments, and finishes are indicated in the paint schedules.
 2. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to formation of a durable paint film.
 3. Provide finish coats that are compatible with primers used.
 4. The term "exposed surfaces" includes areas visible when permanent or built-in fixtures, grilles, convector covers, covers for finned-tube radiation, and similar components are in place. Extend coatings in these areas, as required, to maintain system integrity and provide desired protection.
 5. Paint surfaces behind movable equipment and furniture the same as similar exposed surfaces. Before final installation of equipment, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
 6. Paint interior surfaces of ducts with a flat, nonspecular black paint where visible through registers or grilles.

7. Paint backsides of access panels and removable or hinged covers to match exposed surfaces.
 8. Finish exterior doors and doors in wet areas on tops, bottoms, and side edges the same as exterior faces.
 9. Sand lightly between each succeeding enamel or varnish coat.
- B. Scheduling Painting: Apply first coat to surfaces that have been cleaned, pretreated, or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.
1. The number of coats and film thickness required are the same regardless of application method. Do not apply succeeding coats until previous coat has cured as recommended by manufacturer. If sanding is required to produce a smooth, even surface according to manufacturer's written instructions, sand between applications.
 2. Omit primer over metal surfaces that have been shop primed and touchup painted.
 3. If undercoats, stains, or other conditions show through final coat of paint, apply additional coats until paint film is of uniform finish, color, and appearance. Give special attention to ensure that edges, corners, crevices, welds, and exposed fasteners receive a dry film thickness equivalent to that of flat surfaces.
 4. Allow sufficient time between successive coats to permit proper drying. Do not recoat surfaces until paint has dried to where it feels firm, and does not deform or feel sticky under moderate thumb pressure, and until application of another coat of paint does not cause undercoat to lift or lose adhesion.
- C. Application Procedures: Apply paints and coatings by brush, roller, spray, or other applicators according to manufacturer's written instructions.
1. Brushes: Use brushes best suited for type of material applied. Use brush of appropriate size for surface or item being painted.
 2. Rollers: Use rollers of carpet, velvet-back, or high-pile sheep's wool as recommended by manufacturer for material and texture required.
 3. Spray Equipment: Use airless spray equipment with orifice size as recommended by manufacturer for material and texture required.
- D. Minimum Coating Thickness: Apply paint materials no thinner than manufacturer's recommended spreading rate to achieve dry film thickness indicated. Provide total dry film thickness of the entire system as recommended by manufacturer.
- E. Mechanical and Electrical Work: Painting of mechanical and electrical work is limited to items exposed in equipment rooms and occupied spaces.
- F. Mechanical items to be painted include, but are not limited to, the following:
1. Uninsulated metal piping.
 2. Uninsulated plastic piping.
 3. Pipe hangers and supports.
 4. Tanks that do not have factory-applied final finishes.
 5. Visible portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets.
 6. Duct, equipment, and pipe insulation having "all-service jacket" or other paintable jacket material.
 7. Mechanical equipment that is indicated to have a factory-primed finish for field painting.

- G. Electrical items to be painted include, but are not limited to, the following:
 - 1. Switchgear.
 - 2. Panelboards.
 - 3. Electrical equipment that is indicated to have a factory-primed finish for field painting.
- H. Block Fillers: Apply block fillers to concrete masonry block at a rate to ensure complete coverage with pores filled.
- I. Prime Coats: Before applying finish coats, apply a prime coat, as recommended by manufacturer, to material that is required to be painted or finished and that has not been prime coated by others. Recoat primed and sealed surfaces where evidence of suction spots or unsealed areas in first coat appears, to ensure a finish coat with no burn-through or other defects due to insufficient sealing.
- J. Pigmented (Opaque) Finishes: Completely cover surfaces as necessary to provide a smooth, opaque surface of uniform finish, color, appearance, and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections will not be acceptable.
- K. Transparent (Clear) Finishes: Use multiple coats to produce a glass-smooth surface film of even luster. Provide a finish free of laps, runs, cloudiness, color irregularity, brush marks, orange peel, nail holes, or other surface imperfections.
 - 1. Provide satin finish for final coats.
- L. Completed Work: Match approved samples for color, texture, and coverage. Remove, refinish, or repaint work not complying with requirements.

3.4 FIELD QUALITY CONTROL

- A. The Owner reserves the right to invoke the following test procedure at any time and as often as the Owner deems necessary during the period when paint is being applied:
 - 1. The Owner will engage a qualified independent testing agency to sample paint material being used. Samples of material delivered to Project will be taken, identified, sealed, and certified in the presence of Contractor.
 - 2. Testing agency will perform appropriate tests for the following characteristics as required by the Architect.
 - 3. The Architect may direct Contractor to stop painting if test results show material being used does not comply with specified requirements. Contractor shall remove noncomplying paint from Project site, pay for testing, and repaint surfaces previously coated with the noncomplying paint. If necessary, Contractor may be required to remove noncomplying paint from previously painted surfaces if, on repainting with specified paint, the two coatings are incompatible.

3.5 CLEANING

- A. Cleanup: At the end of each workday, remove empty cans, rags, rubbish, and other discarded paint materials from Project site.

1. After completing painting, clean glass and paint-spattered surfaces. Remove spattered paint by washing and scraping without scratching or damaging adjacent finished surfaces.

3.6 PROTECTION

- A. Protect work of other trades, whether being painted or not, against damage from painting. Correct damage by cleaning, repairing or replacing, and repainting, as approved by Architect.
- B. Provide "Wet Paint" signs to protect newly painted finishes. After completing painting operations, remove temporary protective wrappings provided by others to protect their work.
 1. After work of other trades is complete, touch up and restore damaged or defaced painted surfaces. Comply with procedures specified in PDCA P1.

3.7 PAINT SCHEDULE

- A. Schedule: Provide products and number of coats specified. Use of manufacturer's proprietary product names to designate colors, materials, generic class, standard of quality and performance criteria and is not intended to imply that products named are required to be used to the exclusion of equivalent performing products of other manufacturers.
- B. Exterior Paint Schedule:
 1. Exterior Concrete and Masonry (where indicated), Painted Finish:
 - a. One Coat:
 - 1) Tnemec 156 Enviro-Crete at 6.0 to 10 mils DFT.
 - 2) Liquid Plastics Acrylic at 8.0 to 10.0 mils DFT.
 - 3) Dupont Tufcryn at 8.0 to 10.0 mils DFT.
 - 4) RD Coatings Elasto-Flex at 6.0 to 10.0 mils DFT.
 - b. And One Coat:
 - 1) Tnemec 156 Enviro-Crete at 8 to 10 mils DFT.
 - 2) Liquid Plastics Acrylic at 8.0 to 10.0 mils DFT.
 - 3) Dupont Tufcryn at 8.0 to 10.0 mils DFT.
 - 4) RD Coatings Elasto-Flex at 6.0 to 10.0 mils DFT.
 2. Exterior Concrete and Masonry (where indicated), Stained Finish:
 - a. One Coat:
 - 1) Chemprobe Prima-pel H20 100 to 125 sq ft/gal.
 - 2) QC Construction Products Anti-Graffiti at 100 sq ft/gal.
 - b. And One Coat:
 - 1) Chemprobe Conformal Stain WB 100 to 110 sq ft/gal.
 - 2) QC Construction Products QC Vertical Stain 150 sq ft/gal.

3. Exterior Previously Painted Concrete, Previous Painted Masonry, Glazed Brick, and Plaster (where indicated), Painted Finish:
 - a. One Coat:
 - 1) Tnemec 151 Elast-Grip at 2.0 to 3.0 mils DFT.
 - 2) Liquid Plastics Water Borne Penetrating Primer at 3.0 mils DFT.
 - 3) Dupont Corlar 2.1 PRP at 1.0 to 2.0 mils DFT.
 - 4) RD Coatings Multiprim at 1.5 to 2.0 mils DFT.
 - b. And Two Coats:
 - 1) Tnemec 156 Enviro-Crete at 8 to 10 mils DFT.
 - 2) Liquid Plastics Decadex at 10.0 to 12.0 mils DFT.
 - 3) Dupont Tufcryn at 8.0 to 10.0 mils DFT.
 - 4) RD Coatings Elasto-Flex at 6.0 to 8.0 mils DFT.
4. Exterior Galvanized Metal (not shop-finished under Section 051200 - STRUCTURAL STEEL FRAMING, Section 055000 - METAL FABRICATIONS, or Section 055100 - METAL STAIRS AND RAILINGS), Aliphatic Acrylic Polyurethane System:
 - a. Surface Preparation: SSPC-SP16 Brush-off Blast of Galvanized Steel.
 - b. One Coat:
 - 1) Tnemec 66HS Hi-Build Epoxoline at 3.0 mils DFT.
 - 2) PPG PMC Amerlock 400 Hi-Build Epoxy at 4.0-5.0 mils DFT.
 - 3) Dupont 25P High Solids at 4.0 mils DFT.
 - 4) International Intergard 475 HS at 5.0 to 10.0 mils DFT.
 - c. And One Coat:
 - 1) Tnemec 73 Endura-Shield at 3.0 mils DFT.
 - 2) PPG PMC Amercoat 450H Polyurethane at 3.0 mils DFT.
 - 3) Dupont Imron 2.8 Urethane at 3.0 to 4.0 mils DFT.
 - 4) International Interthane 990 HS at 3.0 to 4.0 mils DFT.
5. Exterior Ferrous Metal, Urethane System:
 - a. Surface Preparation: SSPC-SP6.
 - b. One Coat:
 - 1) Tnemec 90G-1K97 at 3 mils DFT; shop applied under other Sections; use for touch up.
 - 2) PPG PMC Amercoat 68 MCZ at 3 mils DFT; shop applied under other Sections; use for touch up.
 - 3) Dupont Urethane Ganicin Zinc Rich Primer 80% zinc load at 3.0 mils DFT.
 - 4) International Interzinc 315 at 2.0 to 3.0 mils DFT.
 - c. And One Coat:
 - 1) Tnemec 66HS Hi-Build Epoxoline at 3.0 mils DFT.
 - 2) PPG PMC Amerlock 400 Hi-Build Epoxy at 3.0 to 5.0 mils DFT.

- 3) Dupont 25P High Solids Epoxy at 4.0 to 6.0 mils DFT.
 - 4) International Intergard 475 HS at 4.0 to 8.0 mils DFT.
 - d. And One Coat:
 - 1) Tnemec 73 Endura-Shield at 3.0 mils DFT.
 - 2) PPG PMC Amerlock 450H Polyurethane Topcoat at 3.0 mils DFT.
 - 3) Dupont High Solids Imron Urethane at 4.0 mils DFT.
 - 4) International Interthane 990 HS at 2.0 to 3.0 mils DFT.
6. Exterior Ferrous Metal, Fluoropolymer System:
 - a. Surface Preparation: SSPC-SP6.
 - b. One Coat:
 - 1) Tnemec 90G-1K97 at 3.0 mils DFT; use for touch up.
 - 2) Dupont Ganicin Urethane Zinc Rich at 3.0 mils DFT.
 - 3) PPG Coraflon ADS570 Zinc Rich Epoxy Primer at 3.0 mils DFT.
 - c. And One Coat:
 - 1) Tnemec 73 Endura-Shield at 3.0 mils DFT.
 - 2) Dupont Imron HS at 3.0 mils DFT.
 - 3) PPG Pitthane HB Urethane 95-8800 at 3.0 mils DFT.
 - d. And One Coat:
 - 1) Tnemec 1070 Fluoronar at 2.0 mils DFT.
 - a) Finish: 1078 metallic, 1071 satin, or 1072 semi-gloss.
 - 2) Dupont Fluoropolymer at 3.0 mils DFT.
 - 3) PPG Coraflon ADS Fluoropolymer at 1.5-2.0 mils DFT.
7. Exterior Ferrous Metal, Engineered Siloxane/ Polyester Urethane System:
 - a. Surface Preparation: SSPC-SP6.
 - b. One Coat:
 - 1) Tnemec 90G-1K97 at 3.0 mils DFT.
 - 2) PPG PMC Amercoat 68 MCZ at 3.0 mils DFT.
 - 3) Dupont Urethane Zinc Rich Primer 80% zinc load at 3.0 mils DFT.
 - 4) International Interzinc 315 at 2.0 to 3.0 mils DFT.
 - c. And One Coat:
 - 1) Tnemec 66HS Hi-Build Epoxoline at 3.0 to 4.0 mils DFT.
 - 2) PPG PMC Amerlock 400 High Build Epoxy at 3.0 mils DFT.
 - 3) Dupont 25P High Solids Epoxy at 4.0 mils DFT.
 - 4) International Intergard 475 HS at 4.0 to 8.0 mils DFT.
 - d. And One Coat:

- 1) Tnemec 740/750 UVX at 2.0 to 3.0 mils DFT.
 - 2) PPG PMC PSX-700 Engineered Siloxane Topcoat at 5.0 mils DFT.
 - 3) Dupont Imron High Solids Polyester Urethane at 3.0 mils DFT.
 - 4) International Interfine 878 at 2.0 to 3.0 mils DFT.
8. Exterior Aluminum (where required), Painted Finish:
 - a. Surface Preparation: Pressure wash with Oakite and sand with 3M Scotch-Brite nylon pads.
 - b. One Coat:
 - 1) Tnemec 66HS Hi-Build Epoxoline at 2.0 mils DFT.
 - 2) PPG PMC Amerlock 400 Hi-Build Epoxy at 2.0 to 3.0 mils DFT.
 - 3) Dupont 25P High Solids at 4.0 mils DFT.
 - 4) International Intergard 475 HS at 5.0 to 10.0 mils DFT.
 - c. And One Coat:
 - 1) Tnemec 73 Endura-Shield at 2.0 mils DFT.
 - 2) PPG PMC Amercoat 450H Polyurethane at 3.0 mils DFT.
 - 3) Dupont High Solids Imron 2.8 at 4.0 mils DFT.
 - 4) International Interthane 990 HS at 3.0 to 4.0 mils DFT.
9. Exterior Existing Prepainted Steel, for Sandblasting and Painted Finish:
 - a. Surface Preparation- SSPC-SP 6 Commercial Blast Cleaning.
 - b. One Coat:
 - 1) Tnemec 90-97 or 90G-1K97 at 3 to 3.5 mils DFT.
 - 2) PPG PMC Amercoat 68 MCZ at 3.0 mils DFT.
 - 3) Dupont Ganicin 80% Zinc load Zinc Rich Primer at 3.0 to 3.5 mils DFT.
 - c. And One Coat:
 - 1) Tnemec 73 Endura-Shield at 3.0 to 4.0 mils DFT.
 - 2) PPG PMC Amerlock 400 at 4.0 DFT.
 - 3) Dupont Imron 2.8 at 4.0 to 5.0 mils DFT.
 - d. And One Coat:
 - 1) Tnemec 1070, 1071, or 1072 Flouonar at 2.5 to 3.5 mils DFT.
 - 2) PPG PMC Corolon Coating at 5.0 mils DFT.
 - 3) Dupont Flouropolymer at 3.0 mils DFT.
10. Exterior Existing Prepainted Steel, for Overcoat Painted Finish:
 - a. Surface Preparation: Water Blast 5000 psi and SSPC-SP3 Power Tool Clean.
 - b. One Coat:
 - 1) Tnemec 394 Omnithane at 3.0 to 3.5 mils DFT.
 - 2) PPG PMC Amerlock 400 Hi-Build Epoxy at 3.0 to 4.0 mils DFT.
 - 3) RD Coatings Elasto Metal at 3.0 mils DFT.

- 4) International Interplus 356 at 3.0 to 5.0 mils DFT.
- c. And One Coat:
 - 1) Tnemec 66HS Hi-Build Epoxoline at 3.0 to 5.0 mils DFT.
 - 2) PPG PMC Amerlock 400 at 3.0 to 4.0 mils DFT.
 - 3) RD Coatings Elasto Metal at 7.0 mils DFT.
 - 4) International Intergard 475 HS at 5.0 to 10.0 mils DFT.
- d. And One Coat:
 - 1) Tnemec 73 Endura-Shield at 3.0 to 5.0 mils DFT.
 - 2) PPG PMC Amercoat 450H at 3.0 mils DFT.
 - 3) RD Coatings MurCryl at 3.0 to 4.0 mils DFT.
 - 4) International Interthane 990 HS at 3.0 to 4.0 mils DFT.
- 11. Exterior Wood, for Stained Finish:
 - a. Two Coats:
 - 1) Cabot Water-Based Semi-Transparent Stain 1300.
 - 2) Akzo Nobel Paints; Sikkens, approved equal.
 - 3) Moore, approved equal.
- 12. Exterior Wood and Cellular PVC, for Painted Finish:
 - a. Factory Primed per Section 062010 - EXTERIOR FINISH CARPENTRY.
 - b. One Coat, Primer:
 - 1) California Paint Grip-Coat Bonding Primer 505 series.
 - 2) Duron Bond N-Seal Exterior Acrylic Latex Primer 08-124.
 - 3) Moore Ultra Spec Exterior Primer N558.
 - 4) PPG Seal Grip Acrylic Latex Primer.
 - 5) S-W Exterior Latex Acrylic Wood Primer.
 - c. And Two Coats, Flat Finish:
 - 1) California Paint Fresh Coat 100% Acrylic Velvet Flat 450 series.
 - 2) Duron Weathershield Exterior 100% Acrylic Flat House Paint 34-914.
 - 3) Moore Ultra Spec Exterior Flat Finish N447.
 - 4) PPG Sun-Proof Exterior Flat Latex 72 line, N105 or 183.
 - 5) S-W SuperPaint VinylSafe Exterior Latex Acrylic Flat A80 series.
 - d. And Two Coats, Semi-Gloss Finish:
 - 1) California Paint Fresh Coat 100% Acrylic Satin-Gloss 471 series.
 - 2) Duron Weathershield Exterior 100% Acrylic Semi-Gloss House Paint.
 - 3) Moore Ultra Spec Exterior Gloss Finish N449.
 - 4) PPG Sun-Proof Exterior Semi-Gloss Latex 78 line, N096 or 170.
 - 5) S-W SuperPaint VinylSafe Exterior Latex Acrylic Satin A89 series.
- 13. Exterior Fiber-Reinforced Cement Board, for Painted Finish:

- a. Factory Primed per Section 074610 - FIBER-CEMENT SIDING.
 - b. And Two Coats, Flat Finish: At locations as selected by Architect.
 - 1) Duron Weathershield Exterior 100% Acrylic Flat House Paint 34-914.
 - 2) PPG Sun-Proof Exterior Flat Latex 72 line, N105 or 183.
 - 3) S-W SuperPaint Exterior Latex Acrylic Flat A80 series.
 - 4) California Paint Fresh Coat 100% Acrylic Velvet Flat 450 series.
 - c. And Two Coats, Semi-Gloss Finish: At locations as selected by Architect.
 - 1) Duron Weathershield Exterior 100% Acrylic Semi-Gloss House Paint.
 - 2) PPG Sun-Proof Exterior Semi-Gloss Latex 78 line, N096 or 170.
 - 3) S-W SuperPaint Exterior Latex Acrylic Satin A89 series.
 - 4) California Paint Fresh Coat Satin-Gloss 100% Acrylic 471 series.
- C. Interior Paint Schedule, Typical:
- 1. Interior Gypsum Wallboard and Plaster, Latex Paint Finish:
 - a. One Coat, Primer:
 - 1) Imperial Paints ECOS Interior Wall Primer.
 - 2) Moore Ultra Spec 500 Interior Latex Primer 534.
 - 3) PPG Speedhide Zero VOC Interior Primer 6-4900XI.
 - 4) S-W Harmony Interior Primer B11 series.
 - 5) S-W ProMar 200 HP Zero VOC Interior Primer.
 - b. And Two Coats, Flat Finish: At ceilings and elsewhere as indicated.
 - 1) Imperial Paints ECOS Interior Flat.
 - 2) Moore Ultra Spec 500 Interior Latex Flat 536.
 - 3) PPG Speedhide Zero VOC Interior Latex Flat 6-4110XI.
 - 4) S-W ProMar 400 Zero VOC Interior Flat.
 - c. And Two Coats, Eggshell Finish: At walls and elsewhere as indicated.
 - 1) Imperial Paints ECOS Interior Eggshell.
 - 2) Moore Ultra Spec 500 Interior Latex Low Sheen 537.
 - 3) PPG Speedhide Zero VOC Interior Latex Eggshell 6-4310XI.
 - 4) S-W ProMar 200 HP Zero VOC Interior Eg-Shel.
 - d. And Two Coats, Semi-Gloss Finish: At toilet rooms, other wet areas, and elsewhere as indicated.
 - 1) Imperial Paints ECOS Interior Satin.
 - 2) Moore Ultra Spec 500 Interior Latex Semi-Gloss 539.
 - 3) PPG Speedhide Zero VOC Interior Latex Semi-Gloss 6-4510XI.
 - 4) S-W ProMar 200 HP Zero VOC Interior Semi-Gloss.
 - 2. Interior Architectural Woodwork, Finish Carpentry, and Wood Doors (softwoods, paint grade hardwoods, MDF, MDO, and hardwood veneers), Latex Paint Finish:

- a. One Coat, Primer:
 - 1) Imperial Paints ECOS Interior Wood Primer.
 - 2) Moore Ultra Spec 500 Interior Latex Primer 534.
 - 3) PPG Speedhide Zero VOC Interior Primer 6-4900XI.
 - 4) S-W ProMar 200 HP Zero VOC Interior Primer.
- b. And Two Coats, Semi-Gloss:
 - 1) Imperial Paints ECOS Interior Satin.
 - 2) Moore Ultra Spec 500 Interior Latex Semi-Gloss 539.
 - 3) PPG Speedhide Zero VOC Interior Latex Semi-Gloss 6-4510XI.
 - 4) S-W ProMar 200 HP Zero VOC Interior Semi-Gloss.
3. Interior Architectural Woodwork, Finish Carpentry and Millwork (hardwoods and hardwood veneers, except paint grade and factory-finished items), Transparent Polyurethane Finish:
 - a. Sand: 120 grit sandpaper.
 - b. Sand: 220 grit sandpaper.
 - c. One Coat, Stain: Not Used.
 - d. And Three Coats, Satin Finish:
 - 1) American Formulating & Manufacturing, Safecoat Polyureseal BP.
 - 2) Imperial Paints ECOS Woodshield Varnish. Moore Benwood Stays Clear Acrylic Polyurethane Low Lustre W423.
 - 4) Vermont Natural Coatings; PolyWhey Natural Furniture Finish.
 - e. Sand Between Urethane Coats: 220 grit sandpaper.
4. Interior Concrete Masonry Unit (CMU), Latex Paint Finish:
 - a. One Coat, Block Filler:
 - 1) Moore Ultra Spec Hi-Build Masonry Block Filler 571.
 - 2) PPG Speedhide Interior Masonry Hi Fill Latex Block Filler 6-15XI.
 - 3) S-W PrepRite Block Filler B25W25.
 - b. And Two Coats, Eggshell Finish: At walls and elsewhere as indicated.
 - 1) Moore Ultra Spec 500 Interior Latex Low Sheen 537.
 - 2) PPG Speedhide Zero VOC Interior Latex Semi-Gloss 6-4510XI.
 - 3) S-W ProMar 200 HP Zero VOC Interior Eg-Shel.
5. Interior Metals (Not specified to receive other coating systems/not shop finished), Acrylic Paint Finish:
 - a. One Coat: Approved primer, in shop under other Sections (where specified). If not shop primed, provide primer recommended by finish coating manufacturer.
 - b. And Two Coats:
 - 1) Moore Ultra Spec 500 Interior Latex Semi-Gloss 539.

- 2) PPG Speedhide Zero VOC Interior Latex Semi-Gloss 6-4510XI.
 - 3) S-W ProMar 200 HP Zero VOC Interior Semi-Gloss.
6. Interior Exposed Steel, Joists, Ductwork, Conduit and Similar Items (where indicated), Dry-Fall or Dry-Fog Painted System:
 - a. One Coat:
 - 1) Moore Latex Dry Fall Flat 395 at 2.5 to 3.0 mils DFT.
 - 2) PPG Speedhide Super Tech WB Interior Dry-Fog Latex 6-725XI Flat at 2.0 to 2.5 mils DFT.
 - 3) S-W WB Pro Industrial Waterborne Acrylic Dryfall Flat B42 series at 2.5 to 3.0 mils DFT.
 - 4) Tnemec 115 WB Unibond at 2.5 to 3.0 mils DFT.
7. Interior Concrete Floor, Clear Exposed Sealer (Silicate type):
 - a. One Coat:
 - 1) Curecrete Chemical; Ashford Formula.
 - 2) Tnemec (Chem Probe); Series 629 CT Densifyer.
 - 3) WR Meadows; Liqui-Hard.
 - 4) Laticrete; L&M Seal Hard.
 - 5) Prosoco; Consolideck LS.
- D. Interior Paint Schedule, High Performance and Specialty Systems:
 1. Interior Gypsum Wallboard and Plaster at Laboratories, Toilet Rooms, and Other Wet Areas, Urethane Coating:
 - a. Surface Preparation: Cured, clean and dry, free of surface contaminants.
 - b. One Coat:
 - 1) Tnemec 201 Epoxoprime at 3.0- 4.0 mils DFT.
 - 2) PPG PMC Amerlock Sealer at 3.0 to 4.5 mils DFT.
 - 3) Dupont Hi-Solids Colar primer at 3.0 to 4.0 mils DFT.
 - 4) International Interseal 670 HS at 3.0 to 4.0 mils DFT.
 - c. And One Coat:
 - 1) Tnemec 280 Tneme-glaze at 6.0 to 8.0 mils DFT.
 - 2) PPG PMC Amercoat 351 Epoxy at 6.0 to 8.0 mils DFT.
 - 3) Dupont 100 % Solids Epoxy at 8.0-10.0 mils.
 - 4) International Interseal 670 HS at 3.0 to 4.0 mils DFT.
 - d. And One Coat:
 - 1) Tnemec 1080 or 1081 Endurashield WB at 3.0 to 3.5 mils DFT.
 - 2) PPG PMC AmerShield VOC at 2.0 to 3.0 mils DFT.
 - 3) Dupont WB Urethane at 3.5 to 4.0 mils DFT.
 - 4) International Water Borne Urethane at 3.0 to 4.0 mils DFT.

2. Interior Gypsum Wallboard, Epoxy/Acrylic Coating:
 - a. Surface Preparation: Cured, clean and dry, free of surface contaminants.
 - b. Two Coats: Tnemec 27WB at 8-10 mils DFT.
 - c. And One Coat: Tnemec 1028 at 2-3 mils DFT.
3. Interior Concrete Ceiling Surfaces in Dry Areas, Acrylic Paint Finish:
 - a. One Coat:
 - 1) Tnemec 151 Elasto-Grip at 2.0 mils DFT.
 - 2) PPG PMC Amerlock Sealer at 1.0 mils DFT.
 - 3) Dupont High Solids Acrylic Primer at 2.0 mils DFT.
 - 4) International Intercryl 520 at 3.0 mils DFT.
 - b. And Two Coats, Semi-Gloss Finish:
 - 1) Tnemec 1028/1029 Enduratone at 2.0 –3.0 mils DFT per coat min.
 - 2) PPG PMC Amercoat 220 at 3.0 mils DFT.
 - 3) Dupont High Solids Acrylic at 3.0 mils DFT.
 - 4) International Intercryl 530 at 3.0 mils DFT.
4. Interior Concrete Masonry Units, Epoxy/Acrylic Coating:
 - a. Surface Preparation: Cured, clean and dry, free of surface contaminants.
 - b. One Coat: Tnemec 130 Envirofil at 100 sqft/gal.
 - c. And One Coat: Tnemec 27WB at 8-10 mils DFT.
 - d. And One Coat: Tnemec 1028 at 2-3 mils DFT.
5. Interior Concrete Masonry Units, Epoxy/Urethane Coating:
 - a. Surface Preparation: Cured, clean and dry, free of surface contaminants.
 - b. One Coat:
 - 1) Tnemec 130 Envirofil at 100 sqft/gal.
 - 2) PPG PMC Nu-Klad 965 at 100 sqft/gal.
 - 3) Dupont 25P at 100 sq/ft/gal.
 - 4) International Acrylic Cementitious Block Filler at 80 sqft/gal.
 - c. And One Coat:
 - 1) Tnemec 280 Tneme-Glaze at 6.0 8.0 mils DFT.
 - 2) PPG PMC Amercoat 351 6.0 to 8.0 mils DFT.
 - 3) Dupont 100% Solids Epoxy at 7.0 to 9.0 mils DFT.
 - 4) International Interseal 670 HS at 8.0 to 10.0 mils DFT.
 - d. And One Coat:
 - 1) Tnemec 1080 or 1081 EnduraShield at 3.0 to 4.0 mils DFT.
 - 2) PPG PMC AmerShield VOC at 3.0 to 4.0 mils DFT.
 - 3) Dupont Imron WB Urethane at 3.0 to 4.0 mils DFT.
 - 4) International Water Borne Urethane at 3.0 to 4.0 mils DFT.

6. Interior Concrete Walls Exposed to View, Urethane Coating:
 - a. Surface Preparation: Cured, clean and dry, free of surface contaminants.
 - b. And One Coat:
 - 1) Tnemec 201 Epoxoprime at 3.0- 4.0 mils DFT.
 - 2) PPG PMC Amerlock Sealer at 3.0 to 4.5 mils DFT.
 - 3) Dupont Hi-Solids Colar primer at 3.0 to 4.0 mils DFT.
 - 4) International Interseal 670 HS at 3.0 to 4.0 mils DFT.
 - c. And One Coat:
 - 1) Tnemec 280 Tneme-glaze at 6.0 to 8.0 mils DFT.
 - 2) PPG PMC Amercoat 351 Epoxy at 6.0 to 8.0 mils DFT.
 - 3) Dupont 100 % Solids Epoxy at 8.0-10.0 mils.
 - 4) International Interseal 670 HS at 3.0 to 4.0 mils DFT.
 - d. And One Coat:
 - 1) Tnemec 1080 or 1081 EnduraShield at 3.0 to 3.5 mils DFT.
 - 2) PPG PMC AmerShield VOC at 2.0 to 3.0 mils DFT.
 - 3) Dupont WB Urethane at 3.5 to 4.0 mils DFT.
 - 4) International Water Borne Urethane at 3.0 to 4.0 mils DFT.
7. Interior Concrete Walls Exposed to View (Non-Immersion Service), Epoxy Coating:
 - a. Surface Preparation: Cured, clean and dry, free of surface contaminants.
 - b. One Coat:
 - 1) Tnemec 201 Epoxoprime at 2.0 to 3.0 mils DFT.
 - 2) PPG PMC Amerlock Sealer at 1.0 to 1.5 mils DFT.
 - 3) Dupont 25P Epoxy at 6.0 to 8.0 mils DFT.
 - 4) International Interseal 670 HS at 3.0 to 4.0 mils DFT.
 - c. And One Coat:
 - 1) Tnemec 280 Tneme-Glaze at 6.0 to 8.0 mils DFT.
 - 2) PPG PMC Amercoat 133 at 6.0 to 8.0 mils DFT.
 - 3) Dupont 100% Solids Epoxy at 8.0 to 10. mils DFT.
 - 4) International Interseal 670 HS at 3.0 to 4.0 mils DFT.
 - d. And One Coat:
 - 1) Tnemec 1080 or 1081 Endura-Shield 2.0 to 3 mils DFT.
 - 2) PPG PMC AmerShield VOC at 2.0 to 3.0 mils DFT.
 - 3) Dupont WB Urethane at 3.0 to 4.0 mils DFT.
 - 4) International Water Borne Urethane at 3.0 to 4.0 mils DFT.
8. Interior Concrete Ceiling (both new and previously painted), and Acoustical Plaster, Painted Finish:
 - a. Surface Preparation: Cured clean and dry.

- b. One Coat:
 - 1) Tnemec 151 Elasto-grip at 2.0 mils DFT.
 - 2) RD Coatings Multiprim at 1.0-2.0 mils DFT.
- c. And Two Coats:
 - 1) Tnemec 158 Biolastic at 8.0 mils DFT.
 - 2) RD Coatings ElastoFlex at 6.0 to 8.0 mils DFT.

Use the following for high performance and larger public projects (DCAMM Standard), includes painting metal railings, HM doors and frames:

- 9. Interior Metals (Not specified to receive other coating systems/not shop finished), Epoxy Painted Finish:
 - a. One Coat: Approved primer, in shop under other Sections (where specified). If not shop primed, provide primer recommended by finish coating manufacturer.
 - b. And One Coat:
 - 1) Tnemec 1029 Enduratone at 2.0 mils DFT.
 - 2) PPG PMC Amerlock 400 at 2.0 to 4.0 mils DFT.
 - 3) Dupont 25P at 3.0 to 4.0 mils DFT.
 - 4) International Interseal 670 HS at 3.0 mils DFT.
 - c. And One Coat:
 - 1) Tnemec 1029 Enduratone at 2.0 to 3.0 mils DFT.
 - 2) PPG PMC Amerlock 400 at 2.0 to 4.0 mils DFT.
 - 3) Dupont High Solids Acrylic Coating 3.0 mils DFT.
 - 4) International Intercryl 530 at 3.0 to 4.0 mils DFT.
- 10. Interior Exposed Steel, Joists, Ductwork, Conduit and Similar Items (where indicated), Dry-Fall or Dry-Fog Painted System:
 - a. One Coat:
 - 1) Moore Latex Dry Fall Flat 395 at 2.5 to 3.0 mils DFT.
 - 2) S-W WB Acrylic Dryfall B42 at 2.5 to 3.0 mils DFT.
 - 3) Tnemec 115 WB Unibond at 2.5 to 3.0 mils DFT.
 - 4) International Intercryl 530 at 2.5 to 3.0 mils DFT.
 - 5) PPG PMC Amercoat 220 Acrylic at 3.0 mils DFT.
 - 6) RD Coatings Muracryl at 2.0 to 3.0 mils DFT.
- 11. Mechanical Room Concrete Floor System, Waterborne Urethane, dry film thickness 28 mils: Surface preparation: Grind concrete; shot-blast not required.
 - a. Primer: RD Unifix at 1.0-1.5 mils DFT.
 - b. Second Coat: RD Elastodeck Slurry with broadcast aggregate, 25 mils DFT.
 - c. Third Coat: RD Monograph pigmented topcoat, 2-3 mils DFT.
- 12. Heavy Duty Mechanical Room Concrete Floor, Epoxy Coating System:

- a. One Coat:
 - 1) Tnemec 201 Epoxoprime at 4.0 to 6.0 mils DFT.
 - 2) Dex-O-Tex C Bond Coat at 6.0-7.0 mils DFT.
 - 3) RD Coatings Unifix at 2.0 mils DFT.
 - b. And One Coat:
 - 1) Tnemec 206 Flexible Epoxy Underlayment at 30 to 50 mils DFT.
 - 2) Dex-O-Tex Cheminert SC Membrane at 70-80 mils DFT.
 - 3) RD Coatings Elasto Deck at 50-80 mils DFT.
 - c. And One Coat:
 - 1) Tnemec 297 at 3.0 mils DFT.
 - 2) Dex-O-Tex Quik-Glaze at 7.0-8.0 mils DFT.
 - 3) RD Coatings Muracryl at 3.0 mils DFT.
- E. Eversource Transformer Vault:
- 1. Vault Walls and Ceiling (Concrete or CMU): Electrically safe epoxy paint.
 - a. Surface Preparation: Cured, clean and dry, free of surface contaminants.
 - b. One Coat: Tnemec 201 Epoxoprime at 3.0 to 4.0 mils DFT.
 - c. And Two Coats: Tnemec 280 Tnemegglaze at 6.0 to 8.0 mils DFT.
 - d. Color for Walls and Ceiling: White in accordance with ANSI standards.
 - 2. Vault Floor, Doorway Riser and Pads: Electrically safe epoxy paint.
 - a. Surface Preparation: Cured, clean and dry, free of surface contaminants. Shot-blast if recommended by manufacturer.
 - b. One Coat: Tnemec 208 Epoxoprime MVT at 6.0 to 8.0 mils DFT.
 - c. And One Coat: Tnemec 206 Subflex at 50 to 60 mils DFT.
 - d. And One Coat: Tnemec 281 Tnemegglaze at 6.0 to 8.0 mils DFT.
 - e. Vault Floor Color: ANSI light gray #70 as defined by ANSI Z55.1.
 - f. Equipment Pad and Doorway Risers Color: Yellow in accordance with ANSI and OSHA standards.
- F. Mechanical and Electrical Work: Paint all exposed items throughout the project except factory finished items with factory-applied baked enamel finishes which occur in mechanical rooms or areas, and excepting chrome or nickel plating, stainless steel, and aluminum other than mill finished. Paint all exposed ductwork and inner portion of all ductwork. Same as specified for other interior metals, hereinabove.

END OF SECTION

SECTION 101100

VISUAL DISPLAY SURFACES

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Markerboards.
 - 2. Tackboards.
 - 3. Marker wall coverings.
- B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council. Refer to Section 018110, SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 064020 - INTERIOR ARCHITECTURAL WOODWORK for custom wood trim for visual display surfaces.
 - 2. Section 099000 - PAINTING AND COATING for primers under marker wall covering.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. LEED Submittals:
 - 1. Manufacturers' product data for interior adhesives and sealants used at Project site, including printed statement of VOC content.
 - 2. Composite wood manufacturer's product data for each composite wood product used indicating that the bonding agent contains no added urea formaldehyde. Adhesive manufacturer's product data for each adhesive used indicating that the adhesive contains no added urea formaldehyde.
- C. Samples: For each type of visual display surface indicated, for units with factory-applied color finishes, and as follows:
 - 1. Actual sections of visual display surfaces.

VISUAL DISPLAY SURFACES

2. Fabric swatches fabric-faced tack assemblies.

D. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Show location of panel joints.
2. Show location of special-purpose graphics for visual display surfaces.
3. Include sections of typical trim members.

E. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for surface-burning characteristics of fabrics.

F. Maintenance Data: For visual display surfaces to include in maintenance manuals.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of visual display surface through one source from a single manufacturer.

B. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

C. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver factory-built visual display boards, including factory-applied trim where indicated, completely assembled in one piece without joints, where possible. If dimensions exceed maximum manufactured panel size, provide two or more pieces of equal length as acceptable to Architect. When overall dimensions require delivery in separate units, prefabricate components at the factory, disassemble for delivery, and make final joints at the site.

B. Store visual display units vertically with packing materials between each unit.

1.6 PROJECT CONDITIONS

A. Field Measurements: Verify dimensions 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 dimensions and proceed with fabricating visual display surfaces without field measurements. Coordinate wall construction to ensure that actual dimensions correspond to established dimensions.
2. Allow for trimming and fitting where taking field measurements before fabrication might delay the Work.

PART 2 - PRODUCTS

2.1 BASIS-OF-DESIGN

- A. Basis-of-Design Products: Refer to the Finish Schedule on the Drawings.

2.2 MARKERBOARD ASSEMBLIES

- A. Porcelain-Enamel Markerboard Assembly: Balanced, high-pressure, factory-laminated markerboard assembly of 3-ply construction consisting of backing sheet, core material, and 0.021-inch-thick, porcelain-enamel face sheet.
1. Available Manufacturers:
 - a. AACRO Products, Inc.
 - b. Claridge Products & Equipment, Inc.
 - c. Peter Pepper Products.
 - d. MooreCo; Best-Rite Manufacturing.
 - e. Steelcase Company; PolyVision products.
 2. Manufacturer's Standard Core: Minimum 1/4 inch thick, with manufacturer's standard moisture-barrier backing with binder containing no added urea formaldehyde.
 3. Fire Rating: ASTM E 84, Class A.
 4. Color: White, low gloss finish.
 5. Laminating Adhesive: Manufacturer's standard moisture-resistant thermoplastic type.
- B. Glass Markerboards: 6-mm tempered glass markerboard, with smooth polished edge and eased corners; color coated on back surface.
1. Clear Tempered Glass: ASTM C 1048, Kind FT, Condition A, Type I, Class 1, Quality Q3, with exposed edges seamed before tempering.
 2. Mounting: Round, stainless-steel standoffs, holding glass approximately 1 inch from wall surface; mounted in notches in standoffs at top and bottom edges of markerboard.
 3. Color and Surface: As selected by the Architect.
 4. Marker Tray: Glass, supported by stainless-steel clips.

2.3 TACKBOARD ASSEMBLIES

- A. Linoleum Resilient Tackboard: Uni-color linoleum resilient homogeneous tackable surface consisting of linseed oil, granulated cork, rosin binders and dry pigments calendared onto a natural burlap backing with integral color throughout with surface-burning characteristics indicated.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Forbo Industries; Bulletin Board.
 - b. WallTalkers; Tac-wall.
 2. Thickness: 1/4 inch.

3. Manufacturer's Standard Core: Minimum 1/4 inch thick, with manufacturer's standard backing with binder containing no added urea formaldehyde.
4. Fire Rating: ASTM E 84, Class A.
5. Colors: Refer to Finish Schedule.

B. Fabric-Wrapped Tackboard:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Claridge Products & Equipment, Inc.
 - b. Egan Visual Inc.
 - c. MooreCo; Best-Rite Manufacturing.
 - d. Peter Pepper Products.
 - e. Steelcase Company.
2. Manufacturer's Standard Core: Minimum 1/4 inch thick, with manufacturer's standard backing with binder containing no added urea formaldehyde.
3. Fire Rating: ASTM E 84, Class A.
4. Fabric Facing Material, Colors and Patterns: Refer to Finish Schedule.

2.4 VISUAL DISPLAY WALL COVERINGS

- 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. Best-Rite Manufacturing.
 2. Egan Visual Inc.
 3. Marsh Industries, Inc.; Visual Products Group.
 4. Omnova Solutions Inc.; Decorative Products; Commercial Wallcovering.
 5. WallTalkers; a division of RJF International Corporation.
- B. Visual Display Wall Covering: Intended for use with dry-erase markers and as a projection surface and consisting of moderate-gloss, plastic film bonded to fabric backing; not less than 0.020-mil total thickness.
1. Surface Graphics: 2-inch-square grid.
 2. Color: As selected by Architect from manufacturer's full range.
- C. Magnetic Visual Display Wall Covering: Intended for use with dry-erase markers and magnetic aids and consisting of moderate-gloss plastic film bonded to ferrous-powdered fabric backing; not less than 0.025-mil total thickness.
1. Color: As selected by Architect from manufacturer's full range.
- D. Primer/Sealer: Mildew-resistant primer/sealer complying with requirements in Section 099000 - PAINTING AND COATING and recommended in writing by wall covering manufacturer for intended substrate.

2.5 ACCESSORIES

- A. Aluminum Frames and Trim: Factory-applied, fabricated from not less than 0.062-inch-thick, extruded aluminum; of size and shape indicated.
 - 1. Chalk/Marker Tray: Manufacturer's standard, continuous tray.
- B. Adhesive: Mildew-resistant, nonstaining adhesive, for use with specific visual display surfaces and substrate application, as recommended in writing by visual display surface manufacturer.
 - 1. Adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.6 FABRICATION

- A. Porcelain-Enamel Visual Display Assemblies: Laminate porcelain-enamel face sheet and backing sheet to core material under heat and pressure with manufacturer's standard flexible, waterproof adhesive.
- B. Factory-Assembled Visual Display Units: Coordinate factory-assembled units with trim and accessories indicated. Join parts with a neat, precision fit.
- C. Aluminum Frames and Trim: Fabricate units straight and of single lengths, keeping joints to a minimum. Miter corners to neat, hairline closure.

2.7 ALUMINUM FINISHES

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
- D. Class II, Clear Anodic Finish: AA-M12C22A31 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class II, clear coating 0.010 mm or thicker) complying with AAMA 611.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances, surface conditions of wall, and other conditions affecting performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Remove dirt, scaling paint, projections, and depressions that will affect smooth, finished surfaces of visual display boards.
- B. Prepare surfaces to achieve a smooth, dry, clean surface free of flaking, unsound coatings, cracks, defects, and substances that will impair bond between visual display boards and surfaces.

3.3 INSTALLATION

- A. General: Install visual display surfaces in locations and at mounting heights indicated on Drawings. Keep perimeter lines straight, level, and plumb. Provide grounds, clips, backing materials, adhesives, brackets, anchors, trim, and accessories necessary for complete installation.
 - 1. Join adjacent wall panels with concealed steel splines for smooth alignment.
 - 2. Where markerboards abut, install with clean, trimless butt joints.

3.4 CLEANING AND PROTECTION

- A. Clean visual display surfaces according to manufacturer's written instructions. Attach one cleaning label to visual display surface in each room.
- B. Touch up factory-applied finishes to restore damaged or soiled areas.
- C. Cover and protect visual display surfaces after installation and cleaning.

END OF SECTION

SECTION 101400

SIGNAGE

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Code-required interior panel signage, including but not limited to, accessibility signage, toilet room signage and mechanical and electrical room signage.
- B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council. Refer to Section 018110, SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Division 26 - ELECTRICAL for illuminated exit signs.

1.3 SUBMITTALS

- A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of sign.
- B. Shop Drawings: Include plans, elevations, and large-scale sections of typical members and other components. Show mounting methods, grounds, mounting heights, layout, spacing, reinforcement, accessories, and installation details.
 - 1. Provide message list for each sign, including large-scale details of wording, lettering, artwork, and braille layout.
- C. Samples for Verification: For each type of sign, include the following Samples to verify color selected:
 - 1. Panel Signs: Full-size Samples of each type of sign required.
 - 2. Approved samples will not be returned for installation into Project.
- D. Maintenance Data: For signage cleaning and maintenance requirements to include in maintenance manuals.

1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain each sign type through one source from a single manufacturer.
- B. Regulatory Requirements: Comply with the Massachusetts Architectural Access Board, Americans with Disabilities Act (ADA) and with code provisions as adopted by authorities having jurisdiction.

1.5 PROJECT CONDITIONS

- A. Field Measurements: Where sizes of signs are determined by dimensions of surfaces on which they are installed, verify dimensions by field measurement before fabrication and indicate measurements on Shop Drawings.

1.6 COORDINATION

- A. For signs supported by or anchored to permanent construction, advise installers of anchorage devices about specific requirements for placement of anchorage devices and similar items to be used for attaching signs.

PART 2 - PRODUCTS

2.1 PANEL SIGNS

- A. General: Provide signs that comply with requirements indicated for materials, thicknesses, finishes, colors, designs, shapes, sizes, and details of construction as indicated. Produce smooth panel sign surfaces constructed to remain flat under installed conditions within tolerance of plus or minus 1/16 inch measured diagonally. Provide the following:

- 1. Code-Required Signs for Certificate of Occupancy:

- a. Type: Photopolymer on acrylic or printed acrylic / aluminum as applicable.
- b. Color: Selected from manufacturer's standard colors including metallic silver, off white, champagne, light gray, dark red, dark green, dark blue, dark bronze, charcoal.
- c. Color: Custom color as selected.
- d. Type Size: As selected.
- e. Typeface: As selected.

- 2. Interior Signs Based on Owner's Requirements:

- a. Type: Photopolymer on acrylic or printed acrylic as applicable.
- b. Color: Selected from manufacturer's standard colors including metallic silver, off white, champagne, light gray, dark red, dark green, dark blue, dark bronze, charcoal.
- c. Color: Custom color as selected.
- d. Type Size: As selected.
- e. Typeface: As selected.

- 3. Exterior Signs:

- a. Type: As indicated on the Drawings.
 - b. Type – Entrance: Fabricated [monolithic] [curved panel] aluminum sign with [masked and painted] [dimensional] [stencil cut] graphics and [non-] [internally] illuminated.
 - b. Type – Wall: Fabricated aluminum panel with [masked and painted] [dimensional] [stencil cut] graphics and [non-] [halo] [internally] illuminated.
 - c. Type – Wall: Fabricated [aluminum] [stainless steel] [painted] letters and [non-] [halo] [internally] illuminated.
 - d. Type – Directional: Fabricated aluminum sign, 3 inches deep, double post and panel, vinyl graphics.
 - e. Type – Regulatory: Single 18 by 12 by 0.125 inches painted aluminum panel on a 2 inch square aluminum post, vinyl graphics.
4. Specialty Signs:
- a. Type: Custom as indicated on the Drawings.
- B. Tactile and Braille Copy: Manufacturer's standard process for producing copy complying with ADA Accessibility Guidelines and 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.
- 1. Raised-Copy Thickness: Not less than 1/32 inch
- C. Symbols of Accessibility: Provide 6-inch- high symbol fabricated from opaque nonreflective vinyl film, 0.0035-inch nominal thickness, with pressure-sensitive adhesive backing suitable for both exterior and interior applications.
- 2.2 ACCESSORIES
- A. Mounting Methods: Use double-sided vinyl tape fabricated from materials that are not corrosive to sign material and mounting surface.
 - B. Anchors and Inserts: Provide nonferrous-metal or hot-dip galvanized anchors and inserts for exterior installations and elsewhere as required for corrosion resistance. Use toothed steel or lead expansion-bolt devices for drilled-in-place anchors. Furnish inserts, as required, to be set into concrete or masonry work.

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 provided under other sections of Work are sized and located to accommodate signs.
- C. Examine supporting members to ensure that surfaces are at elevations indicated or required to comply with authorities having jurisdiction and are free from dirt and other deleterious matter.

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

3.2 INSTALLATION

- A. General: Locate signs and accessories where indicated, using mounting methods of types described and in compliance with manufacturer's written instructions.
 - 1. Install signs level, plumb, and at heights indicated, with sign surfaces free from 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 Panel Signs: Attach panel signs to wall surfaces using methods indicated below:
 - 1. Vinyl-Tape Mounting: Use double-sided foam tape to mount signs to smooth, nonporous surfaces. Do not use this method for vinyl-covered or rough surfaces.

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 the Architect.

END OF SECTION

SECTION 102110

TOILET COMPARTMENTS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Solid plastic toilet compartments and screens, floor-mounted and overhead braced.
 - 2. Solid plastic toilet compartments and screens, ceiling-hung.
- B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council. Refer to Section 018110, SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 102800 - Toilet Accessories for partition mounted accessories.

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. LEED Submittals:
 - 1. Product data indicating percentage by weight of post-consumer and pre-consumer recycled content for products having recycled content. Include a statement indicating costs for each product having recycled content.
- C. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
 - 1. Show locations of cutouts for compartment-mounted toilet accessories.
- D. Samples for Verification: Of each type of color and finish required for units, prepared on 6-inch-square Samples of same thickness and material indicated for Work.

1.4 QUALITY ASSURANCE

- A. Fire Hazard Classification: Passes NFPA 286.
- B. Regulatory Requirements: Comply with applicable provisions of Massachusetts Architectural Access Board and the Americans with Disabilities Act (ADA), "Accessibility Guidelines for Buildings and Facilities (ADAAG) for compartment door operating hardware and compartments designated as accessible."
- C. Regulatory Requirements: Comply with applicable provisions of ICC A117.1 and the Americans with Disabilities Act (ADA), "Accessibility Guidelines for Buildings and Facilities (ADAAG) for compartment door operating hardware and compartments designated as accessible."

1.5 PROJECT CONDITIONS

- A. Field Measurements: Verify actual locations of walls, columns, ceilings, and other construction contiguous with toilet compartments 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 dimensions and proceed with fabricating toilet compartments without field measurements. Coordinate wall, floor, ceilings, and other contiguous construction to ensure that actual dimensions correspond to established dimensions.

1.6 COORDINATION

- A. Coordinate with the work of Section 061000 - ROUGH CARPENTRY for locations requiring wood blocking or flat plate reinforcing within partitions for compartment mounting.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Accurate Partitions Corporation.
 - 2. General Partitions Mfg. Corp.
 - 3. Global Partitions.
 - 4. Scranton Products

2.2 RECYCLED PLASTIC UNITS

- A. Stainless-Steel Sheet: ASTM A 666, Type 304, stretcher-leveled standard of flatness.
- B. Stainless-Steel Castings: ASTM A 743/A 743M.
- C. Door, Panel, and Pilaster Construction: Solid, recycled high-density polyethylene (HDPE) material, not less than 1 inch thick, seamless, with eased edges, and with homogenous color and pattern throughout thickness of material.

1. Color and Pattern: One color and pattern in each room as selected by Architect from manufacturer's full range of colors and patterns.
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.

D. Brackets and Fittings: Manufacturer's standard designs.

1. Material: Stainless steel.
2. Full-Height (Continuous) Type Brackets: Stainless steel.
3. Pilaster Shoes and Sleeves (Caps): Stainless-steel sheet, not less than 0.031-inch nominal thickness and 3 inches high, finished to match hardware.
4. Stainless-Steel Finish: No. 4 bright, directional polish on exposed faces. Protect exposed surfaces from damage by application of strippable, temporary protective covering before shipment.

2.3 ACCESSORIES

A. Hardware and Accessories: Manufacturer's standard design, heavy-duty operating hardware and accessories.

1. Material: Stainless steel.
2. Coat Hook: Manufacturer's standard combination hook and rubber-tipped bumper, sized to prevent in-swinging door from hitting compartment-mounted accessories.

B. Overhead Bracing: Manufacturer's standard continuous, extruded-aluminum head rail with antigrip profile and in manufacturer's standard finish.

C. Anchorages and Fasteners: Manufacturer's standard exposed fasteners of stainless steel or chrome-plated steel or brass, finished to match hardware, with theft-resistant-type heads. Provide sex-type bolts for through-bolt applications. For concealed anchors, use hot-dip galvanized or other rust-resistant, protective-coated steel.

2.4 FABRICATION

A. Floor-Mounted, 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.

B. Ceiling-Hung Units: Provide manufacturer's standard corrosion-resistant anchoring assemblies with leveling adjustment nuts at pilasters for connection to structural support above finished ceiling. Provide assemblies that support pilasters from structure without transmitting load to finished ceiling. Provide sleeves (caps) at tops of pilasters to conceal anchorage.

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 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-Mounted, Overhead-Braced Units: Secure pilasters to floor and level, plumb, and tighten. Set pilasters with anchors penetrating not less than 1-3/4 inches into structural floor unless otherwise indicated in manufacturer's written instructions. Secure continuous head rail to each pilaster with no fewer than two fasteners. Hang doors to align tops of doors with tops of panels, and adjust so tops of doors are parallel with overhead brace when doors are in closed position.
- C. Ceiling-Hung Units: Secure pilasters to supporting structure and level, plumb, and tighten. Hang doors and adjust so bottoms of doors are level with bottoms of pilasters when doors are in closed position.
- D. Wall-Hung Urinal Screens: Attach with anchoring devices to suit supporting structure. Set units level and plumb and to resist lateral impact.

3.2 ADJUSTING

- A. Hardware Adjustment: Adjust and lubricate hardware according to 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 and doors in entrance screens to return doors to fully closed position.

END OF SECTION

SECTION 102120
CUBICLE CURTAINS AND TRACKS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Curtain tracks and curtain carriers, manual operation.
 - 2. Cubicle curtains.
- B. Sustainable Design Intent: Refer to Section 018110 - SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 061000 - ROUGH CARPENTRY for wood blocking for mounting items requiring anchorage.
 - 2. Section 116143 - THEATRICAL DRAPERY for other curtains.

1.3 PERFORMANCE REQUIREMENTS

- A. Curtains: Provide curtain fabrics with the following characteristics:
 - 1. Fabrics are launderable to a temperature of not less than 160 deg F.
 - 2. Fabrics are flame resistant and are identical to those that have passed NFPA 701, with no chemical flame retardants, when tested by a testing and inspecting agency acceptable to authorities having jurisdiction.
 - a. Identify fabrics with appropriate markings of applicable testing and inspecting agency.

1.4 SUBMITTALS

- A. Product Data: For each product indicated.
 - 1. Include durability, laundry temperature limits, fade resistance, and fire-test-response characteristics for each type of curtain fabric indicated.
- B. LEED Submittals:
 - 1. Low-Emitting Materials, General Emissions Evaluation: Building products must be tested and determined compliant in accordance with California Department of Public Health (CDPH) Standard Method v1.1–2010, using the applicable exposure scenario.

- a. For fabric curtain materials, submit GreenGuard Gold certification.
 - C. Shop Drawings: Show layout and types of cubicles, sizes of curtains, number of carriers, anchorage details, and conditions requiring accessories. Indicate dimensions taken from field measurements.
 - 1. Include details on blocking.
 - D. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:
 - 1. Suspended ceiling components.
 - 2. Structural members to which suspension systems will be attached.
 - 3. Items penetrating finished ceiling, including the following:
 - a. Lighting fixtures.
 - b. Air outlets and inlets.
 - c. Speakers.
 - d. Sprinklers.
 - e. Access panels.
 - 4. Coordinate with other Division 09 Sections for ceilings.
 - E. Samples for Initial Selection: For each type of curtain material indicated.
 - F. Samples for Verification: For each type of product required, prepared on Samples of size indicated below.
 - 1. Curtain Fabric: 12-inch-square swatch or larger as required to show complete pattern repeat, from dye lot used for the Work, with specified treatments applied. Mark top and face of material.
 - 2. Mesh Top: Not less than 4 inches square.
 - 3. Curtain Track: Not less than 4 inches long.
 - 4. Curtain Carrier: Full-size unit.
 - G. Curtain and Track Schedule: Use same designations indicated on Drawings.
 - H. Manufacturer Certificates: Signed by manufacturers certifying that products comply with requirements.
 - I. Operation and Maintenance Data: For curtains, track, and hardware to include in operation and maintenance manuals.
- 1.5 PROJECT CONDITIONS
- A. Environmental Limitations: Do not install cubicles 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.

PART 2 - PRODUCTS

2.1 CURTAIN TRACKS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. AR Nelson.
 - 2. Crowder, K. N. Manufacturing, Inc.
 - 3. Cubicle Curtain Factory.
 - 4. General Cubicle Company, Inc.
 - 5. InPro Corporation.
 - 6. Silent Gliss USA Inc.
- B. Extruded-Aluminum Track: Not less than 1-1/4 inches wide by 3/4 inch high; with minimum wall thickness of 0.062 inch.
 - 1. Basis of Design: AR Nelson; Model No. 1100CT, suspended cubicle track.
 - 2. Finish: Clear anodized.
- C. Track Accessories: Fabricate splices, end caps, connectors, end stops, coupling and joining sleeves, wall flanges, brackets, ceiling clips, and other accessories from same material and with same finish as track.
 - 1. Curtain Carriers: Two nylon rollers and nylon axle with chrome-plated steel hook.
 - 2. Exposed Fasteners: Stainless steel.
 - 3. Concealed Fasteners: Stainless steel.

2.2 CURTAINS

- A. Healthier Hospitals Initiative (HHI): Products shall comply with requirements of Safer Chemicals Challenge: Healthy Interiors.
 - 1. Furniture and furnishings shall eliminate the use of formaldehyde, perfluorinated compounds, polyvinyl chloride (PVC), antimicrobials, and all flame retardants.
- B. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Architex.
 - 2. Carnegie.
 - 3. Maharam.
- C. Cubicle Curtain Fabric: Curtain manufacturer's standard, 100 percent Trevira CS polyester, inherently and permanently flame resistant, stain resistant, and antimicrobial, without added treatments.
 - 1. Color and Pattern: As selected by the Architect from manufacturer's full range.
- D. Curtain Grommets: Two-piece, rolled-edge, rustproof, nickel-plated brass; spaced not more than 6 inches o.c.; machined into top hem.
- E. Mesh Top: No. 40 nylon mesh, minimum. White color.
- F. Curtain Tieback: Nickel-plated brass chain; one at each curtain termination.

2.3 CURTAIN FABRICATION

- A. Fabricate curtains to comply with the following requirements:
1. Width: Equal to track length from which curtain is hung plus 10 percent added fullness, but not less than 12 inches added fullness.
 2. Length: Equal to floor-to-ceiling height, with 20-inch mesh top, and minus distance above the finished floor at bottom as follows:
 - a. Cubicle Curtains: 12 inches.
 3. Top Hem: Not less than 1 inch and not more than 15 1/2 inches wide, triple thickness, reinforced with integral web, and double lock stitched.
 4. Mesh Top: Top hem not less than 1 inch and not more than 15 1/2 inches wide, triple thickness, reinforced with integral web, and double lock stitched. Double lock stitch bottom of mesh directly to 1/25 inch triple thickness, top hem of curtain fabric.
 5. Bottom Hem: 1 inch double thickness and single lock stitched.
 6. Side Hems: Not less than 1/2 inch and not more than 15 1/4 inches wide, with double turned edges, and single lock stitched.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances, and other conditions affecting performance of work.
1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Install tracks level and plumb, according to manufacturer's written instructions. Provide track fabricated from one continuous length.
1. Curtain Track Mounting: As indicated on Drawings.
- B. Surface Track Mounting: Fasten surface mounted tracks at intervals of not less than 24 inches. Fasten support at each splice and tangent point of each corner. Center fasteners in track to ensure unencumbered carrier operation. Attach track to ceiling as follows:
1. Mechanically fasten directly to bottom of concrete deck with anchor screws.
 2. Mechanically fasten directly to finish ceiling with toggle bolts.
 3. Mechanically fasten to suspended ceiling grid with screws.
- C. Suspended Track Mounting: Install track with suspended supports at intervals of not more than 84 inches. Fasten support at each splice and tangent point of each corner. Secure ends of track to wall with flanged fittings or brackets.
- D. Track Accessories: Install splices, end caps, connectors, end stops, coupling and joining sleeves, and other accessories as required for a secure and operational installation.
- E. Curtain Carriers: Provide curtain carriers adequate for 6-inch spacing along full length of curtain plus an additional carrier.
- F. Curtains: Hang curtains on each curtain track. Secure with curtain tieback.

3.3 PROTECTION

- A. Protect installed recessed track openings with nonresidue adhesive tape to prevent construction debris from impeding carrier operation. Remove tape prior to Substantial Completion.

END OF SECTION

SECTION 102610

CORNER GUARDS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Corner guards.
- B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council. Refer to Section 018110, SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 055000 - METAL FABRICATIONS for steel angle type guards, custom fabricated.
 - 2. Section 087100 - DOOR HARDWARE for metal armor, kick, mop, and push plates.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below.
 - 1. Corner Guards: 12 inches long.

1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain corner guards from single source from single manufacturer.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store units in original undamaged packages and containers inside well-ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity.

PART 2 - PRODUCTS

2.1 CORNER GUARDS

- A. Surface-Mounted, Metal Corner Guards: Fabricated from 1-piece, formed or extruded metal with formed edges; with 90- or 135-degree turn to match wall condition.
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Balco, Inc.
 - b. Boston Retail Products.
 - c. Construction Specialties, Inc.
 - d. IPC Door and Wall Protection Systems; Division of InPro Corporation.
 - e. Korogard Wall Protection Systems; Division of RJF International Corporation.
 - f. Nystrom Building Products.
 - g. Pawling Corporation.
 - 2. Material: ASTM A 240, Stainless steel, Type 304.
 - a. Thickness: Minimum 0.0781 inch.
 - b. Finish: Directional satin, No. 4.
 - 3. Wing Size: Nominal 3-1/2 by 3-1/2 inches.
 - 4. Height: Refer to Drawings.
 - 5. Corner Radius: 1/8 inch.
 - 6. Mounting: Flat-head, countersunk screws through factory-drilled mounting holes.
- B. Fasteners: Stainless-steel screws, compatible with items being fastened. Use security-type fasteners where exposed to view.

2.2 FABRICATION

- A. Fabricate units to comply with requirements indicated for design, dimensions, and member sizes, including thicknesses of components.
- B. Fabricate components with exposed edges rolled. Provide surfaces free of wrinkles, chips, dents, uneven coloration, and other imperfections. Fabricate members and fittings to produce flush, smooth, and rigid hairline joints.
- C. Assemble components in factory to greatest extent possible to minimize field assembly. Disassemble only as necessary for shipping and handling.

2.3 METAL FINISHES

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
 - 1. Remove tool and die marks and stretch lines or blend into finish.
 - 2. Grind and polish surfaces to produce uniform, directionally textured, polished finish indicated, free of cross scratches. Run grain with long dimension of each piece.

- B. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.
- C. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

2.4 STAINLESS-STEEL FINISHES

- A. Remove tool and die marks and stretch lines or blend into finish.
- B. Grind and polish surfaces to produce uniform, polished finish indicated, free of cross scratches.
 - 1. Run grain of directionally textured finishes with long dimension of each piece.
- C. Directional Satin Finish: No. 4 finish.
- D. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and wall areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.
- B. Examine walls to which units will be attached for blocking, grounds, and other solid backing that have been installed in the locations required for secure attachment of support fasteners.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Complete finishing operations, including painting, before installing wall protection system components.
- B. Before installation, clean substrate to remove dust, debris, and loose particles.

3.3 INSTALLATION

- A. General: Install units level, plumb, and true to line without distortions. Do not use materials with chips, cracks, voids, stains, or other defects that might be visible in the finished Work.
 - 1. Provide mounting hardware, anchors, and other accessories required for a complete installation.

3.4 CLEANING

- A. Immediately after completion of installation, clean corner guards and accessories using a low VOC, non-ammonia-, non-chlorine, and non-solvent-based, household cleaning agent.

END OF SECTION

SECTION 102800

TOILET ACCESSORIES

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Toilet accessories as scheduled on the Drawings. Coordinate with Owner for accessories provided by Owner.
- B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council. Refer to Section 018110, SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 061000 - ROUGH CARPENTRY for blocking.
 - 2. Section 088000 - GLAZING for frameless mirrors.

1.3 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 on Drawings.
 - 2. Identify products using designations indicated on Drawings.
- C. Maintenance Data: For toilet accessories to include in maintenance manuals.

1.4 QUALITY ASSURANCE

- A. Source Limitations: For products listed together in the same articles in Part 2, provide products of same manufacturer unless otherwise approved by Architect.

1.5 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.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. A & J Washroom Accessories, Inc.
 - 2. American Specialties, Inc.
 - 3. Bobrick Washroom Equipment, Inc.
 - 4. Bradley Corporation.

2.2 MATERIALS

- A. Stainless Steel: ASTM A 666, Type 304, 0.0312-inch minimum nominal thickness, unless otherwise indicated.
- B. Steel Sheet: ASTM A 1008/A 1008M, Designation CS (cold rolled, commercial steel), 0.0359-inch (0.9-mm) minimum nominal thickness.
- C. Galvanized Steel Mounting Devices: ASTM A 153/A 153M, hot-dip galvanized after fabrication.
- D. 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.

2.3 FABRICATION

- A. General: Fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with full-length, continuous hinges. Equip units for concealed anchorage and with corrosion-resistant backing plates.
- B. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to the Owner.

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 method in 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

SECTION 104100

EMERGENCY ACCESS AND INFORMATION CABINETS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Fire department key vault box.
- B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council. Refer to Section 018110, SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 042000 - UNIT MASONRY for substrate.
 - 2. Section 061000 - ROUGH CARPENTRY for wood blocking.

1.3 SUBMITTALS

- A. Product Data: Submit manufacturer's product data, installation instructions, use limitations and recommendations for each product and system used. Provide manufacturer's certifications stating that products and systems comply with requirements.
- B. Shop Drawings: Provide large scale shop drawings for fabrication, installation and erection of all parts of the work. Provide plans, elevations, and details of anchorage, connections and accessory items. Provide installation templates for work installed by others.
- C. Contractor's Review: Before commencing work, submit signed statement that Contract Documents have been reviewed with a qualified representative of supplier/manufacturer, and that selected materials and construction are proper, compatible, and adequate for application shown.

PART 2 - PRODUCTS

2.1 FIRE DEPARTMENT KEY VAULT BOX

- A. Fire Department Key Vault Box: Provide at building entrance; location shall be acceptable to local Fire Department.
 - 1. Basis of Design: Knox Company; Model 3200 Knox-Box, Recessed Mounted Type.
 - 2. Finish: Weather resistant TGIC polyester powder coat, color as selected by local Fire Department.
 - 3. Locking: Provide lock and keys acceptable to local Fire Department.
 - 4. Building Alarm Interface: Provide tamper switch interface with building alarm system.
 - 5. Accessories:
 - a. Provide manufacturer's standard recessed mounting kit, for installation in specified construction.
 - b. Provide alarm tamper switches, UL listed.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Rough-In Work: Examine installation of walls and other conditions under which work is to be installed; verify dimensions of services and substrates before fabricating work.
- B. Notify Contractor of unsatisfactory locations and dimensions of other work and of unsatisfactory conditions for proper installation of equipment. Do not proceed with fabrication and installation until unsatisfactory dimensions and conditions have been corrected in manner satisfactory to Installer.

3.2 FIRE DEPARTMENT KNOX BOX INSTALLATION

- A. General: Set each item of equipment securely in place, level, and adjust to correct height, 4 ft. - 0 in. AFF, unless otherwise required by local Fire Department.
- B. Anchor to supporting substrate where indicated and where required for sustained operation and use without shifting or dislocation. Conceal anchorage where possible. Seal perimeter joints in accordance with Section 079200 - JOINT SEALANTS.

3.3 CLEANING

- A. After completion of installation and other major work remove protective coverings, if any, and clean equipment, internally and externally. Restore exposed and semi-exposed finishes to remove abrasions and other damages; polish exposed-metal surfaces and touch-up painted surfaces. Replace work that cannot be successfully restored.

END OF SECTION

SECTION 104400

FIRE-PROTECTION SPECIALTIES

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Portable fire extinguishers.
 - 2. Fire-protection cabinets for portable fire extinguishers.
 - 3. Mounting brackets for fire extinguishers.
- B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council. Refer to Section 018110, SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 099000 - PAINTING AND COATING for field painting fire-protection cabinets.
 - 2. Division 21 - FIRE PROTECTION for fire hose valves and standpipes.

1.3 SUBMITTALS

- A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each item.
 - 1. Fire Extinguishers: Include rating and classification.
 - 2. Fire-Protection Cabinets: Include roughing-in dimensions, details showing mounting methods, relationships of box and trim to surrounding construction, door hardware, cabinet type, trim style, and panel style.
- B. Maintenance Data: For fire extinguishers and fire-protection cabinets to include in maintenance manuals.

1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain fire extinguishers and fire-protection cabinets through one source from a single manufacturer.

FIRE-PROTECTION SPECIALTIES

- B. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."
- C. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.
- D. Fire-Rated Fire-Protection Cabinets: Listed and labeled to comply with requirements of ASTM E 814 for fire-resistance rating of walls where they are installed.

1.5 COORDINATION

- A. Coordinate size of fire-protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.

PART 2 - PRODUCTS

2.1 PORTABLE FIRE EXTINGUISHERS

- A. General: Provide fire extinguishers of type, size, and capacity for each fire-protection cabinet and mounting bracket indicated.
- B. Multipurpose Dry-Chemical Type in Steel Container: UL-rated 2-A:10-B:C, 5-lb nominal capacity, with monoammonium phosphate-based dry chemical in enameled-steel container.

2.2 FIRE-PROTECTION CABINET

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. JL Industries, Inc.
 - 2. Larsen's Manufacturing Company.
 - 3. Nystrom Building Products.
 - 4. Potter Roemer; Div. of Smith Industries, Inc.
- B. Cabinet Type: Suitable for fire extinguisher.
- C. Cabinet Material: Enameled-steel sheet.
- D. Recessed Cabinet: Cabinet box recessed in walls of sufficient depth to suit style of trim indicated.
 - 1. Trimless with Plaster Stop: Surface of surrounding wall finishes flush with exterior finished surface of cabinet frame and door, without overlapping trim attached to cabinet. Provide recessed flange, of same material as box, attached to box to act as plaster stop. If wall condition does not allow for trimless with plaster stop, provide flat 5/16 inch trim of same material as the cabinet box.
- E. Semirecessed Cabinet: One-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend).
 - 1. Square-Edge Trim: 1-1/4- to 1-1/2-inch backbend depth.

- F. Door Material: Steel sheet with baked enamel finish, color as selected.
- G. Door Style: Vertical duo panel with frame.
- H. Door Glazing: Tempered glass.
- I. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.
- J. Accessories:
 - 1. Mounting Bracket: Manufacturer's standard steel, designed to secure fire extinguisher to fire-protection cabinet, of sizes required for types and capacities of fire extinguishers indicated, with plated or baked-enamel finish.
 - 2. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated by Architect.

2.3 MOUNTING BRACKETS

- A. Mounting Brackets: Manufacturer's standard steel, designed to secure fire extinguisher to wall or structure, of sizes required for types and capacities of fire extinguishers indicated, with plated or baked-enamel finish.
- B. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated by Architect.

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. Construct fire-rated cabinets with double walls fabricated from 0.0428-inch-thick, cold-rolled steel sheet lined with minimum 5/8-inch-thick, fire-barrier material.
 - a. Provide factory-drilled mounting holes.
- B. Cabinet Doors: Fabricate doors according to manufacturer's standards, from materials indicated and coordinated with cabinet types and trim styles selected.
 - 1. Fabricate door frames with tubular stiles and rails and hollow-metal design, minimum 1/2 inch thick.
 - 2. Miter and weld perimeter door frames.
- C. Cabinet Trim: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

2.5 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. Finish fire-protection cabinets after assembly.
- D. 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.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine walls and partitions for suitable framing depth and blocking where recessed cabinets will be installed.
- B. Examine fire extinguishers for proper charging and tagging. Contractor shall be responsible for fire extinguisher tagging by a certified service technician located within 75 miles of the project.
 - 1. Remove and replace damaged, defective, or undercharged units.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prepare recesses for recessed fire-protection cabinets as required by type and size of cabinet and trim style.

3.3 INSTALLATION

- A. General: Install fire-protection specialties in locations and at mounting heights indicated on the Drawings and acceptable to authorities having jurisdiction.
- B. Fire-Protection Cabinets: Fasten fire-protection cabinets to structure, square and plumb.
 - 1. Unless otherwise indicated, provide recessed fire-protection cabinets. If wall thickness is not adequate for recessed cabinets, provide semirecessed fire-protection cabinets.
 - 2. Fasten mounting brackets to inside surface of fire-protection cabinets, square and plumb.
- C. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated.
- D. Identification: Apply vinyl lettering at locations indicated.

3.4 INSTALLATION OF FIRE-RATED CABINETS

- A. Install cabinet with not more than 1/16-inch tolerance between pipe OD and knockout OD. Center pipe within knockout.

- B. Seal through penetrations with firestopping sealant as specified in Section 078410 - PENETRATION FIRESTOPPING.

3.5 ADJUSTING AND CLEANING

- A. Remove temporary protective coverings and strippable films, if any, as fire-protection specialties 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 manufacturer.
- 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

SECTION 105110

METAL LOCKERS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Metal wardrobe lockers.
 - 2. Metal athletic lockers.
 - 3. Locker benches.
- B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council. Refer to Section 018110, SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 061000 - ROUGH CARPENTRY for furring, blocking, and shims required for installing metal lockers and concealed within other construction before metal locker installation.

1.3 SUBMITTALS

- A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of metal locker and bench.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
 - 1. Show base, top, trim and other accessories.
 - 2. Include locker identification system.
- C. Maintenance Data: For adjusting, repairing, and replacing locker doors and latching mechanisms to include in maintenance manuals.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: An authorized representative of metal locker manufacturer for installation and maintenance of units required for this Project.

- B. Source Limitations: Obtain metal lockers and accessories through one source from a single manufacturer.
- C. Regulatory Requirements: Where metal lockers are indicated to comply with accessibility requirements, comply with Massachusetts Architectural Access Board requirements and the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)."
- D. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver metal lockers until spaces to receive them are clean, dry, and ready for metal locker installation.

1.6 PROJECT CONDITIONS

- A. Field Measurements: Verify the following by field measurements before fabrication and indicate measurements on Shop Drawings:
 - 1. Concealed framing, blocking, and reinforcements that support metal lockers before they are enclosed.
 - 2. Recessed openings.
 - 3. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish recessed opening dimensions and proceed with fabricating metal lockers without field measurements. Coordinate wall and floor construction to ensure that actual recessed opening dimensions correspond to established dimensions.

1.7 COORDINATION

- A. Coordinate size and location of bases for metal lockers.
- B. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that metal lockers can be supported and installed as indicated.

PART 2 - PRODUCTS

2.1 ALL-WELDED, CORRIDOR METAL LOCKERS

- A. Available Manufacturers:
 - 1. List Industries Inc.; Marquis Protector Single-Point Latch Corridor Lockers.
 - 2. Lyon Workspace Products; All-Welded Lockers.
 - 3. Penco Products, Inc., Subsidiary of Vesper Corporation; All-Welded Lockers.
- B. Locker Arrangement: Single tier.
- C. Body: Assembled by welding body components together. Fabricate from unperforated, cold-rolled steel sheet with thicknesses as follows:

1. Tops, Bottoms, and Sides: 0.0528 inch thick.
 2. Backs: 0.0428 inch thick.
 3. Shelves: 0.0528 inch thick, with double bend at front and single bend at sides and back.
- D. Frames: Channel formed; fabricated from 0.0528-inch-thick, cold-rolled steel sheet; lapped and factory welded at corners; with top and bottom main frames factory welded into vertical main frames. Form continuous, integral door strike full height on vertical main frames.
- E. Locker Base: Structural channels, formed from 0.0528-inch-thick, cold-rolled steel sheet; welded to front and rear of side-panel frames.
- F. Doors: One-piece; fabricated from 0.0677-inch-thick, cold-rolled steel sheet; formed into channel shape with double bend at vertical edges, and with right-angle single bend at horizontal edges.
1. Reinforcement: Manufacturer's standard reinforcing angles, channels, or stiffeners for doors more than 15 inches (381 mm) wide; welded to inner face of doors.
 2. Door Style: Louvered vents.
- G. Hinges: Self-closing; welded to door and attached to door frame with not less than 2 factory-installed rivets per hinge that are completely concealed and tamper resistant when door is closed; fabricated to swing 180 degrees.
- H. Recessed Door Handle and Latch: Stainless-steel cup with integral door pull, recessed so locking device does not protrude beyond face of door; pry resistant.
- I. Equipment: Equip each metal locker with identification plate and the following, unless otherwise indicated:
1. Single-Tier Units: Shelf, one double-prong ceiling hook, and two single-prong wall hooks.
- J. Accessories:
1. Continuous Sloping Tops: Fabricated from minimum 0.0428-inch-thick, cold-rolled steel sheet; approximately 20-degree pitch.
 2. Recess Trim: Fabricated from 0.0428-inch-thick, cold-rolled steel sheet.
 3. Filler Panels: Fabricated from 0.0428-inch- (1.1-mm-) thick, cold-rolled steel sheet.
 4. Boxed End Panels: Fabricated from 0.0528-inch-thick, cold-rolled steel sheet.
- K. Finish: Baked enamel or powder coat, color as selected.
- 2.2 ALL-WELDED ATHLETIC METAL LOCKERS
- A. Available Manufacturers:
1. All-Welded, Athletic Metal Lockers:
 - a. Lyon Workspace Products; All-Welded Expanded Metal Lockers.
 - b. Penco Products, Inc., Subsidiary of Vesper Corporation; All-Welded Lockers.
 - c. Republic Storage Systems Company; All-Welded Ventilated Lockers.
- B. Locker Arrangement: Double-tier.

- C. Body: Assembled by welding riveting or bolting body components together. Fabricate from unperforated, cold-rolled steel sheet with thicknesses as follows:
 - 1. Tops and Bottoms: 0.0528 inch thick, with single bend at edges.
 - 2. Backs: 0.0428 inch thick.
 - 3. Shelves: 0.0528 inch thick, with double bend at front and right-angle single bend at sides and back.
- D. Frames: Channel formed; fabricated from 0.0528-inch-thick, cold-rolled steel sheet or 0.0966-inch-thick steel angles; lapped and factory welded at corners; with top and bottom main frames factory welded into vertical main frames. Form continuous, integral door strike full height on vertical main frames.
- E. Locker Base: Structural channels, formed from 0.0528-inch-thick, cold-rolled steel sheet; welded to front and rear of side-panel frames.
- F. Perforated Doors: One-piece, fabricated from 0.0677-inch-thick, cold-rolled steel sheet with manufacturer's standard diamond perforations; formed into channel shape with double bends.
 - 1. Reinforcement: Manufacturer's standard reinforcing angles, channels, or stiffeners for doors more than 15 inches wide; welded to inner face of doors.
- G. Hinges: Self-closing; welded to door and attached to door frame with not less than 2 factory-installed rivets per hinge that are completely concealed and tamper resistant when door is closed; fabricated to swing 180 degrees.
- H. Recessed Door Handle and Latch: Stainless-steel cup with integral door pull, recessed so locking device does not protrude beyond face of door; pry resistant.
 - 1. Single-Point Latching: Nonmoving latch hook. Equip each door with 1 latch hook, fabricated from minimum 0.1116-inch-thick steel; welded midway up full-height door strike; with resilient silencer.
- I. Projecting Turn-Handle and Latch: Steel handle welded to manufacturer's standard, three-point, cremone-type latch mechanism that consists of steel rods or bars that engage main locker frame at top and bottom of door, and center latch that engages strike jamb; with steel padlock loop.
- J. Equipment: Equip each metal locker with identification plate and the following, unless otherwise indicated:
 - 1. Double-Tier Units: One double-prong ceiling hook and two single-prong wall hooks.
- K. Accessories:
 - 1. Legs: Fabricated from 0.0677-inch-thick, cold-rolled steel sheet; welded to bottom of locker.
 - 2. Continuous Base: Fabricated from 0.0677-inch-thick, cold-rolled steel sheet.
 - 3. Continuous Sloping Tops: Fabricated from minimum 0.0428-inch-thick, cold-rolled steel sheet; approximately 20-degree pitch.
 - 4. Recess Trim: Fabricated from 0.0428-inch-thick, cold-rolled steel sheet.
 - 5. Filler Panels: Fabricated from 0.0428-inch-thick, cold-rolled steel sheet.

- L. Finish: Baked enamel or powder coat, color as selected.

2.3 LOCKER BENCHES

- A. General: Provide locker benches fabricated by same manufacturer as metal lockers.
- B. Bench Tops: Manufacturer's standard 1-piece units, of the following material, minimum 9-1/2 inches wide by 1-1/4 inches thick, with rounded corners and edges:
 - 1. Laminated maple with one coat of clear sealer on all surfaces, and one coat of clear lacquer on top and sides.
- C. Fixed Pedestals: Manufacturer's standard supports, with predrilled fastener holes for attaching bench top and anchoring to floor, complete with fasteners and anchors.

2.4 FABRICATION

- A. General: Fabricate metal lockers square, rigid, and without warp; with metal faces flat and free of dents or distortion. Make exposed metal edges free of sharp edges and burrs, and safe to touch.
 - 1. Form body panels, doors, shelves, and accessories from one-piece steel sheet, unless otherwise indicated.
 - 2. Provide fasteners, filler plates, supports, clips, and closures as required for a complete installation.
- B. Unit Principle: Fabricate each metal locker with an individual door and frame; individual top, bottom, and back; and common intermediate uprights separating compartments.
- C. All-Welded Construction: Factory preassemble metal lockers by welding all joints, seams, and connections, with no bolts, nuts, screws, or rivets used in assembly of main locker groups. Factory weld main locker groups into one-piece structures. Grind exposed welds flush.
- D. Hooks: Manufacturer's standard ball-pointed type, aluminum or steel; zinc plated.
- E. Coat Rods: Fabricated from steel; nickel plated.
- F. Identification Plates: Manufacturer's standard etched, embossed, or stamped aluminum plates; with numbers and letters at least 3/8 inch (9 mm) high.
- G. Legs: Formed by extending vertical frame members or by attaching gusset-type legs to locker body; with provision for fastening to floor; finished to match lockers.
 - 1. Closed Bases: Fabricate bases without overlap or exposed fasteners; finished to match lockers.
- H. Continuous Base: Formed into channel or Z profile for stiffness, and fabricated in lengths as long as practicable to enclose base and base ends of metal lockers; finished to match lockers.
- I. Continuous Sloping Tops: Fabricated in lengths as long as practicable, without visible fasteners at splice locations; finished to match lockers.

1. Sloped top corner fillers, mitered.

J. Individual Sloping Tops: Fabricated in width to fit one locker frame in lieu of flat locker tops; with integral back; finished to match lockers. Provide wedge-shaped divider panels between lockers.

K. Recess Trim: Fabricated with minimum 2-1/2-inch (64-mm) face width and in lengths as long as practicable; finished to match lockers.

L. Filler Panels: Fabricated in an unequal leg angle shape; finished to match lockers. Provide slip joint filler angle formed to receive filler panel.

M. Boxed End Panels: Fabricated with 1-inch- (25-mm-) wide edge dimension, and designed for concealing fasteners and holes at exposed ends of nonrecessed metal lockers; finished to match lockers.

1. Provide one-piece panels for double-row (back-to-back) locker ends.

N. Finished End Panels: Designed for concealing unused penetrations and fasteners, except for perimeter fasteners, at exposed ends of nonrecessed metal lockers; finished to match lockers.

1. Provide one-piece panels for double-row (back-to-back) locker ends.

O. Center Dividers: Full-depth, vertical partitions between bottom and shelf; finished to match lockers.

2.5 STEEL SHEET FINISHES

A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Factory finish steel surfaces and accessories except stainless-steel and chrome-plated surfaces.

C. Surface Preparation: Clean surfaces of dirt, oil, grease, mill scale, rust, and other contaminants that could impair paint bond. Use manufacturer's standard methods.

D. Powder-Coat Finish: Immediately after cleaning and pretreating, electrostatically apply manufacturer's standard baked-polymer thermosetting powder finish. Comply with resin manufacturer's written instructions for application, baking, and minimum dry film thickness.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine walls, floors, and support bases, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.

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

3.2 INSTALLATION

- A. General: Install level, plumb, and true; shim as required, using concealed shims.
 - 1. Anchor locker runs at ends and at intervals recommended by manufacturer, but not more than 36 inches o.c. Install anchors through backup reinforcing plates, channels, or blocking as required to prevent metal distortion, using concealed fasteners.
 - 2. Anchor single rows of metal lockers to walls near top of lockers and to floor.
 - 3. Anchor back-to-back metal lockers to floor.
- B. All-Welded Metal Lockers: Connect groups of all-welded metal lockers together with standard fasteners, with no exposed fasteners on face frames.
- C. Equipment and Accessories: Fit exposed connections of trim, fillers, and closures accurately together to form tight, hairline joints, with concealed fasteners and splice plates.
- D. Fixed Locker Benches: Provide not less than 2 pedestals for each bench, uniformly spaced not more than 72 inches apart. Securely fasten tops of pedestals to undersides of bench tops, and anchor bases to floor.

3.3 ADJUSTING, CLEANING, AND PROTECTION

- A. Clean, lubricate, and adjust hardware. Adjust doors and latches to operate easily without binding. Verify that integral locking devices operate properly.
- B. Protect metal lockers from damage, abuse, dust, dirt, stain, or paint. Do not permit metal locker use during construction.
- C. Touch up marred finishes, or replace metal lockers that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by metal locker manufacturer.

END OF SECTION

SECTION 107110

EXTERIOR SUN CONTROL DEVICES

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Exterior sunshades.
 - a. Curtainwall sunshades, supported by curtainwall per Section 084410 - GLAZED ALUMINUM CURTAIN WALLS.
- B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council. Refer to Section 018110, SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 084110 - ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS.
 - 2. Section 084410 - GLAZED ALUMINUM CURTAIN WALLS.

1.3 SUBMITTALS

- A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of product indicated.
- B. LEED Submittal:
 - 1. Product Data for Credit MR 4: For products having recycled content, documentation indicating percentages by weight of post-consumer and pre-consumer recycled content.
 - a. Include statement indicating costs for each product having recycled content.
 - 2. Product Data for Credit MR 5: For products having regional materials, documentation indicating percentages of building materials and products that have been extracted, harvested or recovered, as well as manufactured, within 500 miles of the project site.
 - a. Include statement indicating costs for each product having regional materials.

EXTERIOR SUN CONTROL DEVICES

- C. Shop Drawings: For sun control systems. Include plans, elevations, sections, details, and attachments to other work.
 - 1. Include structural analysis data signed and sealed by the qualified professional engineer registered in the jurisdiction where the Project is located responsible for their preparation.
 - 2. Include details of attachment to aluminum framing systems.
 - 3. Include details of provisions for system expansion and contraction and for draining moisture occurring within the system to the exterior.
- D. Samples for Verification: For each type of exposed finish required, in manufacturer's standard sizes.
- E. Qualification Data: For Installer.
- F. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for sun control systems.
- G. Maintenance Data: For sun control systems to include in maintenance manuals.
- H. Warranties: Special warranties specified in this Section.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Capable of assuming engineering responsibility and performing work of this Section and who is acceptable to manufacturer.
 - 1. Engineering Responsibility: Preparation of data for sun control systems including Shop Drawings based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project and submission of reports of tests performed on manufacturer's standard assemblies.

1.5 WARRANTY

- A. Special Finish Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components on which finishes fail within specified warranty period. Warranty does not include normal weathering.
 - 1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Airline Products Co.
 - 2. Airolite Co.
 - 3. C/S Group.
 - 4. Ruskin Manufacturing Co.

2.2 MATERIALS

- A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
 - 1. Sheet and Plate: ASTM B 209.
 - 2. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221.
 - 3. Extruded Structural Pipe and Tubes: ASTM B 429.
 - 4. Structural Profiles: ASTM B 308/B 308M.
 - 5. Welding Rods and Bare Electrodes: AWS A5.10/A5.10M.
- B. Fasteners, Anchors and Inserts: Provide stainless steel or aluminum fasteners, anchors and inserts, as recommended by the manufacturer. Conceal from view to greatest extent possible. Finish exposed items to match sun control systems.

2.3 ACCESSORY MATERIALS

- A. Joint Sealants: For installation at perimeter of systems, as specified in Section 079200 - JOINT SEALANTS.
- B. Bituminous Paint: Cold-applied asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos, formulated for 30-mil thickness per coat.

2.4 FABRICATION

- A. Shop fabricate work to the greatest extent possible. Fabricate work to be truly straight, plumb, level and square. Maintain equal blade spacing from blade to blade and from blade to frame. Use welded connections wherever possible.
- B. Form aluminum shapes before finishing.
- C. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.

2.5 ALUMINUM FINISHES

- A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. High-Performance Organic Finish (3-Coat Fluoropolymer): AA-C12C40R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: conversion coating; Organic Coating: manufacturer's standard 3-coat, thermocured system consisting of specially formulated inhibitive primer, fluoropolymer color coat, and clear fluoropolymer topcoat, with both color coat and clear topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight). 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: Match Section 084110 – ALUMINUM ENTRANCES AND STOREFRONT.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.
 - 1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General:
 - 1. Comply with manufacturer's written instructions.
 - 2. Do not install damaged components.
 - 3. Fit joints to produce hairline joints free of burrs and distortion.
 - 4. Rigidly secure nonmovement joints.
 - 5. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration.
- B. Metal Protection:
 - 1. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape or installing nonconductive spacers as recommended by manufacturer for this purpose.
 - 2. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.
- C. Install components plumb and true in alignment with established lines and grades, without warp or rack.

END OF SECTION

SECTION 107500

FLAGPOLES

1.1 SUMMARY

- A. Section includes:
- B. Section includes:
 - 1. Ground-mounted flagpoles made from aluminum.

1.2 PERFORMANCE REQUIREMENTS

- A. Wind Loads: 125 miles-per-hour.
- B. Engineering design of flagpole by manufacturer.

1.3 PRODUCTS

- A. Flagpoles:
 - 1. Exposed Height: 30 feet (9 m).
 - 2. Aluminum Flagpoles: Cone tapered, with baked-enamel or powder-coat finish.
- B. Mounting Type:
 - 1. Foundation tube.
 - 2. Sleeve for aluminum flagpole.
 - 3. Cast-metal shoe base.
- C. Fittings/Lighting:
 - 1. Finial: Ball including Solar Powered LED downlight.
 - 2. Halyard: Internal, cam cleat system.

END OF SECTION

SECTION 108200

ROOFTOP MECHANICAL SCREENS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Exterior rooftop mechanical equipment screens, that attach to equipment without penetrating roofing system.
- B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council. Refer to Section 018110, SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 074200 - METAL WALL PANELS for metal wall screens.
 - 2. Section 077200 - ROOF ACCESSORIES for rooftop equipment curbs.
 - 3. Division 23 - HEATING, VENTILATING AND AIR CONDITIONING for rooftop mechanical equipment.

1.3 PERFORMANCE REQUIREMENTS

- A. General: Install screens to withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failing, rattling, leaking, and fastener disengagement.
- B. Thermal Movements: Provide screens that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing 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 sheet metal and trim thermal movements. 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, dimensions of individual components and profiles, and finishes for each type of product indicated.
- B. LEED Submittal:
 - 1. For products having recycled content, documentation indicating percentages by weight of post-consumer and pre-consumer recycled content.
 - a. Include statement indicating costs for each product having recycled content.
 - 2. For products having regional materials, documentation indicating percentages of building materials and products that have been extracted, harvested or recovered, as well as manufactured, within 500 miles of the project site.
 - a. Include statement indicating costs for each product having regional materials.
- C. Shop Drawings: For rooftop mechanical screen systems. Include plans, elevations, sections, details, and attachments to other work.
 - 1. Include structural analysis data signed and sealed by the qualified professional engineer registered in the jurisdiction where the Project is located responsible for their preparation.
 - 2. Include details of attachment to rooftop equipment.
 - 3. Include details of provisions for system expansion and contraction and for draining moisture occurring within the system to the exterior.
- D. Samples for Verification: For each type of exposed finish required, in manufacturer's standard sizes.
- E. Qualification Data: For Installer and Engineer.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Capable of assuming engineering responsibility and performing work of this Section and who is acceptable to manufacturer.
 - 1. Engineering Responsibility: Preparation of data for screens including Shop Drawings based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project and submission of reports of tests performed on manufacturer's standard assemblies.
- B. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01.

1.6 PROJECT CONDITIONS

- A. Field Measurements: Where rooftop mechanical screen is indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Product: envisor³, by CityScapes, Hilliard, OH 43026; www.cityscapesinc.com.

2.2 MATERIALS

- A. Thermoformed Plastic Panels: Acrylic Butylene Styrene (ABS) medium impact type, rigid thermo-formed sheets.
 - 1. Thickness: 3/16 in min.
 - 2. Coating System: Manufacturer's standard factory applied color coating.
 - a. Color: To be selected by Architect from manufacturer's full range.
- B. Aluminum Framing: Alloy and temper recommended by manufacturer for type of use and finish indicated.
 - 1. Sheet and Plate: ASTM B 209
 - 2. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221.
 - 3. Extruded Structural Pipe and Tubes: ASTM B 429.
 - 4. Structural Profiles: ASTM B 308/B 308M.
 - 5. Welding Rods and Bare Electrodes: AWS A5.10/A5.10M.
- C. Fasteners, Anchors and Inserts: Provide stainless steel fasteners, anchors and inserts, as recommended by the manufacturer. Conceal from view to greatest extent possible. Finish exposed items to match screens.

2.3 FABRICATION

- A. Shop fabricate work with interlocking panel connections to the greatest extent possible. Fabricate work to be truly straight, plumb, level and square. Cut panels to precise lengths, as indicated on approved Shop Drawings.
 - 1. Panel Style and Height: As indicated on Drawings.
 - 2. Panel Design: Louver.
- B. Trim and Closures: Fabricated from min. 24 ga aluminum sheet in profiles and sizes indicated.

2.4 ALUMINUM FINISHES

- A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Mill Finish: Manufacturer's standard.
- C. Clear Anodic Finish: AAMA 611, AA-M12C22A31, Class II, 0.010 mm or thicker.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.
 - 1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Install screens according to manufacturer's written instructions in orientation, sizes, and locations indicated on Drawings. Anchor screens and other components of the Work securely in place, with provisions for thermal and structural movement.
 - 1. Fasten structural supports to rooftop mechanical equipment without damaging operation of equipment.
 - 2. Do not install damaged components.
 - 3. Fit joints to produce hairline joints free of burrs and distortion.
 - 4. Rigidly secure nonmovement joints.
 - 5. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration.
 - 6. Take care to not damage roof system.
- B. Install components plumb and true in alignment with established lines and grades, without warp or rack.
- C. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action as recommended by screen manufacturer.

3.3 ERECTION TOLERANCES

- A. Installation Tolerances: Shim and align metal-faced composite wall panel units within installed tolerance of 1/4 inch in 20 feet, nonaccumulative, on level, plumb, and location lines as indicated and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

END OF SECTION

SECTION 113100

APPLIANCES

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Appliances.
- B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council. Refer to Section 018110, SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Division 22 - PLUMBING for water distribution piping connections, drainage and vent piping connections, sinks, and waste disposers.
 - 2. Division 26 - ELECTRICAL for services and connections to appliances.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
 - 1. Include operating characteristics, dimensions of individual appliances, and finishes for each appliance.
- B. Appliance Schedule: For appliances; use same designations indicated on Drawings.
- C. Maintenance Data: For each product to include in maintenance manuals.
- D. Warranties: Special warranties specified in this Section.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: An employer of workers trained and approved by manufacturer for installation and maintenance of units required for this Project.

- B. Source Limitations: Provide products from same manufacturer for each type of appliance required.
 - C. Regulatory Requirements: Comply with provisions of the following product certifications:
 - 1. NFPA: Provide electrical appliances listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
 - 2. UL and NEMA: Provide electrical components required as part of residential appliances that are listed and labeled by UL and that comply with applicable NEMA standards.
 - 3. ANSI: Provide gas-burning appliances that comply with ANSI Z21 Series standards.
 - D. Regulatory Requirements, Accessibility: Where residential appliances are indicated to comply with accessibility requirements, comply with Massachusetts Architectural Access Board requirements and the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)."
 - E. Energy Ratings: Provide residential appliances that carry labels indicating energy-cost analysis (estimated annual operating costs) and efficiency information as required by the FTC Appliance Labeling Rule.
 - 1. Provide appliances that qualify for the EPA/DOE ENERGY STAR product labeling program.
 - F. Switches: Provide mercury-free switches in appliances.
 - G. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01.
- 1.5 WARRANTY
- A. Special Warranties: Manufacturer's standard form in which manufacturer of each appliance specified agrees to repair or replace residential appliances or components that fail in materials or workmanship within manufacturer's standard warranty period.

PART 2 - PRODUCTS

2.1 APPLIANCES

- A. Appliance Schedule: Refer to Drawings.

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 work.

- B. Examine roughing-in for piping systems to verify actual locations of piping connections before equipment installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. General: Comply with manufacturer's written instructions.
 - 1. Range Hood, Exhaust Fans, and Dryer Vents: Vent directly to the building exterior.
- B. Built-in Equipment: Securely anchor units to supporting cabinets or countertops with concealed fasteners. Verify that clearances are adequate for proper functioning and rough openings are completely concealed.
- C. Freestanding Equipment: Place units in final locations after finishes have been completed in each area. Verify that clearances are adequate to properly operate equipment.
- D. Utilities: Refer to Division 22 - PLUMBING for plumbing requirements and Division 26 - ELECTRICAL for electrical requirements.

3.3 CLEANING AND PROTECTION

- A. Test each item to verify proper operation. Make necessary adjustments.
- B. Verify that accessories required have been furnished and installed.
- C. Remove packing material from appliances and leave units in clean condition, ready for operation.

3.4 DEMONSTRATION

- A. Engage a factory-authorized service representative to train the Owner's maintenance personnel to adjust, operate, and maintain appliances.

END OF SECTION

SECTION 114000

FOODSERVICE EQUIPMENT

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of contract, including General and Supplementary Conditions and Division 1 Sections, apply to this Section.

1.02 SCOPE

- A. Attention is directed to the detailed Item Specifications, which provide for minimum acceptable products. Item Specifications paragraphs may indicate materials or components that exceed the manufacturer's standards and are required for this project.
- B. Cooperate and coordinate with others engaged on the project in order that work will progress on schedule.
- C. Work to be performed under this Section is shown on Foodservice Equipment Drawings.
- D. Install materials furnished under this Section, other than materials that are expressly noted for installation under other Sections. Installation work shall be performed by workmen compatible with those existent on the project site. Equipment shall be of the latest design; new and unused, unless indicated otherwise in the Item Specifications, complete with all standard parts for normal operations and including such accessories or materials as may be required to comply with these Specifications.
- E. This Specification is to further describe and supplement the applicable Drawings. What is called for by either the Drawings and/or these Specifications shall be furnished and installed as part of this work. Any questions relative to discrepancies or omissions shall be submitted to the Architect.
- F. Provide neatly punched openings or cutouts required to permit passage of plumbing and electrical services by related trades and to accommodate mounted switches and receptacles in the equipment.
- G. Work in this Section shall include but shall not be limited to the following:
 - 1. Catalog items of equipment.
 - 2. Fabricated equipment other than catalog items.
 - 3. Plumbing trim consisting of mechanical system components required for standard operation of equipment items such as faucets and waste outlets. Vacuum breakers shall be furnished for equipment where water is introduced less than 2 in. above flood level.
 - 4. Electrical equipment forming an integral part of equipment items such as electric motors, heating elements, controls, switches, starters, temperature regulators and internal wiring to a control panel or switch, if mounted on the equipment.

1.03 RELATED WORK SPECIFIED ELSEWHERE

- A. Finished floor and walls, structural supports for all ceiling supported equipment, acoustical ceilings and related building.
- B. Connecting piping, waste lines, traps and vent piping, complete with shut-off valves to all the equipment, and the rough-in for sanitary waste, domestic water, floor drains and plumbing fixtures except those provided under this Section, and related mechanical work.
- C. Exhaust ventilating systems complete with blowers, ductwork, hangers, access panels, and insulation between the exhaust collars and the exhaust blowers.
- D. External wiring; the mounting and wiring of motor starters, solenoid valves, switches and receptacles not integral with the equipment; mounting and wiring of walk-in refrigerated room ceiling mount light fixtures; wiring of walk-in refrigerated room interior evaporator coils; connecting conduit, and external connections to equipment to the building electrical distribution system.

1.04 SUBMITTALS

- A. Submit Shop Drawings for approval in accordance with the General Conditions.
- B. Stub-in drawings shall indicate the layout of equipment and dimensioned locations of all services to the equipment.
 - 1. Hand drawn scale: 1/2 in. = 1 ft., 0 in.
 - 2. CAD drawn scale: 1/4 in. = 1 ft., 0 in.
 - 3. Stubbed services shall include electrical, hot and cold water, floor drains or floor sinks, solid wastes and exhaust collar connections. Point of connection services shall include steam supply, condensate return, gas connection and indirect waste connections. Service dimensions shall include height measured from finish floor.
 - 4. Electrical and plumbing services shall be indicated and coordinated on the same drawing.
 - 5. Call-outs for each stub point indicated at the point, or clearly keyed to a schedule on the same drawing.
 - 6. Special conditions plan shall include all floor recesses, curbs and special wall construction indicated and dimensioned
- C. Fabrication drawings shall be furnished for non-catalog items, showing plans, elevations and full construction details with gauges, components, fasteners, erection and connections. Drawings shall be to the minimum scale of 3/4 in. = 1 ft., 0 in.
- D. Standard items of equipment, not built-in or part of other assemblies shall be submitted for approval in the form of bound catalog cuts. Each cut shall include a clearly marked item number, a listing of all optional accessories and finishes, and connection data.
- E. Catalog Cuts shall include letters of approval, under a separate binder, indicating compliance with M.G.L. c. 142 and 248 CMR. Only products and materials that have been listed by the

Board as Product-approved shall be used for plumbing and gas fitting work performed in the Commonwealth of Massachusetts.

1. Catalog Cuts shall include operation manuals for all existing foodservice equipment that is scheduled for reuse and that requires gas fitting work performed in the Commonwealth of Massachusetts.
- F. Mechanical refrigeration system submittal shall include the firm name and address of the installation contractor and name of the qualified installer.
- G. Energy Star - Specified Energy Star rated equipment and appliances shall serve as the standard for all types of equipment and appliances whenever possible. Kitchen Equipment Contractor shall clearly indicate that items are Energy Star rated both on the submittal cover sheet and manufacturer cut sheets.
- H. Failure to comply with approved shop drawings shall be cause for rejection of an improperly built assembly.

1.05 SAMPLES

- A. If the bidder's proposed equipment fabricator is unknown to the Consultant's office, immediately after award of contract, submit the following samples for selection and approval:
 1. Section of table showing edge, bullnose, framing, fasteners, gusset, leg, and foot, all assembled.
 2. Drawer assembly (will be returned for use on this project).
- B. Work delivered to the job shall match approved samples.

1.06 GUARANTEES AND WARRANTIES

- A. New equipment furnished for this facility shall be guaranteed for a period of not less than one calendar year beginning on the date of final acceptance of the work of this Section. In the case of a manufacturer whose standard warranty exceeds this period the longer period shall apply. Self-contained refrigeration units for reach-in refrigerators, freezers, ice cream chests and ice machines shall carry a five-year replacement warranty for the sealed unit. The guarantee shall protect against defective material, design and workmanship.
- B. In addition to the guarantee called for under the General Conditions, this Contractor shall further agree that in the event of failure of any system or item of equipment or improper functioning of specified work during the guarantee period, he shall have "on call" competent service personnel available to make the necessary repairs or replacements of specified work promptly at no cost to the Owner. In the event that replacement of an entire item is required, the Owner shall have the option of full use of the defective equipment until a replacement has been delivered and completely installed.
- C. Furnish manufacturer's warranties for each item of standard equipment and a warranty on fabricated equipment. Submit guarantees and warranties to the Architect in accordance with conditions found in "Demonstration and Operating Instructions" paragraphs, contained in Part 3, this Section.

1.07 REGULATORY AGENCIES

- A. Work shall be in accordance with the governing health, building and safety, and fire protection codes and regulations.
- B. Standards of the National Sanitation Foundation (NSF) shall serve as guidelines for the work of this Section.
- C. Electric equipment and accessories shall conform to the standards of the National Electric Manufacturers Association (NEMA), Underwriters Laboratories, Inc. (UL) or Electrical Testing Station (ETS).
- D. Steam generating equipment and accessories shall conform to the standards of the American Society of Mechanical Engineers (ASME).
- E. Gas fired equipment and accessories shall conform to the standards of the American Gas Association (AGA) and the American National Standards Institute (ANSI) Z83.11.
- F. Energy Star - Specified Energy Star rated equipment and appliances shall serve as the standard for all types of equipment and appliances whenever possible.
- G. BOARD OF STATE EXAMINERS OF PLUMBERS AND GAS FITTERS
Board Required Product-approval. Only products and materials that have been listed by the Board as Product-approved shall be used for plumbing and gas-fitting work performed in the Commonwealth and governed by M.G.L. c. 142 and 248 CMR.

1.08 EQUALITY OF MATERIALS AND EQUIPMENT

- A. The base bid shall contain no substitutions to these drawings or specifications. Bidders may offer substitute equipment in a separate proposal, indicating the proposed model and sum to be added or deducted if the alternate item is accepted by the Owner. Each line item shall include delivery, installation and taxes. Decisions to accept or reject a piece of equipment shall be made by the Owner, and all decisions shall be final.

PART 2 - PRODUCTS

2.01 MATERIALS AND FINISHES

- A. General
 - 1. Metals shall be free from defects impairing strength, durability or appearance, made of new materials with structural properties to withstand strains and stresses to which normally subject.
 - 2. Stock materials, patterns, products and methods of fabrication shall be approved provided that they conform to the requirements specified under Item Specifications.
- B. Stainless Steel
 - 1. Stainless steel shall be non-magnetic corrosion resistant chromium-nickel steel, Type 302 or 304 (18-8 Alloy), polished to a Number 4 finish where exposed, unless otherwise noted. Minimum gauges shall be as specified under Item Specifications.

C. Galvanized (Galvannealed) Steel

1. Galvannealed steel shall be commercial quality with tight coat of zinc galvanizing metal applied to a soft steel sheet, subsequently passed through a 1200 degree F. oven, resulting in a spangle free paintable surface. Minimum gauges shall be as specified under Item Specifications.

D. Plastic Laminate Materials

1. The laminate facing shall be GP-50, .050 in. thick, general purpose, high pressure, decorative plastic laminate that meets or exceeds the requirements of NEMA Publication LD3-1985, and NSF Standard 35. The plastic laminate exposed surfaces shall be provided in accordance with the specified manufacturer, finish and color. Balancing sheet shall be backing grade GP-28 in matching color at semi-exposed and BK-20 unfinished where hidden.
2. Plastic laminate covered surfaces shall be factory fabricated with 3/4 in. thick core having plastic laminate facing on both faces and all edges, laminated with waterproof glue under pressure in accordance with the plastic laminate manufacturer's specifications.
3. The core shall be medium density phenolic resin particleboard conforming to ANSI A208.1, Type 2-M-2, 45 pound per cubic foot density minimum.
4. Provide veneer core plywood or solid hardwood edge banding for doors and vertical dividers or panels where hardware is attached to casework.
5. Hinges shall be articulated, spring loaded type equal to Grass CST65-170-F or Stanley, with quantity adequate to support the door without deformation. Do not provide handles on plastic laminate clad doors.

2.02 CONSTRUCTION

A. General

1. Flat metal work items of equipment, such as tables, sinks, or counter tops, and other non-catalog items described under Item Specifications, shall be manufactured by a food service equipment fabricator who has the plant, personnel and engineering facilities to properly design, detail and manufacture high quality food service equipment.
2. The equipment fabricator shall be subject to the approval of the Architect, Owner and Consultant. Refer to Paragraph 1.05, Samples.
3. Fabricated foodservice equipment shall be manufactured by one manufacturer, of uniform design, material and finish.
4. Equipment shall conform to the applicable requirements of current Federal, State, and Local Codes and Regulations.

B. Welding

1. The words "weld", "welded" or "welding" as used in this Section of the Specification shall mean that metal joints shall be continuously welded and the exposed parts ground

smooth and polished to match adjoining surfaces. Welding electrodes shall match the material being welded.

2. Where spot welding is specified, the welds shall be a maximum spacing of 3 in. on center.
3. Where tack welding is specified, the pieces welded shall have 1/2 in. minimum lengths of welding material at 4 in. on center maximum spacing.

C. Grinding, Polishing and Finishing

1. Exposed welding joints shall be ground flush with the adjoining material and neatly finished to harmonize therewith. Wherever material has been depressed or sunken by a welding operation, such depressions shall be suitably hammered and peened flush with the adjoining surfaces and, if necessary, again welded and ground to eliminate low spots. Ground surfaces shall be polished or buffed to a degree consistent with good workmanship. Coves shall be ground and polished to match adjoining material.
2. Care shall be exercised in grinding operations to avoid excessive heating of metal and discoloration. Abrasives, wheels, and belts used in grinding stainless steel shall be iron free and shall have not been used on carbon steel. The texture of the final polishing operation shall be uniform and smooth. Grain direction shall be uniform, uni-directional for a total length of material. Cross grains and random polishing are not acceptable.
3. The general finish of equipment shall be consistent throughout the job. Brake ends shall be free of open texture or orange peel appearance, and where brake work mars the uniform finish of the material, the marks shall be removed by grinding and polishing, and finishing. Sheared edges shall be free of burrs, projections or fins to eliminate all danger of laceration. Mitered or bullnosed corners shall be neatly finished with the underedge of the material neatly ground to a uniform condition and in no case will overlapping material be acceptable. The equipment surfaces, where exposed, shall be finished to a grained Number 4 (satin) finish unless otherwise specified. An exposed surface shall include an inside surface, which is exposed to view when a swinging or sliding door is opened. Underside of shelves need not be satin finish unless otherwise specified.
4. Excessive distortion caused by welding shall be cause for rejection for that item of equipment.

2.03 BUY-OUT COMPONENTS

- A. CASTERS: 5 in. diameter polyurethane tired, swivel, plate or stem mount to suit application, 300 pound capacity, brakes only if specified, NSF approved; Component Hardware C-21-3050 (plate/no brake), C21-3051 (plate/brake) C23-3350 (stem/no brake) or C23-3351 (stem/brake), or equal.
- B. COUNTER LEGS: Stainless steel, 6 in. to 7-3/4 in. height adjustment; Component Hardware A72-0811, or A77-5048, or equal.
- C. DOOR AND DRAWER PULLS: Stainless steel, full grip type with beveled edge, NSF approved for stud mounting in device, in horizontal attitude to meet NSF requirements; Component Hardware P63-1012, or equal.

- D. DOOR HINGES: Stainless steel, lift off type, swedged knuckle for minimum clearance, nylon bearings; Component Hardware M75-1002.
- E. DRAWER PANS: Molded plastic or fiberglass, 20 in. by 20 in. by 5 in. deep, NSF approved; Component Hardware S80-2020, or equal.
- F. DRAWER SLIDES: Stainless steel, NSF approved, full extension, 200 pound capacity with stainless steel ball bearing wheels; Component Hardware S-52 series, or equal.
- G. FAUCET SETS, DECK MOUNTED: Chrome plated cast bronze with 1/2 in. IPS eccentric flanged female inlets on 8 in. centers, removable cartridges, lever handles, and aerator tip on swivel nozzle or swivel gooseneck to suit the application; T&S Brass B-0221 or B-0321, or equal by Component Hardware, Chicago, or Fisher.
- H. FAUCET SETS, POTWASHING SINK: Chrome plated cast bronze with removable cartridges, 3/4 in. passages, eccentric flanged female inlets on 8 in. centers with LL street EL inlets with locknuts, four prong handles, 12 in. swing spout; T&S Brass B-290.
- I. FAUCET SETS, SPLASH MOUNTED: Chrome plated cast bronze with 1/2 in. IPS eccentric flanged female inlets on 8 in. centers, removable cartridges, lever handles, and aerator tip on 12 in. swing spout; T&S Brass, B-0231 or equal by Component Hardware, Chicago, or Fisher. Provide each with a mounting kit.
- J. GUSSETS: Stainless steel, stepped side, fully closed, NSF approved, mild steel interior reinforcement, wide flange for welding to framing, set screw anchor for leg; Component Hardware A20-0206C, or equal.
- K. LEG AND BULLET FOOT ASSEMBLIES: Stainless steel tubing, 16 gauge, number 4 finish, adjustable bullet foot with minimum of 3 in. vertical travel, 2,000 pound capacity, top designed for mounting in gusset, length to suit application; Component Hardware A46-6272-C, or equal.
- L. LEG AND FLANGED FOOT ASSEMBLIES: Stainless steel tubing, 16 gauge, number 4 finish, adjustable bullet foot with 3-1/2 in. diameter flange and two holes for securing to floor, minimum of 3 in. vertical travel, 2,000 pound capacity, top designed for mounting in gusset, length to suit application; Component Hardware A46-4272-C, or equal.
- M. NUTS: Zinc plated "Pal Nuts" with integral cap and lockwasher; Component Hardware Q-34-1024 or equal.
- N. SEALANT: Silicone type sealant for sealing equipment to walls or filling crevices between components, TRANSLUCENT, NSF approved; Component Hardware M90-1010, or Dow Corning 732-RTV.
- O. SOUND DEADENING BASINS: Component Hardware Q75-1366
- P. SOUND DEADENING TOPS AND SHELVES: Component Hardware Q85-5225 "Tacky Tape" installed between all channel or angle reinforced tops, drainboards or undershelves.
- Q. WASTE OUTLETS, CRUMB CUP: Stainless steel body, removable crumb cup stopper, gasket, coupling nut and sealing washer, 1-1/2 in. IPS, and optional 4 in. long nickel plated brass tailpiece with gasket; Component Hardware E38-1010, or equal.

- R. WASTE OUTLETS, LEVER OPERATED: Cast stainless steel rotary type with 1-1/2 in. NPS and 2 in. NPS threads, and removable beehive crumb-cup; Component Hardware DSS-8000.
- S. WELD STUDS: Copper flashed steel with 10-24 threads, length to suit; Component Hardware Q-36, or equal.
- T. GFCI RECEPTACLES: Pass & Seymour 2095-W, 115 volt, 20 amp GFCI Duplex Receptacle or equal.

2.04 FABRICATED COMPONENTS

A. Box Type Cabinet Construction

- 1. Sheet metal cabinet bases of box type construction shall be fabricated without general interior framing. Structural strength shall be achieved by the gauge of the metal and the formed angle and channel edges and corners. Vertical sections shall be closed. Cabinet base shall be fabricated of 18 gauge minimum of material specified at Item Specifications. Mount on counter legs or base as specified.
- 2. Intermediate shelf shall be fabricated of 16 gauge stainless steel with rear and sides turned up 1-1/2 in. tight to the cabinet sides. The front edge of shelf shall be turned down 1-1/2 in. and in 1/2 in. at 45 degrees and shelf spot welded in place. Reinforce underside with longitudinal 14 gauge channel on the centerline.
- 3. Bottom shelf shall be fabricated of 16 gauge stainless steel similar to the intermediate shelf except that the front edge shall be formed into a full width 1-1/2 in. by 4 in. welded in boxed channel. Rear edge shall be fitted with a full width channel. Underside shall be reinforced.

B. Counters and Drainboards

- 1. Counters, table tops and drainboards shall be 14 gauge stainless steel, of NSF construction, with edges per Item Specifications. Metal tops shall be made of the largest pieces available and shall appear as one piece with all field and shop joints reinforced and welded, ground and polished. Short pieces of metal will not be acceptable. Counter bends shall be not less than 1/8 in. radius. Wherever a fixture has a waste or drain outlet, the surface shall pitch toward the outlet.
- 2. Counters, table tops and drainboards shall be reinforced with channel or angle frame as specified in the Item Specifications. Framing shall be secured to the underside with sound deadening material sandwiched between the surfaces, weld studs, and nuts.
- 3. Wherever bolts or screws are welded to the underside of trim or tops, neatly finish the reverse side of the weld uniform with the adjoining surface of the trim or top. Depressions at these points will not be acceptable. Raise dimples and depressions by peening, or heating and shrinking, and grind and polish to present a flat surface.

C. Crossrails

- 1. Crossrails shall be not less than 1-1/4 in. outside diameter 16 gauge stainless steel tubing welded, ground and polished to a Number 4 finish. Crossrails shall be welded to

legs at a height of 10 in. above finished floor, and shall extend from left to right between front legs, unless otherwise specified, and from front to back between all legs.

D. Drawer Assembly

1. Drawer assemblies shall consist of a removable drawer pan set in a removable 16 gauge stainless steel channel shaped drawer support frame with gusset plate reinforced corners.
2. Support frame shall have double pan front cover consisting of boxed 18 gauge stainless steel outer shell with welded corners, flush mounted recessed stainless steel pull, 20 gauge stainless steel back shell tack welded to outer shell with fiberglass sound deadening between. Drawer shall be provided with rubber bumpers to quiet closing. Support drawer frame on full extension drawer slides.
3. Drawer shall be suspended from table in a three-sided, 16 gauge stainless steel enclosure with flanged-in bottom edges, banded lower front, flanged-out front side and top edges. All sharp corners shall be broken and any exposed exterior threads of slide mounting bolts shall be provided with solid metal acorn nuts.
4. Component Hardware S91-0020 with thermoplastic pan is considered as equivalent to the above specified construction.

E. Edges

1. Marine: Bumped up 1/2 in. at 45 degrees and turned down 1-1/2 in. and in 1/2 in. at 45 degrees; corners welded and square.
2. Raised roll: Coved up and rolled 180 degrees on a 1-1/2 in. diameter with 3 in. height; corners welded and rounded or coved.
3. Rolled: Rolled 180 degrees on a 1-1/2 in. diameter; corners welded and bullnosed.
4. Short (6 in.) splash on counters and tables: Coved up 6 in., turned back to wall or equipment 1 in. and down 1/2 in.; ends welded closed. Secure tight to face of wall with clips unless specified otherwise and seal joint.
5. Tall (10 in.) splash on preparation sinks, dishtables, counter, and tables: Coved up 8-1/2 in., turned back to wall or equipment 1-1/2 in. at 45 degrees and down 1/2 in.; ends welded closed. Secure 3 in. off face of wall with brackets unless specified otherwise.
6. Turn down: Turn down 2 in. and in 1/2 in. at 45 degrees; corners welded and square.

F. Framing of Tops, Drainboards, Undershelves

1. Channel: Reinforce with 1 in. by 4 in. by 1 in. 14 gauge galvannnealed steel channels; stainless steel if exposed to view. Channels shall run front-to-back at all legs and longitudinally on the centerline. Cross and longitudinal members shall be welded into a single assembly at intersections and sharp corners shall be broken. Framing shall be secured to underside of tops with pairs of weld studs. Framing shall be installed maintaining NSF required clearance to adjacent vertical surfaces and edges of top. The following specified angle framing is considered superior to channel framing and may be used in its place.

2. Angle: 1-1/2 in. by 1-1/2 in. by 1/8 in. perimeter angle frame with crossmembers not over 30 in. on center. Framing shall be secured to top with weld studs, 18 in. on center maximum with three minimum studs on any single face of a table. Perimeter angle frame that is exposed to normal view, shall be stainless steel. Crossmembers and framing not unexposed to normal view shall be iron. Corners of angle frame shall be mitered, or notched and brake formed to form a closed corner. Corner gusset plates used for mounting of leg gussets shall be 1/8 in. thick and sealed to underside of the top. Iron framework joints shall be ground smooth, and shall be painted with a minimum of two coats of aluminum lacquer after degreasing. Framing shall be installed maintaining NSF required clearance to adjacent vertical surfaces and edges of top. Channel framing shall not be considered equal to specified angle framing.
3. Sound deaden all horizontal framed surfaces with material sandwiched between the framing and the bottom of the surface.

G. Hinged Doors

1. Hinged doors shall be double pan type stainless steel construction with 18 gauge exterior and 20 gauge interior, welded corners, and 1/2 in. fiberglass insulation for sound deadening. Each door shall be provided with a stainless steel recessed handle, and an adjustable tension door catch equal to Component Hardware M22-2430. Doors shall close against the bottom shelf and flush with body of equipment.
2. Louvered hinged doors for ventilation shall be fabricated of the same components and provided with a full perimeter 3 in. wide channel reinforcing frame on the interior face. Remaining face shall be die punched with drip-proof louvers fully utilizing the remaining flat metal or a stainless steel flattened expanded metal grille per Item Specifications.

H. Sinks and Sink Inserts

1. Unless otherwise specified, sinks including sink inserts built into tops of fixtures, shall be made of 14 gauge stainless steel with all vertical and horizontal corners rounded to a radius of approximately 3/4 in. with the intersections meeting in a spherical section. Sinks shall be integrally welded to fixture tops.
2. Sinks with two or more compartments shall have full height, 1 in. thick double wall partitions consisting of two pieces of stainless steel back-to-back so fabricated that each compartment will be a deep bowl with coved corners. Partitions shall be welded in place to the bottom, front and back of the sink with smooth rounded coved corners. Top edges of the partitions shall be continuously welded. The front of the sinks shall consist of a stainless steel smooth, flush apron, same gauge as the sinks. Bottom and rear of partitions shall be closed. Sink dimensions contained in Item Specifications are inside dimensions.
3. Sinks shall be provided with integral 14 gauge stainless steel drainboards when specified. Drainboards and sink basins shall be pitched toward waste outlets and shall be self draining. The underside of all sink basins shall sound deadened. Sink units shall be provided with an integral splash at walls. Provide the necessary holes for the mounting of faucet sets.

I. Sliding Doors

1. Sliding doors shall be double pan type stainless steel construction with 18 gauge exterior and 20 gauge interior, welded corners, and 1/2 in. fiberglass insulation for sound deadening. Each door shall be provided with a stainless steel recessed handle. Provide sliding doors with nylon roller bearing sheaves and overhead track components equal to Component Hardware B58-5523 and 5513 sheaves, B57 track, B62-1093 nylon door guides and B60-1086 door stops.

J. Undershelves

1. Undershelf in an open type table shall be 16 gauge stainless steel unless otherwise noted. Edges shall be turned down 1-1/2 in. and in 1/2 in. at 45 degrees with corners notched out to fit legs to which shelf shall be welded from underside. Line up all edges of shelf with centerline of legs. Reinforce underside with longitudinal 14 gauge channel on the centerline.

K. Wall Brackets

1. Dish tables, sinks and counters with sinks shall be securely anchored 3 in. off the face of the wall unless specified otherwise. Brackets shall be "Z" shaped and fabricated of 3 in. wide, 14 gauge stainless steel. Brackets shall be secured in a vertical attitude to the rear of equipment backsplash with weld studs, and to the wall with appropriate fasteners.
2. Counters that are specified tight-to-wall shall be secured in a hidden manner with steel clips, and the wall/fixture joint shall be sealed.

L. Wall Shelves

1. Wall shelves shall be fabricated of 16 gauge stainless steel, size per Item Specifications, with back and ends raised 1-1/2 in., front edges of ends angled back, all corners broken, and front turned down 1-1/2 in., and in 1/2 in. at 45 degrees. Shelf corners shall be welded, ground and polished. Mount shelf 1 in. off face of wall with suitable fasteners on 14 gauge stainless steel flag brackets, 48 in. on center maximum. Flag brackets shall have a web angle of 30 degrees, measured from horizontal.

2.05 ELECTRICAL EQUIPMENT AND WIRING

- A. Under this Section, items of equipment having mounted electrical motors, electrical heating units, lighting fixtures, controllers, control stations, switches, receptacles and the like shall be internally wired as specified herein, terminating at a junction box mounted on the equipment and left ready for connection to the building electrical distribution system by the Electrical Contractor. Extra ceiling mount light fixtures for refrigerated rooms shall be delivered to Electrical Contractor for field installation and wiring. Connections to evaporator coils mounted inside refrigerated rooms shall be wired by the Electrical Contractor.
- B. Provide openings or cutouts required to accommodate the switches and receptacles in the specified work, and the wiring in conduit from terminal blocks in junction boxes.
- C. Electrically operated equipment and fabricator wiring shall conform to the requirements of Underwriter's Laboratories, Inc. Motors over one horsepower shall be equipped with overload protection.

- D. Furnish wiring diagrams for equipment as requested by the Architect or Contractor.

2.06 ITEM SPECIFICATIONS

To Follow

PART 3 - EXECUTION

3.01 SANITATION REQUIREMENTS

- A. Equipment specified herein shall be fabricated to conform to the "Food Service Equipment Standards" of the National Sanitation Foundation prepared by the Committee on Food Service Standards, and published by the National Sanitation Foundation, Ann Arbor, Michigan. Any differences of opinion on sanitation shall be referred to the State Department of Health for a ruling.
- B. Equipment shall be installed in accordance with the manufacturer's instructions and the best practices of the food service industry, with careful attention to eliminating all cracks, crevices and concealed spaces in wet areas that would be difficult to clean or keep free of vermin and soil.

3.02 EXAMINATION AND ACCEPTANCE

- A. Determine whether the General Contractor will furnish and provide temporary power and light, openings and storage space to permit scheduled delivery of equipment. Verify water pressure and provide necessary reducing valves.
- B. Examine space in which specified work is to be installed to assure that conditions are satisfactory for the installation of specified work. Report in writing to the Architect, any deficiency in the work of other contractors affecting specified work. Commencement of specified work shall be construed as acceptance of space conditions.
- C. Obtain and verify all measurements and conditions on the job, and assume responsibility in respect to same.
- D. Inspect flooring and raised concrete bases, wall finishes, painting, ceiling installation and all related work for readiness to commence installation of foodservice equipment. Verify the existence of required mechanical and electrical rough-ins.

3.03 CLEANING UP

- A. Debris and surplus materials resulting from installation work shall be removed promptly as work progresses, to a location indicated by the General Contractor.
- B. Following completion, and before final acceptance by the Owner, clean finished surfaces in accordance with the manufacturer's instructions, and leave specified work free of imperfections.

3.04 DEMONSTRATION AND OPERATING INSTRUCTIONS

- A. Before final acceptance, and by appointment with the Owner and his representatives, completely demonstrate with power, the correct operation of each new item of operating equipment.
- B. Prior to the demonstration, turn on all mechanical and electrical foodservice equipment. Test for leaks, poor connections, and inadequate or faulty performance and correct if necessary. Adjust for proper operation. Thermostatically controlled equipment and equipment with automatic features shall be operated for a sufficient length of time with proper testing equipment to prove controls are functioning as intended. Recalibrate thermostats if necessary.
- C. Provide Architect or Consultant with a loose leaf bound manual of operating data and maintenance instructions containing complete description, wiring diagrams, operating data, maintenance requirements and other information pertaining to the proper operation and upkeep of the various items of electrical or mechanical equipment. Include names, addresses and telephone numbers of authorized service agencies for all items. Arrange all material in alphabetical order by Manufacturer. Book shall be turned over to Owner after review and approval.
- D. Submit guarantees and warranties to the Architect in the above specified manual with all warranty cards completed and becoming effective at the time the equipment was satisfactorily demonstrated.

3.05 PROTECTION OF WORK

- A. Protect specified work from damage during transportation to the project site, storage at the site, during installation, and after completion until acceptance by the Owner.
- B. Protect adjacent work under other contracts during installation until completion of specified work. After completion, the contractor for other work shall be responsible for the protection of his work until acceptance by the Owner.
- C. Damaged work as determined by the Architect, shall be repaired or replaced as determined by and to the satisfaction of the Architect.

3.06 EXISTING EQUIPMENT

- A. Foodservice equipment that is scheduled for reuse shall be removed and stored in a location provided by the General Contractor on site. This Contractor shall provide transportation of equipment.
- B. Verify and document the operating condition of all relocated equipment prior to its being disconnected. Document the condition of the equipment to note any dents, scratches, broken components or other damage prior to placing it in storage. Protect equipment during transport and storage, and assume responsibility for its re-installation in the condition viewed prior to removal. Transport and install the equipment in accordance with Item Specifications.
- C. This Contractor is not responsible for refurbishing equipment noted as "Existing" on plans or specifications unless work is specifically called for in the Item Specifications.
- D. Disconnecting and reconnecting of services to "Existing" equipment shall be performed by related trades.

- E. This Contractor shall restart all existing equipment following its reconnection to building services and verify its correct operation as viewed prior to removal.
- F. This Contractor shall not provide a warranty or guarantee on "Existing" equipment. In the case of a new component being provided by this Contractor for an "Existing" piece of equipment, the component shall be warranted or guaranteed as specified hereinbefore.
- G. Foodservice equipment that is scheduled for reuse must be verified for NSF certification.
- H. Foodservice equipment that is scheduled for reuse and that requires plumbing and/or gas fitting work performed in the Commonwealth of Massachusetts, must be Board of State Examiners of Plumbers and Gas Fitters approved.

END OF SECTION

SECTION 115210
PROJECTION SCREENS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Manually-operated projection screens.
 - 2. Electrically-operated projection screens.
- B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council. Refer to Section 018110, SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 095100 - ACOUSTICAL CEILINGS for coordination with ceiling-recessed units.
 - 2. Division 26 - ELECTRICAL for electrical service and connections including metal device boxes for switches and conduit, where required, for low-voltage control wiring.

1.3 SUBMITTALS

- A. Product Data: For each type of screen indicated.
- B. Shop Drawings: Show layouts and types of projection screens. Include the following:
 - 1. Location of screen centerline relative to ends of screen case.
 - 2. Location of wiring connections.
 - 3. Location of seams in viewing surfaces.
 - 4. Drop length.
 - 5. Connections to supporting structure for pendant- and recess-mounted screens.
 - 6. Anchorage details.
 - 7. Details of juncture of exposed surfaces with adjacent finishes.
 - 8. Frame details.
 - 9. Accessories.
 - 10. Wiring Diagrams: For electrically operated units.
- C. Maintenance Data: For projection screens to include in maintenance manuals.

1.4 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver projection screens until building is enclosed and other construction within spaces where screens will be installed is substantially complete and ready for screen installation.
- B. Store rear-projection screens in manufacturer's protective packaging and according to manufacturer's written instructions.

1.6 COORDINATION

- A. Coordinate layout and installation of projection screens with adjacent construction, including ceiling framing, light fixtures, HVAC equipment, and partitions.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Bretford Manufacturing, Inc.
 - 2. Da-Lite Screen Co., Inc
 - 3. Draper Inc.
 - 4. Stewart Filmscreen.
- B. Basis-of-Design:

2.2 FRONT-PROJECTION SCREENS

- A. Manually Operated Screens: Manufacturer's standard spring-roller-operated units, consisting of case, screen, mounting accessories, and other components necessary for a complete installation.
 - 1. Screen Mounting: Top edge securely anchored to a 3-inch-diameter, rigid steel roller; bottom edge formed into a pocket holding a tubular metal slat, with ends of slat protected by plastic caps, and with a saddle and pull attached to slat by screws.
- B. Electrically Operated Screens: Manufacturer's standard units consisting of case, screen, motor, controls, mounting accessories, and other components necessary for a complete installation. Provide units that are listed and labeled as an assembly by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.
 - 1. Line Voltage Control: Remote, 3-position control switch installed in recessed metal device box with flush cover plate matching other electrical device cover plates in room where switch is installed.

2. Motor in Roller: Instant-reversing motor of size and capacity recommended by screen manufacturer; with permanently lubricated ball bearings, automatic thermal-overload protection, preset limit switches to automatically stop screen in up and down positions, and positive-stop action to prevent coasting. Mount motor inside roller with vibration isolators to reduce noise transmission.
 3. Screen Mounting: Top edge securely anchored to rigid metal roller and bottom edge formed into a pocket holding a 3/8-inch- diameter metal rod with ends of rod protected by plastic caps.
 - a. Roller for end-mounted motor supported by self-aligning bearings in brackets.
 - b. Roller for motor in roller supported by vibration- and noise-absorbing supports.
- C. Recessed, Electrically Operated Screens with Automatic Ceiling Closure: Motor in roller units designed and fabricated for recessed installation in ceiling; with bottom of case composed of two panels fully enclosing screen, motor, and wiring, one panel hinged and designed to open and close automatically when screen is lowered and fully raised, the other removable or openable for access to interior of case.
1. Provide screen case constructed to be installed with underside flush with ceiling.
 2. Prime paint surfaces of screen case that will be exposed to view in the finished work.
- D. Screen Material and Viewing Surface:
1. Matte-White Viewing Surface: Peak gain of 0.9 to 1.0, and gain of not less than 0.8 at an angle of 50 degrees from the axis of the screen surface.
 2. Mildew Resistance: Rating of 0 or 1 when tested according to ASTM G 21.
 3. Flame Resistance: Passes NFPA 701.
 4. Seamless Construction: Provide screens, in sizes indicated, without seams.
 5. Edge Treatment: Black masking borders.
 6. Provide extra drop length of dimension indicated to comply with the following requirements for fabric color and location of drop length:
 7. Size of Viewing Surface: As indicated on the Drawings.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: Install projection screens at locations indicated to comply with screen manufacturer's written instructions.
- B. Install front-projection screens with screen cases in position and in relation to adjoining construction indicated. Securely anchor to supporting substrate in a manner that produces a smoothly operating screen with vertical edges plumb and viewing surface flat when screen is lowered.
1. Install low-voltage controls according to NFPA 70 and manufacturer's written instructions.
 - a. Wiring Method: Install wiring in raceway except in accessible ceiling spaces and in gypsum board partitions where unenclosed wiring method may be used. Use UL-listed plenum cable in environmental air spaces, including plenum ceilings. Conceal raceway and cables except in unfinished spaces.

2. Test electrically operated units to verify that screen controls, limit switches, closure, and other operating components are in optimum functioning condition.
3. Test manually operated units to verify that screen operating components are in optimum functioning condition.

3.2 PROTECTING AND CLEANING

- A. After installation, protect projection screens from damage during construction. If damage occurs despite such protection, remove and replace damaged components or entire unit as required to provide units in their original, undamaged condition.

END OF SECTION

SECTION 116620
ATHLETIC EQUIPMENT

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Basketball equipment.
 - 2. Volleyball and badminton equipment.
 - 3. Safety pads.
 - 4. Divider curtains.
 - 5. Scoreboards and shot clocks.
- B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council. Refer to Section 018110, SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.
- C. Related Work: The following items are not included in this Section and will be performed under the designated Sections:
 - 1. Section 033000 - CAST-IN-PLACE CONCRETE for installation of floor insert sleeves to be cast in concrete slabs and footings.
 - 2. Section 096460 - WOOD ATHLETIC FLOORING for installation of floor insert sleeves.
 - 3. Division 26 - ELECTRICAL for electrical service for motor operators, controls, and other powered devices for motorized gymnasium equipment.
 - 4. Division 26 - ELECTRICAL for electronic scoreboards.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
 - 1. If applicable, include assembly, disassembly, and storage instructions for removable equipment.
 - 2. Motors: Show nameplate data, ratings, characteristics, and mounting arrangements.
- B. Shop Drawings: For gymnasium equipment. Include plans, elevations, sections, details, attachments to other work, and the following:
 - 1. Method of field assembly for removable equipment, connections, installation details, mountings, floor inserts, attachments to other work, and operational clearances.

2. Transport and storage accessories for removable equipment.

- C. Structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation including loads, point reactions, and locations for attachment of gymnasium equipment to structure.
- D. Coordination Drawings: Court layout plans, drawn to scale, and coordinating floor inserts, game lines, and markers applied to finished flooring.
- E. Samples for Initial Selection: For each type of gymnasium equipment indicated.
- F. Samples for Verification: For the following products:
 - 1. Net: Full size.
 - 2. Pad Fabric: Not less than 3 inches square, with specified treatments applied. Mark face of material.
- G. Product Certificates: For each type of gymnasium equipment, signed by product manufacturer.
- H. Operation and Maintenance Data: For gymnasium equipment to include in emergency, operation, and maintenance manuals.
- I. Warranty: Special warranty specified in this Section.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: An employer of workers trained and approved by manufacturer.
- B. Source Limitations: Obtain each type of gymnasium equipment through one source from a single manufacturer.
- 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. Equipment shall conform to applicable rules and specifications of National Federation of State High School Associations (NFSHSA).

1.5 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install gymnasium equipment until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
- B. Field Measurements: Verify position and elevation of floor inserts and layout for gymnasium equipment.

1.6 COORDINATION

- A. Coordinate installation of floor inserts with structural floors and finish flooring installation and with court layout and game lines and markers on finish flooring.

- B. Coordinate layout and installation of overhead-supported gymnasium equipment and suspension system components with other construction including light fixtures, HVAC equipment, fire-suppression-system components, and partition assemblies.

1.7 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of gymnasium equipment 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 BASKETBALL EQUIPMENT

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

- 1. ADP Lemco Inc.
 - 2. Draper Inc.
 - 3. Jaypro Sports, LLC.
 - 4. Porter Athletic Equipment Company.

- B. General: Protruding fasteners or exposed bolt heads on front face of backboards are not permitted.

- C. Basis-of-Design: Basketball backstop and backboard assembly shall be manufactured by Porter Athletic Equipment Co.; or approved equal. Porter Catalog designations are specified to establish standard of quality for performance and materials. Provide components as follows:

- 1. Competition Court: Provide Center-Strut Ceiling-Suspended Forward Folding, Rear Braced Backstop equal to Porter Model No. 90917.
 - a. Backboard: Rectangular Tempered Glass Backboard with Unitized Steel Frame: Porter Model No. 00208-000.
 - b. Backstop Safety Strap: Porter Model No. 10797-100.
 - c. Electric 1/2 H.P. Backstop-Mounted Winch with Ganged Key Switch: Porter Model No. 00706-000.
 - d. Retractor Reel: Porter Model No. 10798-000.
 - e. Rectangular Backboard Padding Kit: Porter Model No. 00326-X00. Color as selected by Architect.
 - f. Goal: Porter Model No. 00233-00 Power-Flex Goal Assembly.

2.2 VOLLEYBALL EQUIPMENT

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

- 1. ADP Lemco Inc.
 - 2. Draper Inc.
 - 3. Jaypro Sports, LLC.

4. Porter Athletic Equipment Company.
- B. Floor Insert: Aluminum floor plate and aluminum pipe sleeve, concealed by floor plate, with capped bottom end, sized with ID to fit post standards, 10 in. or not less than length required to securely anchor pipe sleeve as indicated; with anchors designed for securing floor insert to floor substrate indicated; quantity as indicated.
 1. Floor Plate: Lockable swivel access cover with swivel type retainer pin, designed to be flush with adjacent flooring, with powder coated finish. Provide two tools for unlocking access covers.
 - a. Basis of Design: PVB-91C by Jaypro.
 2. Floor Sleeve, Basis of Design: PVB-105, by Jaypro.
- C. Volleyball equipment, including standards, floor plates, and sleeves, shall be manufactured by Porter Athletic Equipment Co. or approved equal. Porter Catalog designations are specified to establish standard of quality for performance and materials.
- D. Competition Volleyball Package System:
 1. Basis-of-Design: Powr-Rib II Competition Volleyball Package: "Powr-Rib II" Model No. 01961-000. Provide components as follows:
 - a. Volleyball Standards: "Powr-Rib II" Model No. 01971-000.
 - b. Floor Sleeves (for 3-1/2 in. diameter post) with brass cover plate: Model No. 00870-200. Installation Method for Typical Cover Mounting Detail in Wood Floor.
 - c. Volleyball Net: Model No. 02295-360.
 - d. Upright Protective Pads: Model No. 00717-000.
 - e. Net Boundary Marker: Model No. 02297-000.
 - f. Antenna: Model No. 02296-100.
 - g. Judge's Stand: Model No. 00889-100.
 - h. Protective Pads (Judge's Stand): Model No. 00993-100.
 - i. Storage and Transport System: Model No. 00956-100 Volleyball Storage/Transport System.

2.3 SAFETY PADS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 1. ADP Lemco Inc.
 2. Draper Inc.
 3. Jaypro Sports, LLC.
 4. Porter Athletic Equipment Company.
- B. Safety Pad Surface-Burning Characteristics: ASTM E 84 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:
 1. Flame-Spread Index: 25 or less.
 2. Smoke-Developed Index: 450 or less.
- C. Pad Coverings: Provide safety pad fabric covering fabricated from puncture- and tear-resistant, not less than 14-oz./sq. yd PVC-coated polyester or nylon-reinforced PVC fabric treated with

fungicide for mildew resistance; with surface-burning characteristics indicated, and lined with fire-retardant liner.

- D. Wall Safety Pads: Padded wall wainscot panels designed to be attached in a continuous row; each panel section consisting of fill laminated to backer board with visible surfaces fully covered by seamless fabric covering, free of sag and wrinkles and firmly attached to back of backer board.
1. Size: Each panel section, as indicated.
 2. Number of Panel Sections: As indicated modular panel sections.
 3. Installation Method: Concealed mounting Z-clips, unless indicated otherwise.
 4. Fabric Covering Color(s): As selected by Architect from manufacturer's full range for two color(s).

2.4 DIVIDER CURTAINS

- A. Gymnasium divider curtains and tracks shall be manufactured by Porter Athletic Equipment Co., or approved equal. Provide as follows:
1. Divider Curtain Type: Porter Model No. 90675-100.
 2. Lower Section of Curtain (where indicated): Provide Porter "Flexivide II", consisting of a solid vinyl polyester reinforced fabric, 8'-0" high, 22 oz. per square yard min., with anti-bacterial and flame retardant chemicals.
 3. Upper Net Section: Provide Porter "Flexinet", consisting of an open polyester type, interlocking grid weave, coated with polyvinyl chloride, 7 x 5 - 1000 denier polyester based fabric.
 4. Top Hem: Provide top hem 3 in. wide, solid material with 3/16 in. diameter metal spur grommets spaced 12 in. o.c.
 5. Bottom Hem: Provide a pocket to conceal a 4 in. diameter rolling batten. Model No. 92085-400, 92085-500, and 92085-600.
 6. Suspension Hardware shall include a double-pipe assembly of 2 in. diameter tubes with modular suspension frame. Support pipe frame at 12 ft. o.c. maximum. Belt support assembly shall be fabricated from 11 gage formed steel members to provide a support system for hoist belt roller mechanism. Provide manufacturer's standard hoist belts, and steel line shafts.
 7. Motor and Operator: Provide manufacturer's standard motor and operator, sized to smoothly raise and lower curtains. Provide ganged key switch assemblies, mounted on wall as indicated on Drawings. Wiring shall be by electrical trade.
 8. Inertia Safety Brake: Model No. 797 Saf-Strap.
 9. Key Switch: Shall be furnished complete with a stainless steel cover plate for flush mounting into a 4" square by 3 1/2" deep wall junction box, Steel City No. GW-235-C or approved equal.

2.5 SCOREBOARD AND SHOT CLOCKS

- A. General: Scoreboard and shot clocks shall meet requirements for FCC Class A.
1. Provide two scoreboards and six shot clocks in Gymnasium.
- B. Basketball Scoreboard: Standard electronic scoreboard with LED displays controlled by wireless remote control system.

1. General:
 - a. Scoreboard face and perimeter material: 0.063" (1.60 mm) thick aluminum.
 - b. Scoreboard back material: 0.050" (1.27 mm) thick aluminum.
 - c. Overall Dimensions: 4'-0" (1.2 m) tall by 8'-0" (2.4 m) long by 8 inches (203 mm) deep.
 - d. Finish: Powder-coat; color as selected by Architect from manufacturers full range.
 2. Display:
 - a. Digits: 100,000 hour-rated, LED digits, minimum 13 inches high,
 - b. Dots and Arrows: 100,000 hour-rated, LED circular or triangular shapes, 3 inches (76 mm) high.
 - c. Captions: Vinyl lettering to identify each type of information.
 3. Information displayed: Scoreboard shall display the following information:
 - a. Three-digit HOME score; red LED
 - b. Three-digit GUEST score; red LED
 - c. One-digit PERIOD; orange LED
 - d. Home and Guest BONUS circular dots; red LED
 - e. Home and Guest POSSESSION arrows; red LED
 - f. Four-digit count-down CLOCK; orange LED
 4. Product: Daktronics Model BB-2101-15, or equal by approved manufacturer.
- C. Shot Clocks
1. General:
 - a. Shot clock face and perimeter material: 0.063" (1.60 mm) thick aluminum.
 - b. Shot clock back material: 0.050" (1.27 mm) thick aluminum.
 - c. Overall Dimensions: 2'-0" (610 mm) tall by 2'-0" (610 mm) long by 8 inches (203 mm) deep.
 - d. Finish: Powder-coat; color as selected by Architect from manufacturers full range.
 - e. Quantity: Two shot clocks for each scoreboard.
 2. Display: 100,000 hour-rated, LED digits, 13 inches (330 mm) high,
 3. Information displayed: Scoreboard shall display the following information: Two-digit count-down CLOCK; orange LED
 4. Product: Daktronics BB-2114-15 or equal by approved manufacturer.
- D. Remote Control for Scoreboard and Shot Clocks: Manufacturer's standard wireless system comprising the following:
1. Controller: Universal LCD keyboard controller, with nine keypad inserts for basketball, volleyball and wrestling.
 2. Transformer: 12-volt DC wall transformer
 3. Transmitter: FCC Part 15-certificed, 2.4 GHz transmitter connected to keyboard
 4. Receiver: 2.4 GHz receiver, in conformance with the requirements of FCC Part 15, connected to scoreboard.
- E. Power Requirements:
1. Scoreboard: Hard-wired into 20-amp, 120-volt, 60-Hz grounded AC circuit.
 2. Shot Clock: Hard-wired into 20-amp, 120-volt, 60-Hz grounded AC circuit

3. Keyboard: Plug-in to receptacle on 20-amp, 120-volt, 60-Hz grounded AC circuit.

2.6 MISCELLANEOUS MATERIALS

- A. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.
- B. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior applications.
- C. Floor Inserts: Provide as required for gymnastics equipment.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for play court layout, alignment of mounting substrates, installation tolerances, operational clearances, accurate locations of connections to building electrical system, and other conditions affecting performance.
 1. Verify critical dimensions.
 2. Examine supporting structure and subgrades, subfloors and footings below finished floor.
 3. Examine wall assemblies, where reinforced to receive anchors and fasteners, to verify that locations of concealed reinforcements have been clearly marked. Locate reinforcements and mark locations.
 4. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. General: Comply with manufacturer's written installation instructions and competition rules indicated for each type of gymnasium equipment. Complete equipment field assembly, where required.
- B. Unless otherwise indicated, install gymnasium equipment after other finishing operations, including painting, have been completed.
- C. Corrosion Protection: Coat concealed surfaces of aluminum that will come into contact with grout, concrete, masonry, wood, or dissimilar metals with a heavy coat of bituminous paint.
- D. Permanently Placed Gymnasium Equipment and Components: Rigid, level, plumb, square, and true; anchored securely to supporting structure; positioned at locations and elevations indicated on Shop Drawings; in proper relation to adjacent construction; and aligned with court layout.
 1. Floor Insert Location: Coordinate location with application of game lines and markers, and core drill floor for inserts after game lines have been applied.
 2. Floor Insert Installation: Set metal sleeve into cored concrete slab with non-shrink grout and secured to floor slab. Attach sleeve base to underside of the slab with expansion anchors.
 3. Floor Insert Elevation: Coordinate installed heights of floor insert with installation and field finishing of finish flooring and type of floor plate.

- 4. Operating Gymnasium Equipment: Verify clearances for movable components of gymnasium equipment throughout entire range of operation and for access to operating components.
 - E. Safety Pads: Mount with bottom edge at 4 inches above finished floor.
 - F. Anchoring to In-Place Construction: Use anchors and fasteners where necessary for securing built-in and permanently placed gymnasium equipment to structural support and for properly transferring load to in-place construction.
 - G. Floor Insert Setting: Position sleeve in oversized, recessed voids in concrete slabs. Clean voids of debris. Fill void around sleeves with grout, mixed and placed to comply with grout manufacturer's written instructions. Protect portion of sleeve above subfloor[from splatter. Verify that sleeves are set plumb, aligned, and at correct height and spacing; hold in position during placement and finishing operations until grout is sufficiently cured. Set insert so top surface of completed unit is flush with finished flooring surface.
- 3.3 ADJUSTING
- A. Adjust movable components of gymnasium equipment to operate safely, smoothly, easily, and quietly, free from binding, warp, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Lubricate hardware and moving parts.
- 3.4 CLEANING
- A. After completing gymnasium equipment installation, inspect components. Remove spots, dirt, and debris and touch up damaged shop-applied finishes according to manufacturer's written instructions.
 - B. Replace gymnasium equipment and finishes that cannot be cleaned and repaired, in a manner approved by Architect, before time of Substantial Completion.

END OF SECTION

SECTION 116800

PLAY EQUIPMENT AND STRUCTURES

1.1 SUMMARY

- A. Section includes the following freestanding and composite structures of the playground equipment as specified herein and located in the Contract Drawings:
 - 1. 5 to 12-year play structures; Area 1.
 - 2. 5 to 12-year play structures; Area 2.
 - 3. Gaga pit.
 - 4. Basketball goal and net.

1.2 QUALITY ASSURANCE

- A. Safety Standards: Provide playground equipment complying with or exceeding requirements in ASTM F 1487 and/or CPSC No. 325.

1.3 WARRANTY

- 1. Workmanship (installation) warranty Period: at least two-years from date of Substantial Completion.

PART 2 - PRODUCTS

- A. Freestanding Play Structure; 9 to 12-years:
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings by Landscape Structures or approved equal:
 - 2. Skyport Climber.
 - 3. Swoosh Slide.
 - 4. Tightrope.
 - 5. Tower Bubble.
 - 6. Wooshwinder.
 - 7. Netplex; 7 post.
 - 8. Geoplex Climber.
 - 9. Croquet Climber.
 - 10. Playodyssey Tower.
 - 11. Talk Tube.
 - 12. Age Appropriateness: 9 through 12 years.
- B. Freestanding Play Elements; 5 to 12-years:
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings by Landscape Structures or approved equal:
 - 2. Global Motion.
 - 3. Drop Shot.
 - 4. Swings.
 - 5. Age Appropriateness: 5 through 12 years.
- C. Freestanding Play Structure; 5 to 8-years:
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings by Landscape Structures or approved equal:

2. Slidewinder2.
3. Cliff Climber.
4. Flex Climber.
5. Canyon Climber.
6. Playstructure Seat.
7. Croquet Climber.
8. Crest Climber.
9. Bridge.
10. Single Wave Slide.
11. Talk Tube.
12. Age Appropriateness: 5 through 8 years.

2.2 SPORT COURT EQUIPMENT AND STRUCTURES

- A. Gaga pit game; MODEL# APS-GaGaPit 20:
 1. Manufacturer: Subject to compliance with requirements, provide product indicated on Drawings by Acton Play Systems, LLC or approved equal.
 2. Age Appropriateness: 5 through 12 years.
- B. Basketball Goal and Net: MODEL# 996 OUTDOOR BASKETBALL GOOSE NECK.
 1. Basis-of-Design Product: Subject to compliance with requirements, provide Jaypro Sports or approved equal:
 2. Post: Galvanized-steel pipe.
 3. Equipment: Include the following play event components:
 - a. Protective Pad.

2.3 CAST-IN-PLACE CONCRETE FOOTINGS

- A. Concrete Materials and Properties: Concrete installation should be according to the Manufacturer Specification. Recommended strength for concrete is 3000 psi. (15 Mpa). The recommended setting time for concrete is 24-hours to 48-hours.

END OF SECTION

SECTION 122110

HORIZONTAL LOUVER BLINDS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Miniblinds with aluminum louver slats.
- B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council. Refer to Section 018110, SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 061000 - ROUGH CARPENTRY for wood blocking and grounds for mounting horizontal louver blinds and accessories.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated. Include styles, material descriptions, construction details, dimensions of individual components and profiles, features, finishes, and operating instructions.
- B. Shop Drawings: Show location and extent of horizontal louver blinds. Include elevations, sections, details, and dimensions not shown in Product Data. Show installation details, mountings, attachments to other Work, operational clearances, and relationship to adjoining work.
- C. Samples for Verification: Louver slat in specified color, minimum 12 inches long.
- D. Window Treatment Schedule: Include horizontal louver blinds in schedule using same room designations indicated on Drawings.
- E. Maintenance Data: For horizontal louver blinds to include in maintenance manuals. Include the following:
 - 1. Methods for maintaining horizontal louver blinds and finishes.

HORIZONTAL LOUVER BLINDS

2. Precautions about cleaning materials and methods that could be detrimental to finishes and performance.
3. Operating hardware.

1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain horizontal louver blinds through one source from a single manufacturer.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver blinds in factory packages, marked with manufacturer and product name, and location of installation using same room designations indicated on Drawings and in a window treatment schedule.

1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install horizontal louver blinds until construction and wet and dirty finish work in spaces, including painting, is complete and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
- B. Field Measurements: Where horizontal louver blinds are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Allow clearances for operable glazed units' operation hardware throughout the entire operating range. Notify Architect of discrepancies. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 1. Hunter Douglas Window Fashions.
 2. Levolor Contract; a Newell Company; Levolor.
 3. Springs Window Fashions Division, Inc.; Graber.
 4. Verosol USA, Inc.
- B. Basis-of-Design:

2.2 HORIZONTAL LOUVER BLINDS, ALUMINUM LOUVER SLATS

- A. Louver Slats: Aluminum, alloy and temper recommended by producer for type of use and finish indicated; with crowned profile and radiused corners.
 1. Nominal Slat Width: 1 inch for miniblinds.
 2. Nominal Slat Thickness: Not less than 0.008 inch.
 3. Slat Finish: Two colors as indicated, one per side of slat.

- B. Headrail: Formed steel or extruded aluminum; long edges returned or rolled; fully enclosing operating mechanisms on three sides and ends
- C. Tilt Control: Consisting of enclosed worm gear mechanism[, slip clutch or detachable wand preventing overrotation, and linkage rod, for the following operation:
 - 1. Tilt Operation: Manual with clear plastic wand
 - 2. Length of Tilt Control: Length required to make operation convenient from floor level.
 - 3. Tilt: Full.
- D. Lift Operation: Manual, cord lock; locks pull cord to stop blind at any position in ascending or descending travel.
- E. Ladders: Evenly spaced to prevent long-term louver sag; braided string.
- F. Mounting: As indicated on Drawings, mounting permitting easy removal and replacement without damaging blind or adjacent surfaces and finishes; with spacers and shims required for blind placement and alignment indicated.
 - 1. Provide intermediate support brackets if end support spacing exceeds spacing recommended by manufacturer for weight and size of blind.
- G. Hold-Down Brackets and Hooks or Pins: Manufacturer's standard, as indicated.
- H. Colors, Textures, Patterns, and Gloss: As selected by the Architect.

2.3 HORIZONTAL LOUVER BLINDS FABRICATION

- A. Product Standard and Description: Comply with AWCMA Document 1029, unless otherwise indicated, for each horizontal louver blind designed to be self-leveling and consisting of louver slats, rails, ladders, tapes, lifting and tilting mechanisms, cord, cord lock, tilt control, and installation hardware.
- B. Concealed Components: Noncorrodible or corrosion-resistant-coated materials.
 - 1. Lifting and Tilting Mechanisms: With permanently lubricated moving parts.
- C. Unit Sizes: Obtain units fabricated in sizes to fill window and other openings as follows, measured at 74 deg F:
 - 1. Blind Units Installed between (Inside) Jambs: Width equal to 1/4 inch per side or 1/2 inch total, plus or minus 1/8 inch, less than jamb-to-jamb dimension of opening in which each blind is installed. Length equal to 1/4 inch, plus or minus 1/8 inch, less than head-to-sill dimension of opening in which each blind is installed.
- D. Installation Brackets: Designed for easy removal and reinstallation of blind, for supporting headrail and operating hardware, and for hardware position and blind mounting method indicated.
- E. Installation Fasteners: Not fewer than two fasteners per bracket, fabricated from metal noncorrosive to blind hardware and adjoining construction; type designed for securing to supporting substrate; and supporting blinds and accessories under conditions of normal use.

- F. Color-Coated Finish: For components exposed to view, apply manufacturer's standard baked finish complying with manufacturer's written instructions for surface preparation including pretreatment, application, baking, and minimum dry film thickness.
- G. Component Color: Provide rails, cords, ladders, and exposed-to-view metal and plastic matching or coordinating with slat color, unless otherwise indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, operational clearances, and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 HORIZONTAL LOUVER BLIND INSTALLATION

- A. Install blinds level and plumb and aligned with adjacent units according to manufacturer's written instructions, and located so exterior louver edges in any position are not closer than 1 inch to interior face of glass. Install intermediate support as required to prevent deflection in headrail. Allow clearances between adjacent blinds and for operating glazed opening's operation hardware, if any.

3.3 ADJUSTING

- A. Adjust horizontal louver blinds to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.

3.4 CLEANING AND PROTECTION

- A. Clean blind surfaces after installation, according to manufacturer's written instructions.
- B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that horizontal louver blinds are without damage or deterioration at time of Substantial Completion.
- C. Replace damaged blinds that cannot be repaired, in a manner approved by Architect, before time of Substantial Completion.

END OF SECTION

SECTION 122400

SHADES

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Roller shades with manual **and motorized** shade operators.
- B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council. Refer to Section 018110, SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 061000 - ROUGH CARPENTRY for wood blocking and grounds for mounting roller shades and accessories.
 - 2. **Division 26 - ELECTRICAL for electrical service and connections for motor operators, controls, limit switches, and other powered devices and for system disconnect switches for motorized shade operation.**

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
 - 1. Include styles, material descriptions, construction details, dimensions of individual components and profiles, features, finishes, and operating instructions.
 - 2. **Motorized Shade Operators: Include operating instructions.**
 - 3. **Motors: Show nameplate data, ratings, characteristics, and mounting arrangements.**
- B. LEED Submittals:
 - 1. Building Product Disclosure and Optimization, Material Ingredients:
 - a. Option 1, Material Ingredient Reporting: For shadecloth, submit Cradle to Cradle (C2C) certifications, Health Product Declarations (HPD), or Declare product labels.

2. Low-Emitting Materials, General Emissions Evaluation: Building products must be tested and determined compliant in accordance with California Department of Public Health (CDPH) Standard Method v1.2–2017.
 - a. For shade cloth materials, submit GreenGuard Gold certification.
- C. Shop Drawings: Show location and extent of roller shades. Include elevations, sections, details, and dimensions not shown in Product Data. Show installation details, mountings, attachments to other work, operational clearances, and relationship to adjoining work.
 1. Motorized Shade Operators: Show locations and details for installing operator components, switches, and controls. Indicate motor size, electrical characteristics, drive arrangement, mounting, and grounding provisions.
 2. Wiring Diagrams: Power, system, and control wiring.
- D. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:
 1. Ceiling suspension system members and attachment to building structure.
 2. Ceiling-mounted or penetrating items including light fixtures, air outlets and inlets, speakers, sprinklers, recessed shades, and special moldings at walls, column penetrations, and other junctures of acoustical ceilings with adjoining construction.
 3. Shade mounting assembly and attachment.
 4. Size and location of access to shade operator and adjustable components.
 5. Minimum Drawing Scale: 1/4 inch = 1 foot.
- E. Samples for Initial Selection: For each colored component of each type of shade indicated.
 1. Include similar Samples of accessories involving color selection.
- F. Samples for Verification:
 1. Complete, full-size operating unit not less than 16 inches wide for each type of roller shade indicated.
 2. For the following products:
 - a. Shade Material: Not less than 12-inch- square section of fabric, from dye lot used for the Work, with specified treatments applied. Show complete pattern repeat. Mark top and face of material.
 - b. Valance: Full-size unit, not less than 12 inches long.
- G. Window Treatment Schedule: For roller shades. Use same designations indicated on Drawings.
- H. Product Certificates: For each type of roller shade, signed by product manufacturer.
- I. Qualification Data: For Installer.
- J. Product Test Reports: For each type of roller shade.
- K. Maintenance Data: For roller shades to include in maintenance manuals. Include the following:

1. Methods for maintaining roller shades and finishes.
2. Precautions about cleaning materials and methods that could be detrimental to fabrics, finishes, and performance.
3. Operating hardware.
4. **Motorized shade operator.**

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Fabricator of products.
- B. Source Limitations: Obtain roller shades through one source from a single manufacturer.
- C. Fire-Test-Response Characteristics: Provide roller shade band materials with the fire-test-response characteristics indicated, as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:
 1. Flame-Resistance Ratings: Passes NFPA 701.
- D. **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.**
- E. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 1. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver shades in factory packages, marked with manufacturer and product name, fire-test-response characteristics, and location of installation using same designations indicated on Drawings and in a window treatment schedule.

1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install roller shades until construction and wet and dirty finish work in spaces, including painting, is complete and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
- B. Field Measurements: Where roller shades are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Allow clearances for operable glazed units' operation hardware throughout the entire operating range. Notify Architect of discrepancies. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1.7 **EXTRA MATERIALS (ATTIC STOCK)**

- 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. **Rollers Shades:** Before installation begins, for each size, color, texture, and pattern indicated, full-size units equal to 5 percent of amount installed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 1. Draper Inc.
 2. Hunter Douglas Contract; Nysan Shading Systems.
 3. **Lutron Electronics Co.**
 4. MechoShade Systems, Inc.

2.2 ROLLER SHADES

- A. Shadecloth: 100% polyester or PLA biopolymer fabric, PVC-free.
 1. Solar Control Type: Provide transparent type shadecloth with percentage as acceptable to Architect.
 2. **Black-Out Type: Provide black-out type shadecloth at selective locations as directed by Architect.**
 3. Fire-Test-Response Characteristics: Passes NFPA 701, with no chemical flame retardants.
 4. Building Product Disclosure and Optimization, Material Ingredients: Cradle to Cradle (C2C) Gold certification.
 5. Low-Emitting Materials: Provide adhesives and sealants in compliance with the 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."
 - a. GreenGuard Gold certification.
 6. Bottom Hem: Straight.
 7. Colors: To be selected by Architect from manufacturer's full range.
- B. Rollers: Electrogalvanized or epoxy primed steel or extruded-aluminum tube of diameter and wall thickness required to support and fit internal components of operating system and the weight and width of shade band material without sagging; designed to be easily removable from support brackets; with removable spline fitting integral channel in tube for attaching shade material.
 1. Direction of Roll: Regular, from back of roller
- C. Mounting Brackets: Galvanized or zinc-plated steel.
- D. Fascia: L-shaped, formed-steel sheet or extruded aluminum; long edges returned or rolled; continuous panel concealing front and bottom of shade roller, brackets, and operating hardware and operators; length as indicated on Drawings removable design for access.

- E. Top/Back Cover: L-shaped; material and finish to match fascia; combining with fascia and end caps to form a six-sided headbox enclosure sized to fit shade roller and operating hardware inside.
- F. Pocket-Style Headbox: U-shaped, formed-steel sheet or extruded aluminum; long edges returned or rolled; with a bottom cover consisting of slot opening of minimum dimension to allow lowering and raising of shade and a removable or an openable, continuous metal access panel concealing shade roller, brackets, and operating hardware and operators within.
- G. Bottom Bar: Steel or extruded aluminum. Provide concealed, by pocket of shade material, internal-type bottom bar with concealed weight bar as required for smooth, properly balanced shade operation.
- H. Mounting: As indicated on Drawings, mounting permitting easy removal and replacement without damaging roller shade or adjacent surfaces and finishes.
- I. Hold-Down Brackets and Hooks or Pins: Manufacturer's standard for anchoring roller shade bottom in place and keeping shade band material taut.

2.3 ROLLER SHADE FABRICATION

- A. Product Description: Roller shade consisting of a roller, a means of supporting the roller, a flexible sheet or band of material carried by the roller, a means of attaching the material to the roller, a bottom bar, and an operating mechanism that lifts and lowers the shade.
- B. Concealed Components: Noncorrodible or corrosion-resistant-coated materials.
 - 1. Lifting Mechanism: With permanently lubricated moving parts.
- C. Unit Sizes: Obtain units fabricated in sizes to fill window and other openings as follows, measured at 74 deg F:
 - 1. Shade Units Installed between (Inside) Jambs: Edge of shade not more than 1/4 inch from face of jamb. Length equal to head to sill dimension of opening in which each shade is installed.
 - 2. Shade Units Installed Outside Jambs: Width and length as indicated, with terminations between shades of end-to-end installations at centerlines of mullion or other defined vertical separations between openings.
- D. Installation Brackets: Designed for easy removal and reinstallation of shade, for supporting fascia, roller, and operating hardware and for hardware position and shade mounting method indicated.
- E. Installation Fasteners: No fewer than two fasteners per bracket, fabricated from metal noncorrosive to shade hardware and adjoining construction; type designed for securing to supporting substrate; and supporting shades and accessories under conditions of normal use.
- F. Color-Coated Finish: For metal components exposed to view, apply manufacturer's standard baked finish complying with manufacturer's written instructions for surface preparation including pretreatment, application, baking, and minimum dry film thickness.

2.4 MANUALLY OPERATED SHADES WITH SINGLE ROLLERS

- A. Chain-and-Clutch Operating Mechanisms: With continuous-loop bead chain and clutch that stops shade movement when bead chain is released; permanently adjusted and lubricated.
 - 1. Bead Chains: Manufacturer's standard.
 - a. Loop Length: Full length of roller shade.
 - b. Limit Stops: Provide upper and lower ball stops.

2.5 MOTORIZED ROLLER SHADE OPERATORS

- A. General: Provide factory-assembled motorized shade operation systems designed for lifting shades of type, size, weight, construction, use, and operation frequency indicated. Provide operation systems of size and capacity and with features, characteristics, and accessories suitable for Project conditions and recommended by shade manufacturer, complete with electric motors and factory-prewired motor controls, remote-control stations, remote-control devices, power disconnect switches, enclosures protecting controls and all operating parts, and accessories required for reliable operation without malfunction. Include wiring from motor controls to motors. Coordinate operator wiring requirements and electrical characteristics with the building electrical system.
- B. Comply with NFPA 70.
- C. Control Equipment: Comply with NEMA ICS 1, NEMA ICS 2, and NEMA ICS 6 with NFPA 70, Class 2 control circuit, maximum 24-V ac or dc.
- D. Electric Motors: UL-approved or -recognized, totally enclosed, insulated motor, complying with NEMA MG 1, with thermal-overload protection, brake, permanently lubricated bearings, and limit switches; sized by shade manufacturer to start and operate size and weight of shade considering service factor or considering Project's service conditions without exceeding nameplate ratings.
 - 1. Service Factor: According to NEMA MG 1, unless otherwise indicated.
 - 2. Motor Characteristics: Single phase, 220 V, 60 Hz.
 - 3. Motor Mounting: Within manufacturer's standard roller enclosure.
- E. Position of Motor and Electrical Connection: Right side of roller, as determined by hand of user facing shade from inside, unless otherwise indicated on Drawings.
- F. Remote Controls: Electric controls with NEMA ICS 6, Type 1 enclosure for recessed or flush mounting. Provide the following devices for remote-control activation of shades:
 - 1. Control Stations: Keyed, maintained-contact, three-position, switch-operated control station with open, close, and off functions. Provide two keys per station.
 - a. Color: White.
 - 2. Group Control Stations: Maintained-contact, three-position, rocker-style, wall switch-operated control station with open, close, and center off functions for single-switch group control.

- a. Color: White
- 3. Microprocessor Controls: Electronic programmable means for setting, changing, and adjusting control features. Provide unit isolated from voltage spikes and surges.
- G. Limit Switches: Adjustable switches, interlocked with motor controls and set to automatically stop shade at fully raised and fully lowered positions.
- H. Operating Function: Stop and hold shade at any position
- I. Operating Features: Include the following:
 - 1. Group switching with integrated switch control; single face plate for multiple switch cut-outs.
 - 2. Capable of interface with audiovisual control system.
 - 3. Capable of accepting input from building automation control system.
 - 4. Override switch.
 - 5. Backup gear and crank operator for manual operation during power failures with detachable handle, length required to make operation convenient from floor level

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, operational clearances, other conditions affecting performance.
 - 1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 ROLLER SHADE INSTALLATION

- A. Install roller shades level, plumb, and aligned with adjacent units according to manufacturer's written instructions, and located so shade band is not closer than 2 inches to interior face of glass. Allow clearances for window operation hardware.
- B. Connections: Connect motorized operators to building electrical system.

3.3 ADJUSTING

- A. Adjust and balance roller shades to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.

3.4 CLEANING AND PROTECTION

- A. Clean roller shade surfaces after installation, according to manufacturer's written instructions.
- B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that roller shades are without damage or deterioration at time of Substantial Completion.

- C. Replace damaged roller shades that cannot be repaired, in a manner approved by Architect, before time of Substantial Completion.

3.5 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain roller shades. Refer to Division 01 Sections for contract closeout procedures.

END OF SECTION

SECTION 124810

ENTRANCE FLOOR MATS AND FRAMES

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Roll-up aluminum-tread rail floor mats with aluminum hinges.
 - 2. Carpet-type matting.
- B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council. Refer to Section 018110, SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 033000 - CAST-IN-PLACE CONCRETE for concrete work, including forming, placing, and finishing concrete floor slabs, and for concrete materials for grouting and filling around and under recessed mats and frames.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. LEED Submittals:
 - 1. Low-Emitting Materials, General Emissions Evaluation: Building products must be tested and determined compliant in accordance with California Department of Public Health (CDPH) Standard Method v1.1-2010.
 - a. For adhesives, submit test results, including TVOC emissions and VOC content.
 - b. For wet-applied products, submit volume used.
- C. Shop Drawings: Show the following:

1. Items penetrating floor mats and frames, including door control devices.
2. Divisions between mat sections.
3. Perimeter floor moldings.

D. Samples for Verification: For each type of product indicated.

1. Floor Mat: 12-inch- square, assembled sections of floor mat.
2. Frame Members: 12-inch- long Sample of each type and color.

E. Maintenance Data: For floor mat and frames to include in maintenance manuals.

1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain floor mats and frames through one source from a single manufacturer.
- B. Accessibility Requirements: Provide installed floor mats that comply with Section 4.5 in the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)" and the **Massachusetts Architectural Access Board**.

1.5 PROJECT CONDITIONS

- A. Field Measurements: Indicate measurements on Shop Drawings.

1.6 COORDINATION

- A. Coordinate size and location of recesses in concrete with installation of finish floors to receive floor mats and frames.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 1. Roll-up Aluminum Rail Hinged Mats:
 - a. AFCO-USA.
 - b. Balco, Inc.
 - c. Construction Specialties, Inc.
 - d. Mats Inc.
 - e. Nystrom.
 2. Carpet-Type Matting:
 - a. AFCO-USA.
 - b. Mats Inc.
 - c. Milliken.
 - d. Nystrom.

- e. Shaw Contract.
- f. Tennessee Mat Company, Inc.

2.2 METAL FRAME MATERIALS

- A. Extruded Aluminum: ASTM B 221 alloy 6061-T6 or alloy 6063-T5, T6, or T52 as standard with manufacturer.

2.3 CONCRETE FILL AND GROUT MATERIALS

- A. Provide concrete materials complying with Section 033000 - CAST-IN-PLACE CONCRETE for grout and fill around and under recessed mats and frames that produce concrete equivalent in strength to cast-in-place concrete slabs. For concrete fill, adjust aggregate size to not exceed one-third fill thickness.

2.4 FLOOR MATS

- A. General: Provide colors, patterns, and profiles of materials, including metals and metal finishes indicated or specified. If not indicated, provide colors, patterns, and profiles selected by Architect from manufacturer's standards.
- B. Roll-up Aluminum Rail Hinged Mats: Clear-anodized finish, extruded-aluminum tread rails sitting on continuous vinyl cushions with 1-1/2-inch-wide by 3/8-inch-thick, tread rail modules. Provide aluminum hinges and 28-oz./sq. yd. weight, level-cut, nylon-pile, fusion-bonded carpet tread inserts].
 - 1. Tapered Rigid Frame: Tapered extruded-aluminum frame members, not less than 1-1/2 inches wide, with mitered corners and finish to match tread-slat extrusions.
- C. Loop Filament Matting: 3M's "Nomad" loop filament vinyl material 3/8 inch thick, with solid vinyl sheet backing and built-in chemical agents to reduce fungus and mildew. Provide color specified or scheduled or, if not specified or scheduled, as selected by Architect.
 - 1. Flexible Edging: 2-inch-minimum, vinyl edge strip in matching color, bonded to each end of mat material or backing sheet.
- D. Adhesives: Water-resistant, mildew-resistant, nonstaining, pressure-sensitive type to suit products and subfloor conditions indicated.
 - 1. Low-Emitting Materials: Provide adhesives and sealants in compliance with the 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. VOC Content: 50 g/L or less.
 - 3. Do not use adhesives that contain urea formaldehyde.
 - 4. Methylene chloride and perchloroethylene may not be intentionally added to adhesives and sealants.

2.5 FABRICATION

- A. General: Where possible, verify sizes by field measurement before shop fabrication.

- B. Floor Mats: Shop fabricate units to greatest extent possible in sizes as indicated. If not otherwise indicated, provide single unit for each mat installation; do not exceed manufacturer's recommended maximum sizes for units that are removed for maintenance and cleaning. Where joints in mats are necessary, space symmetrically and away from normal traffic lanes. Miter corner joints in framing elements with hairline joints or provide prefabricated corner units without joints.
- C. Recessed Metal Mat Frames: Extruded aluminum of size and style to fit floor mat type specified, for permanent recessed installation, complete with corner pins or reinforcement and anchorage devices.
 - 1. Fabricate edge-frame members in single lengths or, where frame dimensions exceed maximum available lengths, provide minimum number of pieces possible, with hairline joints equally spaced and pieces spliced together by straight connecting pins.
- D. With manufacturer's standard protective coating, coat surfaces of aluminum frames that will contact cementitious material.

2.6 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.

2.7 ALUMINUM FINISHES

- A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
- B. Class II, Clear Anodic Finish: AA-M12C22A31 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class II, clear coating 0.010 mm or thicker) complying with AAMA 611.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrate for compliance with requirements for location, sizes, minimum recess depth, and other conditions affecting installation of floor mats and frames.
 - 1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install recessed mat frames to comply with manufacturer's written instructions. Set mat tops at height recommended by manufacturer for most effective cleaning action; coordinate top of mat surfaces with bottom of doors that swing across mats to provide clearance between door and mat.

1. Install necessary shims, spacers, and anchorages for proper location and secure attachment of frames.
2. Install grout and fill around frames and, if required to set mat tops at proper elevations, in recesses under mats. Finish grout and fill smooth and level.

3.3 PROTECTION

- A. After completing frame installation and concrete work, provide temporary filler of plywood or fiberboard in recesses and cover frames with plywood protective flooring. Maintain protection until construction traffic has ended and Project is near Substantial Completion.
- B. Defer installation of floor mats until Project is near Substantial Completion.

END OF SECTION

SECTION 126100

FIXED AUDIENCE SEATING

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Fixed and removable tread, floor, and riser mounted audience seating with folding seats, tablet arms, and aisle lights.
- B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council. Refer to Section 018110, SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.
- A. Related Work:
 - 1. Section 033000, Cast-In-Place Concrete; Substrate.
 - 2. Division 26, Electrical, for wiring to fixed seating.

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 fixed audience seating. Include electrical characteristics.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
 - 1. Seating Layout: Show seating layout, mounting type, aisle widths, row-lettering and chair-numbering scheme, chair widths, chair spacing in each row, location of seating with tablet arms. Indicate location of seats with different colors, textures, or patterns.
 - 2. Accessories: Show accessories, including electrical devices, accessibility provisions, and attachments to other work.
 - 3. Wiring Diagrams: For power, signal, and control wiring.
- C. Samples for Initial Selection: Provide 6-inch x 6-inch fabric samples of full range of submitted manufacturer and pattern.
- D. Samples for Verification:
 - 1. Two standard size units, showing aisle and connection.

- E. Product Certificates: For each type of flame-retardant treatment of fabric, from manufacturer.
- F. Field quality-control reports.
- G. Maintenance Data: For fixed audience seating to include in maintenance manuals. Include the following:
 - 1. Methods for maintaining upholstery fabric.
 - 2. Precautions for cleaning materials and methods that could be detrimental to seating finishes and performance.
- H. Warranty: Sample of special warranty.

1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain each type of seating required, including accessories and mounting components, from single source from single manufacturer.
 - 1. Upholstery Fabric: Obtain fabric of a single dye lot for each color and pattern of fabric required.
- B. Fire-Test-Response Characteristics of Upholstered Chairs:
 - 1. Fabric: Class 1 according to DOC CS 191 and 16 CFR 1610.61, tested according to California Technical Bulletin 117 or NFPA 260 Class 1.
 - 2. Padding: Comply with California Technical Bulletin 117.
- 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.

1.5 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install seating until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above ceilings is complete, and temporary or permanent HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
- B. Field Measurements: Verify actual dimensions of seating layout and construction contiguous with seating by field measurements before fabrication.

1.6 COORDINATION

- A. Coordinate layout and installation of electrical wiring and devices with seating layout to ensure that floor junction boxes for electrical devices are accurately located to allow connection without exposed conduit. Coordinate with HVAC, vents and registers.

1.7 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of fixed audience seating that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:

- a. Structural failures including standards, beams, and pedestals.
 - b. Wear and deterioration of fabric and stitching beyond normal use.
 - c. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.
 - d. Non-working aisle lights, excluding lamps.
2. Warranty Periods: As follows, from date of Substantial Completion.
 - a. Structural: 10 years.
 - b. Plastic, Wood, and Paint Components: Five years.

1.8 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. Arm Rests: Furnish 12 additional arm rests for Owner's attic stock.
 2. Fabric: Furnish 6 spare seats and seat backs for Owner's attic stock for each pattern, texture and color selected.
 3. Table Arms: Furnish 12 additional tablet arms for Owner's attic stock.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers:
 1. KI.
 2. Hussey Seating Company, U.S.A
 3. Irwin Seating Co.
- B. Basis of Design: Quattro as manufactured by Hussey Seating Company, U.S.A, or approved equal.
 1. Product: Hussey Quattro Chair System
 - a. Model: QUATTRO
 - b. Series: Classic
 - c. Back Foam: 2" [51mm]
 - d. Back: Soft Square Polymer
 - e. Back height: Low
 - f. Aisle Lighting: Low mount
 - g. Seat Type: Standard cushion.
 - h. Armrest Type: Wood veneer. Species as selected by Architect from manufacturers full range.
 - i. Tablet Arms: Plastic laminate clad.
 - j. Tablet arm Style: Writing T1
 - k. Standards: Cast aluminum
 - l. Chair Mount: Tread Mount and Riser Mount – Low Rise.
 - m. End Panels: Wood veneer
 - n. End Panel Style: Quattro
 2. Product Description/Criteria:

- a. Number of Chairs: As indicated on Drawings.
- b. Number of Rows: As indicated on Drawings.
- c. Number of Chairs with Tablet Arms: As indicated on Drawings.
- d. Number of Wheelchair Locations: As indicated on Drawings.
- e. Number of ADA Easy Access End Standards: one percent of seating capacity. At aisle seats evenly distributed within the Auditorium.
- f. Rise: As indicated.
- g. Fabric: As selected by Architect from manufacturers full range.

2.2 MATERIALS

- A. Cast Aluminum: AA - 380
- B. Steel Tubing: ASTM A513
- C. Steel Sheet/Coil: ASTM A607
- D. Mechanical or Adhesive Concrete Anchors: SAE grade 2
- E. Exposed Hardwood Lumber: Wood Species: As selected by Architect from manufacturers full range.
- F. Concealed Plywood: Engineered Wood Association PS1-95 2000: Poplar
- G. Exposed Plywood: Hardwood Plywood ANSI/HPVA-1 2000: Match arm rests.
- H. Medium Density Fiberboard: ANSI A208-2-1986
- I. Plastic Laminate: NEMA LD3.1-1985, GP 48
- J. Polyurethane Foam Padding: ASTM D-3574
- K. Fabric: As selected by Architect from the manufacturers and patterns listed below. Up to 5 different colors within the same product line may be selected.
 - 1. Subject to compliance with requirements, provide fabrics from one of the following:
 - a. Maharam – Medium 463490
 - b. Maharam – Metric 466014
 - c. Momentum Textiles – Origin
 - d. Guilford of Maine – Open House 2334
 - 2. Fabric Construction
 - a. Contents: 100% Polyester
 - b. Soil and stain resistant finish
 - c. Minimum abrasion: 100,000 double-rubs
 - d. Maintenance: W/S – clean with water-based cleaning agents.”
- L. Molded plastic: Injection Molded copolymer polypropylene or nylon 6/6.

2.3 FABRICATION

- A. Upholstered Seats:

1. The seat assembly shall consist of a stylish padded and upholstered top surface, a polypropylene bottom shell with dual contours, and a dual sprung lifting mechanism. Seat shall have the ability to achieve a full fold position when rearward pressure is applied. Superior comfort shall be derived through careful ergonomic engineering.
2. Upholstery Pad: The upholstered seat topper shall consist of a 5/8" thick formed ply form base with contoured molded polyurethane foam padding and fabric upholstered cover. Seat padding shall be properly contoured to support the body without causing discomfort. The upholstered seat cover shall exhibit a high degree of tailoring and will be affixed to the base with upholstery staples.
3. Seat Mechanism: Seat lifting mechanism shall use lubricated lifting springs to provide whisper quiet fail-safe operation. The seat structure shall rotate on a 3/4" [19mm] spanner bar to assure shaft alignment and eliminate binding due to irregular floor conditions. Seats shall be certified to withstand 350,000 lifting cycles and a 600lb static load without failure.
4. Standard Bottom Cover: Seat shell/bottom shall be constructed of polypropylene plastic to provide a durable yet aesthetic design. The cover shall protect the mechanical parts of the lifting hinge and upholstered seat topper. The shell / bottom shape shall compliment the overall design of the chair.
5. Seat Cover Tailoring: Waterfall - Standard.
6. Seat Width: Minimum 20" wide.

B. Classic Series Back (Plastic Outer Back Cover)

1. The outer back panel shall be constructed of injection molded polypropylene Plastic. The panel shall be no less than 27" in length and conceal the rear and sides of the upholstered inner panel. The panel shall extend below the rear of the seat to protect the chair occupant's back.
2. The inner upholstered panel shall be 5/8" (15mm) 11 ply thick-formed hardwood with an ergonomically engineered contour. The wings for attachment of chair back to standard shall be not less than 14 ga (1.9mm) and will be attached via concealed fasteners. Wings shall position the chair back at one of three positions: 15, 18, or 21 degrees. There shall be no exposed fasteners above the seat. Chair back upholstery shall exhibit a high degree of workmanship and customization.
 - a. Soft Square - 33": The top corners of the back are conically shaped for stylish looks and a timeless appearance. Overall back height is 33" above the floor allowing proper shoulder support of the chair occupant. The back surface shall be compound contoured to facilitate proper posture of a seated individual.
3. BACK FOAM TYPE. 2" (51mm) cut
4. BACK COVER TAILORING. Waterfall Standard

C. Cast Aluminum Standards:

1. Standards shall be die cast Aluminum AA380 grade.
2. Standards shall be tread and riser mount, designed to maintain a constant seat height to floor.
3. Cast Aluminum Standards shall be an integral aesthetic part of the chair's appearance.

D. Seat Hinges:

1. Seat hinges shall be fully contained within the seat pan and fitted with a pair of independent, permanently lubricated bearings.
2. Each of the independent seat hinges shall be fitted with double acting; self-centering, pre-loaded coiled seat return springs.

3. Seat hinge and spring installation shall be designed not to require periodic adjustment or lubrication.

E. Finish:

1. Finish for Steel / Aluminum Components: Material shall be pre-treated in an iron phosphate wash system prior to finish application. Finish shall be a specially blended polyester T.G.I.C./Epoxy powder coating with a minimum dry film thickness of 1.5 mils. Color as selected by Architect from manufacturers full range.
2. Injection molded polypropylene or nylon: Shall be pigmented, in one of manufacturers standard colors as selected by Architect, and have a textured surface.
3. Fabric: As specified hereinabove.
4. Color: Seating Contractor shall submit color samples for owner's approval prior to manufacture.

F. Armrests:

1. Armrests, Solid wood: Armrest to be secured to standard with concealed fasteners.

G. End Panels: Wood veneer, as selected by Architect from manufacturer's standard options.

1. Style: Quattro.

H. Tablet Arms: Manufacturer's standard-size, fixed tablet arm with plastic-laminate writing surface over medium-density fiberboard or plywood core and with rounded, matching PVC edges.

1. Mounting: Right-hand mounted unless otherwise indicated.
2. Style: Writing T1.
3. Fold-Away Mechanism: Cast-iron or steel hinge and swivel mechanism that gives positive support in open position and semiautomatic return to stored position below arm block and parallel to chair standard.

2.4 FASTENINGS

A. Chair Assembly

1. All welds shall be made at the factory by welders that are certified on the equipment and process used.
2. All structural connections shall be made with S.A.E. stress rated zinc plated or, black oxide steel bolts, washers and nuts.

B. Attachment

1. Chair stanchions shall each be attached by means of two 1/4" mechanical wedge anchors set in holes drilled to a minimum depth of 2" in the concrete.
 - a. Wedge Anchors: ASTM E488 and listed by ICBO and SBCCI; Wedge anchors feature a type 18-8 stainless steel split expansion ring and a threaded stud bolt body and integral cone expander, and a nut and washers. Stanchion shall be placed on the bolts, stanchions to be permanently secured with a flat washer, lock washer and nut.
2. Comply with manufacturer requirements for riser mounting.

C. Removable Chairs:

1. Provide floor mounted chairs, ganged in groups of one, two, or three chair units for easy removal. Chair standards shall be mounted to a painted steel skid base. Skid base to be secured to concrete floor by means of flush mounted internally threaded expansion anchors positioned under each leg of the skid. When removed, the anchor holes are filled by flat head bolts to provide a flat surface and prevent dirt and debris from entering.

2.5 ACCESSORIES

- A. Armrest, Easy Access: Armrest shall hinge on end standards to allow easy access for disabled patrons. Swing-up end arms shall be provided for one percent of fixed seating capacity to meet the Americans with Disabilities Act (ADA). Each accessible chair shall include the universal handicap symbol on the end aisle standard for clear identification.
- B. End Panels: Panels to be 1/2" MDF, finish with wood veneer. Style: Quattro.
- C. Standard Chair Numbers: Black text with gray background on a 23/32" x 2 7/32" [18.5mm x 56.5mm] elliptical Lexan plate. Plate fitted in a vandal resistant recess located in rear of armrest and secured with adhesive.
- D. Standard Row Letters: Black text with gray background on a 23/32" x 2 7/32" [18.5mm x 56.5mm] elliptical Lexan plate. Plate fitted in a vandal resistant recess located in rear of armrest and secured with adhesive.
- E. Aisle Lights: Aisle lights shall operate from 24 volts (low voltage) requiring a transformer system (supplied by manufacturer). "Low Voltage Luminaire" electrical system approved by Underwriters Laboratories Inc. Aisle lights to be mounted onto aisle standard and will be furnished with cover as an integral part of the chair standard.
 1. Aisle light shall be Low Mount option.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine floors, risers, and other adjacent work and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.
- B. Examine locations of electrical connections.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install seating in locations indicated and fastened securely to substrates according to manufacturer's written installation instructions.
 1. Use installation methods and fasteners that produce fixed audience seating assemblies with individual chairs capable of supporting an evenly distributed 600-lb static load without failure or other conditions that might impair the chair's usefulness.
 2. Install standards and pedestals plumb.

- B. Install seating with chair end standards aligned from first to last row and with backs and seats varied in width and spacing to optimize sightlines. Review drawings for additional alignment requirements.
- C. Install tread and riser mounted attachments to maintain uniform chair heights above floor.
 - 1. Provide removable units where indicated on the Drawings.
- D. Install chairs in curved rows at a smooth radius.
- E. Install seating so moving components operate smoothly and quietly.
- F. Install wiring conductors and cables concealed in components of seating and accessible for servicing.

3.3 FIELD QUALITY CONTROL

- A. 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.
- B. Prepare test and inspection reports.

3.4 ADJUSTING

- A. Adjust chair backs so that they are aligned with each other.
- B. Adjust self-rising seat mechanisms so seats in each row are aligned when in upright position.
- C. Verify that all components and devices are operating properly.
- D. Verify that seating returns to correct at-rest position.
- E. Repair minor abrasions and imperfections in finishes with coating that matches factory-applied finish.
- F. Replace upholstery fabric damaged during installation.

END OF SECTION

SECTION 126610
TELESCOPING STANDS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Wall-attached telescoping stands.
- B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council. Refer to Section 018110, SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Division 26 - ELECTRICAL for electrical service for motor operators, controls, and other powered devices for motorized gymnasium dividers.

1.3 SUBMITTALS

- A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for telescoping stands.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
 - 1. Include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
 - 2. Include wiring diagrams for electrically operated units.
- C. Samples for Initial Selection: For each type of exposed finish required.
- D. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below.
 - 1. Decking: 3-inch- square samples of finished material.
 - 2. Metal Components: 3-inch- square sample of each color and finish indicated.
 - 3. Seating: 3-inch- square sample of each seating material, color, and finish indicated.
- E. Qualification Data: For Installer.

- F. Operation and Maintenance Data: For telescoping stands to include in emergency, operation, and maintenance manuals.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.
- B. Manufacturer's Engineering Responsibility: Preparation of data for telescoping stands, including Shop Drawings, and comprehensive engineering analysis by a qualified professional engineer.
- C. Safety Standard: Provide telescoping stands that comply with requirements in NFPA 102.
- D. Welding: Qualify procedures and personnel according to AWS D1.1 "Structural Welding Code - Steel" and AWS D1.3 "Structural Welding Code - Sheet Steel."
- E. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- F. Accessibility Requirements: Provide telescoping stands that comply with requirements in the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)" and local accessibility standards.
- G. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."

1.5 PROJECT CONDITIONS

- A. Field Measurements: Verify actual locations of walls, columns, and other construction that will interface with telescoping stands by field measurements before fabrication and indicate measurements on Shop Drawings.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:
 - 1. Hussey Seating Company.
 - 2. Interkal LLC.
 - 3. Irwin Telescopic Seating (formerly Folding Bleacher) Company.

2.2 MATERIALS

- A. Wood:
 - 1. Lumber: Kiln-dried, surfaced four sides; southern pine complying with SPIB's "Standard Grading Rules for Southern Pine Lumber" for C&Btr Finish (C and better) grade-of-finish requirements.

2. Plywood: APA grade trademarked, DOC PS 1.

B. Steel:

1. Structural Steel Shapes, Plates, and Bars: ASTM A 36/A 36M.
2. Galvanized Steel Sheet: ASTM A 653/A 653M, G90 coating designation.
3. Uncoated Steel Sheet: ASTM A 1008/A 1008M, Designation CS (cold-rolled commercial steel), or ASTM A 1011/A 1011M, Designation CS (hot-rolled commercial steel).
4. Tubing: ASTM A 500, cold formed; ASTM A 501, hot formed; or ASTM A 513, mechanical.

- C. Extruded Aluminum: ASTM B 221, alloy as standard for manufacturer.

- D. Polyethylene Plastic: High-density polyethylene; molded, color-pigmented, textured, impact-resistant, structural formulation.

2.3 TELESCOPING STANDS

- A. Description: Operable systems of multiple-tiered seating on interconnected folding platforms that close, without being dismantled, into a nested stack for storing or moving. Stand units permit opening and closing of adjacent rows, allow individual and collective rows to be locked open for use, and close with vertical faces of upper skirts on the same vertical plane.

- B. Wall-Attached Telescoping Stands: Rear of understructure permanently attaches to wall construction.

1. Basis-of-Design Product: Hussey, Maxam Telescopic Gym Seat System.
2. Operation: Automatic, power assisted by portable, manually guided, electrically powered unit.
 - a. Limit Switches: Automatically stop integral power system when telescoping stands reach fully opened or closed positions.
 - b. Motion Monitor: Flashing light with self-contained warning horn, rated at 85 decibels (dB) at 10 feet, mounted under telescoping seating for audio and visual warning during integral power operation.
 - c. Transformer: As required to coordinate current characteristics of motor and control station with building electrical system.

- C. Row Spacing: 22 inches.

- D. Row Rise: 10 inches.

- E. Bench Seats and Skirts:

1. Material: Molded polyethylene plastic with contour seat surface and end caps.
 - a. Colors: As selected by Architect from manufacturer's standard.
2. Bench Height: Not less than 16 inches or more than 18 inches.
3. Bench Depth: 10 inches.

- F. Wheelchair-Accessible Seating: Locate cutouts to provide wheelchair-accessible seating at locations indicated on Drawings.

1. Equip tiers adjacent to wheelchair-accessible seating with front rails as required by referenced safety standard.
 2. Equip cutouts with full-width front closure panels that match decking construction and finish and that extend from underside of tiers adjacent to cutouts to 1-1/2 inches from finished floor.
- G. Deck: Plywood.
1. Finish: Manufacturer's standard finish.
- H. Risers: Steel sheet with manufacturer's standard rust-inhibiting coating or hot-dip galvanized finish.
- I. Rails: Structural steel or extruded aluminum, finished with manufacturer's standard powder coat system.
1. Color: Black.
- J. Understructure: Structural steel.
1. Finish: Manufacturer's standard rust-inhibiting finish.
 2. Color: Manufacturer's standard.
- K. Support Column Wheels: Nonmarring, soft, rubber-face wheel assembly under each support column.
1. Include wheels of size, number, and design required to support stands and operate smoothly without damaging the flooring surface, but not less than four per column or less than 3-1/2 inches in diameter and 1 inch wide.
- L. Aisle Closures: Manufacturer's standard that produce flush vertical face at aisles when system is stored.
- M. Fasteners: Vibration proof, in manufacturer's standard size and material.
- N. Accessories:
1. Slip-resistant, abrasive tread surfaces at vertical aisles.
 2. Intermediate aisle steps, fully enclosed, at each vertical aisle.
 3. Transitional top step, fully enclosed, at each vertical aisle where last row of telescoping stands is adjacent to a cross aisle.
 4. Removable front steps, fully enclosed, at each vertical aisle, that engage with front row to prevent accidental separation or movement and are equipped with a minimum of four skid-resistant feet.
 5. Folding, nonremovable mid-aisle handrails located at centerline of each vertical aisle with seating on both sides.
 6. End rails (guards) that are telescoping and self-storing.
 7. Back rails (guards) along rear of units where required by referenced safety standard.
 8. Front rails (guards) along front of units where required by referenced safety standard.
 9. Removable, programming-support front rails to allow seating in upper rows while lower rows remain in the stored position.
 10. Rear fillers including supports for closing openings between top row and rear wall of adjoining construction.

11. Gap fillers for closing openings between stand units or between stand units and adjoining construction.
12. End panels covering exposed ends of stands in stored position.

2.4 FABRICATION

- A. Fabricate understructure from structural steel members in size, spacing, and form required to support design loads specified in referenced safety standard.
- B. Weld understructure to comply with applicable AWS standards.
- C. Round corners and edges of components and exposed fasteners to reduce snagging and pinching hazards.
- D. Form exposed sheet metal with flat, flush surfaces, level and true in line, and without cracking and grain separation.
- E. Seating Supports: Fabricate supports to withstand, without damage to components, the forces imposed by use of stands without failure or other conditions that might impair the usefulness of seating units.
 1. Cantilever bench seat supports to produce toe space uninterrupted by vertical bracing.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas where telescoping stands are to be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.
 1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install telescoping stands to comply with referenced safety standard and manufacturer's written instructions.

3.3 ADJUSTING AND CLEANING

- A. On completion of installation, lubricate, test, and adjust each telescoping stand unit so that it operates according to manufacturer's written operating instructions.
- B. Clean installed telescoping stands on exposed and semiexposed surfaces. Touch up shop-applied finishes or replace components as required to restore damaged or soiled areas.

3.4 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain telescoping stands. Refer to Division 01.

END OF SECTION

SECTION 140001

ELEVATORS

(Filed Sub-Bid Required)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

B. Time, Manner and Requirements for Submitting Sub-Bids:

1. Sub-bids for work under this Section shall be for the complete work and shall be filed in a sealed envelope with the _____ at a time and place as stipulated in the "NOTICE TO CONTRACTORS".

The following should appear on the upper left hand corner of the envelope:

NAME OF SUB-BIDDER: (Insert name of sub-bidder)

MASS. STATE PROJECT: ((Insert project number from top of page))

SUB-BID FOR SECTION: 140001 – ELEVATORS

2. Each sub-bid submitted for work under this Section shall be on forms furnished by the _____ as required by Section 44F of Chapter 149 of the General Laws, as amended. Sub-bid forms may be obtained at the office of the _____, or may be obtained by written or telephone request; telephone _____.
3. Sub-bids filed with the _____ shall be accompanied by BID BOND or CASH or CERTIFIED CHECK or TREASURER'S CHECK or CASHIER'S CHECK issued by a responsible bank or trust company payable to the _____ in the amount of five percent of the sub-bid. A sub-bid accompanied by any other form of bid deposit than those specified will be rejected.

C. Sub Sub-Bid Requirements: (None required under this Section.)

D. Reference Drawings: The Work of this Filed Sub-Bid is shown on the following Contract Drawings: *to be issued with final documents.*

1.2 DESCRIPTION OF WORK

A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. All Work of Section 142100 – ELECTRIC TRACTION ELEVATORS

2. All Work of Section 144600 – MATERIAL LIFTS

END OF SECTION

SECTION 141200

DUMBWAITERS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Power-operated dumbwaiters and self-supporting dumbwaiter structures, in existing hoistway.
- B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council. Refer to Section 018110, SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 033000 - CAST-IN-PLACE CONCRETE for lintels, sleeves, anchors, inserts, plates and similar items.
 - 2. Section 055000 - METAL FABRICATIONS for subsills and hoistway entrance frames made from structural-steel shapes.
 - 3. Division 26 - ELECTRICAL for electrical service to dumbwaiters, including disconnect switches.

1.3 SUBMITTALS

- A. Product Data: Include capacities, sizes, performances, operations, safety features, controls, and finishes for dumbwaiters.
- B. LEED Submittal:
 - 1. MRc3-5, Building Products Disclosure and Optimization: To be determined.
- C. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
 - 1. Indicate maximum and average power demands.
- D. Product Certificates: For each type of dumbwaiter, signed by product manufacturer.

- E. Qualification Data: For Installer.
- F. Field quality-control test reports.
- G. Operation and Maintenance Data: For dumbwaiters to include in emergency, operation, and maintenance manuals.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Dumbwaiter manufacturer or a qualified installer approved by dumbwaiter manufacturer.
- B. Regulatory Requirements: Comply with ASME A17.1 and applicable local Code.
- C. Fire-Rated Door Assemblies: Door and frame assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing at as close to neutral pressure as possible according to NFPA 252.
- D. 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.
- E. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 - GENERAL REQUIREMENTS.

1.5 MAINTENANCE SERVICE

- A. Initial Maintenance Service: Beginning at Substantial Completion, provide two years' full maintenance service by skilled employees of dumbwaiter Installer. Include monthly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper dumbwaiter operation at rated speed and capacity. Provide parts and supplies same as those used in the manufacture and installation of original equipment.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Auton Motorized Systems.
 - 2. Atlas Elevator Co.
 - 3. Baldwin, J. L. Conveyor Co., Inc.
 - 4. Butlers Buddy Inc.
 - 5. Flinchbaugh Company, Inc.
 - 6. Florlift of New Jersey, Inc.
 - 7. Giant Lift Equipment Mfg. Co., Inc.
 - 8. Inclinator Company of America.
 - 9. Matot Inc.

10. Powerlift Inc.; Residential Dumbwaiters.
11. Waupaca Elevator.

2.2 MATERIALS AND COMPONENTS

- A. General: Provide manufacturer's standard preengineered dumbwaiters. Where not otherwise indicated, provide manufacturer's products as indicated in published product literature and as required for complete dumbwaiter systems.
- B. Dumbwaiter No. DBW1:
 1. Basis of Design: Matot Inc.; Model 101.
 2. Hoistway: Existing.
 3. Car Size: 32"W x 46"D x 60"H.
 4. Capacity: 750 lbs.
 5. Number of Stops: Four, with openings on same side of hoistway.
 6. Entry: Floor loading entry, with pit and drawbridge.
 7. Travel Distance: As indicated on Drawings.
 8. Speed: 40 fpm.
 9. Power Supply: 480 volt, 3 Phase, 60 Hz.
- C. Systems and Machinery:
 1. Driving Machine Type: Winding drum, overhead type.
 2. Self-Supporting Structure: Units with structural-steel, self-supporting hoistway framing that requires vertical-load support only at base and lateral support only at landing levels.
 3. Furnish masonry inserts and similar anchorage devices required for installing structural members, guide rails, machines, and other components of dumbwaiter work.
 4. Brackets: Attachments required for fastening guide-rail brackets and other dumbwaiter components to structural-steel building frame.
 5. Machine Locations: Unless otherwise indicated, locate dumbwaiter machines inside shaft at top of hoistway.
- D. Control System: Provide manufacturer's standard, fully automatic, call-and-send microprocessor control system that responds to momentary push-button signals at each landing and as follows:
 1. Car shall not respond to station calls for service while in transit, for a predetermined time after arrival at a landing, and when doors are open.
 2. Noninterference Timer: Provide adjustable, limited period of time for receiving station to gain access to car before it responds to next station call for service.
 3. When delivery has been completed and doors are closed and no calls for service are registered, return car automatically for parking at lowest floor.
- E. Leveling Tolerance: Provide leveling with 1/4-inch leveling tolerance, regardless of load or direction of travel.
 1. Drawbridge for Floor Loading Models: Provide drawbridge, raised and lowered by opening and closing of car gate.
- F. Provide the following materials and finishes where indicated for exposed parts of dumbwaiter car enclosures, car doors, hoistway doors and frames, and signal equipment:

1. Stainless-Steel: ASTM A 666, Type 304, with No. 4, directional satin finish.

G. Car Construction: Manufacturer's standard.

1. Formed, reinforced, and sound-deadened steel sheet with welded joints.
2. Plywood, stainless-steel clad, with mechanically riveted or bolted joints, and with exposed edges of plywood covered with metal and with internal seams sealed by soldering.
3. Shelves, compartments, and other features as indicated.
4. Light Fixture: Manufacturer's standard recessed incandescent light fixture, located in ceiling near front of car.
5. Glazed port through car door and hoistway doors near light location sufficient for observation that car is at landing.
6. Power-Operated Car Doors: Provide manufacturer's standard vertical-biparting counterbalanced doors, same width and height as car, equipped with power operator and with connecting linkages to operate hoistway doors at each landing when car is present.

H. Hoistway Doors and Frames: Manufacturer's standard, manual operation, with tamper resistant locks at all levels.

I. Signal Equipment: Manufacturer's standard signal equipment at each landing push-button station; include call button, send button for each landing served, and illuminated "car-in-use" pilot light that flashes when car arrives at landing until door is opened. Station recessed, set in face of door jamb, with surface-mounted, stainless-steel face plate.

1. Power-Operated Door Buttons: Momentary-pressure "door open" and constant-pressure "door close" buttons.
2. Arrival Signal: Manufacturer's standard arrival lantern and gong system, located above each hoistway entrance, that indicates car is approaching landing to which it has been dispatched. Lantern remains illuminated until car door is opened.
3. Audible, Service Call Signal: Manufacturer's standard buzzer system, located on top of each car, equipped to sound continuously when call button is depressed and held, but only if car is located at landing where hoistway or car door is open.
4. Master Control Station: Manufacturer's standard master control station for each dumbwaiter or group of dumbwaiters, located where indicated. Provide keyed switches and pilot lights for shutdown/startup and emergency stop buttons.

J. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107.

2.3 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.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine conditions, with Installer present, for compliance with requirements for hoistway installation tolerances and other conditions affecting performance of work.
 - 1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install in accordance with ASME A17.1 Part 7 and the manufacturer's written instructions.
- B. Alignment: Coordinate hoistway doors with dumbwaiter travel and car positioning for accurate alignment and minimum clearance between car, hoistway doors, sills, and door frame at each landing.
- C. Set sills flush with finished surface of floors or counters. Fill space under sills solidly with nonshrink, nonmetallic grout.
- D. Adjust car stops for accurate leveling of car at each landing, within specified tolerances.
- E. Lubricate operating parts of dumbwaiter, including wire ropes, guide rails, door tracks, and hardware.

3.3 FIELD QUALITY CONTROL

- A. Testing Agency: Owner may engage a qualified testing agency to perform tests and inspections and prepare test reports.
 - 1. Perform tests required by ASME A17.2.
- B. Test-operate dumbwaiter continuously between lowest and highest landings served, hoisting full-rated capacity load for a minimum of 30 minutes. Re-adjust car stops and other devices and signal equipment for accurate landings and operation of system after completing test.

3.4 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to operate, adjust, and maintain dumbwaiter(s).

END OF SECTION

SECTION 142100

ELECTRIC TRACTION ELEVATORS

(Part of Work of Section 140001 - ELEVATORS, Filed Sub-Bid Required)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Machine-room-less electric traction passenger elevators.
- B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council. Refer to Section 018110, SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.
- C. Items To Be Furnished Only: Furnish the following items for installation by the designated Sections
 - 1. Section 033000 - CAST-IN-PLACE CONCRETE:
 - a. Lintels, sleeves, anchors, inserts, plates and similar items for elevators.
 - 2. Section 042000 - UNIT MASONRY:
 - a. Elevator rail bracket inserts.
- D. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 051200 - STRUCTURAL STEEL FRAMING for the hoist beams, attachment plates, angle brackets, and other preparation of structural steel for fastening guide-rail brackets.
 - 2. Section 055000 - METAL FABRICATIONS for miscellaneous framing and supports for hoisting machines, and for elevator door sills, cants in hoistways made from sheet steel, and elevator pit ladders.
 - 3. Division 09 - FINISHES for floor finish requirements.
 - 4. Division 26 - ELECTRICAL for telephone service to elevators.
 - 5. Division 26 - ELECTRICAL for electrical service for elevators to and including disconnect switches at machine room door and telephone wiring to elevator.

ELECTRIC TRACTION ELEVATORS

1.3 DEFINITIONS

- A. Definitions in ASME A17.1 apply to work of this Section.
- B. Defective Elevator Work: Operation or control system failures; performances below specified ratings; excessive wear; unusual deterioration or aging of materials or finishes; unsafe conditions; the need for excessive maintenance; abnormal noise or vibration; and similar unusual, unexpected, and unsatisfactory conditions.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
 - 1. Include capacities, sizes, performances, operations, safety features, finishes, and similar information. Include product data for the following:
 - 2. Car enclosures and hoistway entrances.
 - 3. Operation, control, and signal systems.
- B. LEED Submittals:
 - 1. Building Product Disclosure and Optimization, Environmental Product Declarations (EPD):
 - a. Option 1: For elevators, submit product-specific Type III EPDs.
- C. Shop Drawings: Show plans, elevations, sections, and large-scale details indicating service at each landing, equipment layout, coordination with building structure, relationships with other construction, and locations of equipment and signals. Include large-scale layout of car control station and standby power operation control panel. Indicate variations from specified requirements, maximum dynamic and static loads imposed on building structure at points of support, and maximum and average power demands.
- D. Samples for Verification: For exposed finishes of cars, hoistway doors and frames, and signal equipment; 3-inch-square Samples of sheet materials; and 4-inch lengths of running trim members.
- E. Manufacturer Certificates: Signed by elevator manufacturer certifying that hoistway, pit, and machine room layout and dimensions, as shown on Drawings, and electrical service, as shown and specified, are adequate for elevator system being provided.
- F. Qualification Data: For Installer.
- G. Operation and Maintenance Data: For elevators to include in emergency, operation, and maintenance manuals.
- H. Inspection and Acceptance Certificates and Operating Permits: As required by authorities having jurisdiction for normal, unrestricted elevator use.
- I. Warranty: Special warranty specified in this Section.
- J. Continuing Maintenance Proposal: Service agreement specified in this Section.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Elevator manufacturer or manufacturer's authorized representative who is trained and approved for installation of units required for this Project.
- B. Source Limitations: Obtain elevators through one source from a single manufacturer.
 - 1. Provide major elevator components, including driving machines, controllers, signal fixtures, door operators, car frames, cabs, and entrances, manufactured by a single manufacturer.
- C. Regulatory Requirements: Comply with ASME A17.1 and Massachusetts Elevator Code.
- D. Accessibility Requirements: Comply with Section 4.10 in the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG) and the Massachusetts Architectural Access Board.
- E. Fire-Rated Hoistway Entrance Assemblies: Door and frame assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing at as close to neutral pressure as possible according to NFPA 252.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle materials, components, and equipment in manufacturer's protective packaging.
- B. Store materials, components, and equipment off of ground, under cover, and in a dry location. Handle according to manufacturer's written recommendations to prevent damage, deterioration, or soiling.

1.7 COORDINATION

- A. Coordinate installation of sleeves, block outs, and items that are embedded in concrete or masonry for elevator equipment. Furnish templates and installation instructions and deliver to Project site in time for installation.
- B. Coordinate sequence of elevator installation with other work to avoid delaying the Work.
- C. Coordinate locations and dimensions of other work relating to traction elevators including pit ladders, sumps, and floor drains in pits; entrance subsills; and electrical service, electrical outlets, lights, and switches in pits and machine rooms.

1.8 WARRANTY

- A. Special Manufacturer's Warranty: Manufacturer's standard form in which manufacturer agrees to repair, restore, or replace defective elevator work within specified warranty period.
 - 1. Warranty Period: One year from date of Substantial Completion.

1.9 MAINTENANCE SERVICE

- A. Initial Maintenance Service: Beginning at Substantial Completion, provide one year's full maintenance service by skilled employees of elevator Installer. Include monthly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper elevator operation at rated speed and capacity. Provide parts and supplies same as those used in the manufacture and installation of original equipment.
 - 1. Include 24-hour-per-day, 7-day-per-week emergency callback service.
- B. Continuing Maintenance Proposal: Provide a continuing maintenance proposal from Installer to Owner, in the form of a standard one-year maintenance agreement, starting on date initial maintenance service is concluded. State services, obligations, conditions, and terms for agreement period and for future renewal options.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering electric traction elevators that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Fujitec America, Inc.
 - 2. KONE Inc.; EcoSpace Elevator
 - 3. Otis Elevator Co.; Gen2 Stream.
 - 4. Schindler Elevator Corp.
 - 5. ThyssenKrupp Elevator; Endura MRL Elevator

2.2 PASSENGER ELEVATORS

- A. Elevator No.:
 - 1. Type: Machine-room-less (MRL), gearless traction.
 - 2. Rated Load: 3500 lb.
 - 3. Rated Speed: 150 fpm.
 - 4. Operation System: [Selective collective automatic operation] [Group automatic operation, two-car group] [Group automatic operation].
 - 5. Auxiliary Operations:
 - a. Standby power operation.
 - b. Standby powered lowering.
 - c. Battery-powered lowering.
 - d. Independent service.
 - e. Loaded-car bypass.
 - f. Automatic dispatching of loaded car.
 - g. Nuisance call cancel.
 - 6. Car Enclosures: As follows:
 - a. Inside Width: As indicated on the Drawings.

- b. Inside Depth: As indicated on the Drawings.
 - c. Inside Height: As indicated on the Drawings.
 - d. Front Walls: Satin stainless steel with integral car door frames.
 - e. Car Fixtures: Satin stainless steel.
 - f. Side and Rear Wall Panels: Satin stainless steel.
 - g. Reveals: Satin stainless steel.
 - h. Door Faces (Interior): Satin stainless steel.
 - i. Door Sills: Aluminum.
 - j. Ceiling: Satin stainless steel, with LED downlights.
 - k. Handrails: Satin stainless steel, at side and rear walls.
 - l. Floor prepared to receive carpet specified in Section 096800 - CARPETING.
 - m. Floor prepared to receive resilient flooring specified in Section 096510 - RESILIENT FLOORING AND ACCESSORIES.
 - n. Floor recessed and prepared to receive dimension stone tile specified in Section 093000 - TILING. Provide cementitious backer units applied over 5/8-inch underlayment grade, exterior plywood, screwed to car platform.
7. Hoistway Entrances: As follows:
- a. Width: As indicated on the Drawings
 - b. Height: As indicated on the Drawings.
 - c. Type: [Single-speed side sliding] [Two-speed side sliding] [Single-speed center opening] [Two-speed center opening].
 - d. Frames: Satin stainless steel.
 - e. Doors: Satin stainless steel.
 - f. Sills: Aluminum.
8. Hall Fixtures: Satin stainless steel.
9. Additional Requirements: As follows:
- a. Provide inspection certificate in each car, mounted under acrylic cover with satin stainless-steel frame.
 - b. Provide protective blanket hooks in all cars and two complete sets of full-height blankets.
10. Building Product Disclosure and Optimization, Environmental Product Declarations (EPD): Type III EPD.

2.3 SYSTEMS AND COMPONENTS

- A. General: Provide manufacturer's standard elevator systems. Where components are not otherwise indicated, provide standard components published by manufacturer as included in standard preengineered elevator systems and as required for complete system.
- B. Elevator Machines: Provide variable-voltage, variable-frequency, ac-type or variable-voltage, dc-type hoisting machines. Provide solid-state power converters.
 - 1. Provide regenerative or nonregenerative system.
 - 2. Limit total harmonic distortion of regenerated power to 5 percent per IEEE 519.
 - 3. Provide means for absorbing regenerated power when elevator system is operating on standby power.

4. Provide line filters or chokes to prevent electrical peaks or spikes from feeding back into building power system.
- C. Fluid for Oil Buffers: If oil buffers are used, use only fire-resistant hydraulic fluid containing antioxidant, anticorrosive, antifoaming, and metal-passivating additives.
 1. Available Product: Subject to compliance with requirements, a product that may be incorporated into the Work includes, but is not limited to, "Hydro Safe (FR)" by Hydro Safe Oil Division, Inc.
- D. Inserts: Furnish required concrete and masonry inserts and similar anchorage devices for installing guide rails, machinery, and other components of elevator work where installation of devices is specified in another Section.
- E. Machine Beams: Provide framing to support elevator hoisting machine and deflector sheaves from the building structure. Comply with Division 05 Section "Metal Fabrications" for materials and fabrication.
- F. Car Frame and Platform: Welded steel units.
- G. Guides: Provide roller guides or polymer-coated, nonlubricated sliding guides at top and bottom of car and counterweight frames.

2.4 OPERATION SYSTEMS

- A. General: Provide manufacturer's standard microprocessor operation system for each elevator as required to provide type of operation system indicated.
- B. Single-Car Auxiliary Operations: In addition to primary operation system features, provide the following operational features for elevators where indicated:
 1. Standby Power Operation: On activation of standby power, car is returned to a designated floor and parked with doors open. Car can be manually put in service on standby power, either for return operation or for regular operation, by switches in control panel located at main lobby. Manual operation causes automatic operation to cease.
 2. Nuisance Call Cancel: When car calls exceed a preset number while car load is less than a predetermined weight, all car calls are canceled. Preset number of calls and predetermined weight can be adjusted.
- C. Security Features: Provide the following security features, where indicated. Security features shall not affect emergency firefighters' service.
 1. Card-Reader Operation: System uses card readers at car control stations to authorize calls. Security system determines which landings and at what times calls require authorization by card reader. Provide required conductors in traveling cable and panel in machine room for interconnecting card readers, other security access system equipment, and elevator controllers. Provide stripe-swipe card reader integral with each car control station.
 2. Keyswitch Operation: Push buttons are activated and deactivated by security keyswitches at car control stations. Key is removable only in deactivated position.
 3. Car-to-Lobby Feature: Feature, activated by keyswitch at main lobby, that causes car to return immediately to lobby and open doors for inspection. On deactivation by keyswitch,

calls registered before keyswitch activation are completed and normal operation is resumed.

2.5 DOOR REOPENING DEVICES

- A. Infrared Array: Provide door reopening devices with uniform array of 36 or more microprocessor-controlled, infrared light beams projecting across car entrance. Interruption of one or more of the light beams shall cause doors to stop and reopen.

2.6 FINISH MATERIALS

- A. General: Provide the following materials for exposed parts of elevator car enclosures, car doors, hoistway entrance doors and frames, and signal equipment as indicated.
- B. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, commercial steel, Type B, exposed, matte finish.
- C. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, commercial steel, Type B, pickled.
- D. Stainless-Steel Sheet: ASTM A 240/A 240M, Type 304, satin (No. 4) finish.
 - 1. Textured Stainless-Steel Sheet: Product with embossed texture rolled into exposed surface.
- E. Stainless-Steel Tubing: ASTM A 554, Grade MT 304, satin (No. 4) finish.
- F. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), Alloy 6063.
- G. Nickel Silver Extrusions: ASTM B 151/B 151M, Alloy UNS No. C74500 or No. C77600.
- H. Plastic Laminate: High-pressure type complying with NEMA LD 3, Type HGS for flat applications.

2.7 CAR ENCLOSURES

- A. General: Provide enameled-steel car enclosures to receive removable wall panels, with removable car roof, access doors, power door operators, and ventilation.
 - 1. Provide standard railings complying with ASME A17.1 on car tops where required by ASME A17.1.
 - 2. Provide finished car including materials and finishes specified below.
- B. Materials and Finishes: Provide manufacturer's standards, but not less than the following:
 - 1. Subfloor: Underlayment grade, exterior plywood, 5/8-inch nominal thickness.
 - 2. Fabricate car with recesses and cutouts for signal equipment.
 - 3. Fabricate car door frame integrally with front wall of car.
 - 4. Stainless-Steel Doors: Flush, hollow-metal construction; fabricated from stainless-steel sheet.
 - 5. Sight Guards: Provide sight guards on car doors.
 - 6. Sills: Extruded nickel silver, with grooved surface, 1/4 inch thick.

7. Handrails: Manufacturer's standard handrails meeting code requirements, of shape, metal, and finish indicated.

2.8 HOISTWAY ENTRANCES

- A. General: Provide manufacturer's standard horizontal-sliding, door-and-frame hoistway entrances complete with track systems, hardware, sills, and accessories. Provide frame size and profile to coordinate with hoistway wall construction.
 1. Where gypsum board wall construction is indicated, provide self-supporting frames with reinforced head sections.
- B. Materials and Fabrication: Provide manufacturer's standards, but not less than the following:
 1. Stainless-Steel Frames: Formed from stainless-steel sheet.
 2. Sight Guards: Provide sight guards on doors matching door edges.
 3. Sills: Extruded metal, with grooved surface, 1/4 inch thick.
 4. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107.

2.9 SIGNAL EQUIPMENT

- A. General: Provide hall-call and car-call buttons that light when activated and remain lit until call has been fulfilled. Fabricate lighted elements with long-life incandescent lamps and acrylic or other permanent, nonyellowing translucent plastic diffusers or LEDs.
- B. Car Control Stations: Provide manufacturer's standard recessed car control stations. Mount in return panel adjacent to car door, unless otherwise indicated.
- C. Emergency Communication System: Provide system that complies with ASME A17.1 and the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)." On activation, system dials preprogrammed number of monitoring station and identifies elevator location to monitoring station. System provides two-way voice communication without using a handset and provides visible signals that indicate when system has been activated and when monitoring station has responded. System is contained in flush-mounted cabinet, with identification, instructions for use, and battery backup power supply.
- D. Firefighters' Two-Way Telephone Communication Service: Provide flush-mounted cabinet in each car and required conductors in traveling cable for firefighters' two-way telephone communication service specified in Division 26 - ELECTRICAL.
- E. Car Position Indicator: Provide illuminated, digital-type car position indicator, located above car door or above car control station. Also provide audible signal to indicate to passengers that car is either stopping at or passing each of the floors served.
 1. Include travel direction arrows if not provided in car control station.
- F. Hall Push-Button Stations: Provide one hall push-button station at each landing for each single elevator or group of elevators, but not less than one station for each four elevators in a group.

- G. Hall Lanterns: Units with illuminated arrows; but provide single arrow at terminal landings. Provide[one of] the following:
 - 1. Manufacturer's standard wall-mounted units, for mounting above entrance frames.
- H. Hall Annunciator: With each hall lantern, provide audible signals indicating car arrival and direction of travel. Signals sound once for up and twice for down.
 - 1. At manufacturer's option, audible signals may be placed on each car.
- I. Corridor Call Station Pictograph Signs: Provide signs matching hall push-button stations, with text and graphics as required by authorities having jurisdiction, indicating that in case of fire elevators are out of service and exits should be used instead. Provide one sign at each hall push-button station, unless otherwise indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine elevator areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance. Examine hoistways, hoistway openings, pits, and machine rooms as constructed; verify critical dimensions; and examine supporting structure and other conditions under which elevator work is to be installed.
 - 1. For the record, prepare a written report, endorsed by Installer, listing dimensional discrepancies and conditions detrimental to performance or indicating that dimensions and conditions were found to be satisfactory.
 - 2. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Comply with manufacturer's written instructions.
- B. Welded Construction: Provide welded connections for installing elevator work where bolted connections are not required for subsequent removal or for normal operation, adjustment, inspection, maintenance, and replacement of worn parts. Comply with AWS standards for workmanship and for qualifications of welding operators.
- C. Sound Isolation: Mount rotating and vibrating equipment on vibration-isolating mounts designed to minimize transmission of vibrations to structure and thereby minimize structure-borne noise from elevator system.
- D. Lubricate operating parts of systems, including ropes, as recommended by manufacturers.
- E. Alignment: Coordinate installation of hoistway entrances with installation of elevator guide rails for accurate alignment of entrances with car. Where possible, delay final adjustment of sills and doors until car is operable in shaft. Reduce clearances to minimum, safe, workable dimension at each landing.
- F. Leveling Tolerance: 1/8 inch, up or down, regardless of load and direction of travel.

- G. Set sills flush with finished floor surface at landing. Fill space under sill solidly with nonshrink, nonmetallic grout.
- H. Locate hall signal equipment for elevators as follows, unless otherwise indicated:
 - 1. For groups of elevators, locate hall push-button stations between two elevators at center of group or at location most convenient for approaching passengers.
 - 2. Place hall lanterns either above or beside each hoistway entrance.
 - 3. Mount hall lanterns at a minimum of 72 inches above finished floor.

3.3 FIELD QUALITY CONTROL

- A. Acceptance Testing: On completion of elevator installation and before permitting use (either temporary or permanent) of elevators, perform acceptance tests as required and recommended by ASME A17.1 and by governing regulations and agencies.
- B. Advise Owner, Architect, and authorities having jurisdiction in advance of dates and times tests are to be performed on elevators.

3.4 PROTECTION

- A. Temporary Use: Limit temporary use for construction purposes to one elevator. Comply with the following requirements for each elevator used for construction purposes:
 - 1. Provide car with temporary enclosure, either within finished car or in place of finished car, to protect finishes from damage.
 - 2. Provide strippable protective film on entrance and car doors and frames.
 - 3. Provide padded wood bumpers on entrance door frames covering jambs and frame faces.
 - 4. Provide other protective coverings, barriers, devices, signs, and procedures as needed to protect elevator and elevator equipment.
 - 5. Do not load elevators beyond their rated weight capacity.
 - 6. Engage elevator Installer to provide full maintenance service. Include preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as necessary for proper elevator operation at rated speed and capacity. Provide parts and supplies same as those used in the manufacture and installation of original equipment.
 - 7. Engage elevator Installer to restore damaged work, if any, so no evidence remains of correction. Return items that cannot be refinished in the field to the shop, make required repairs and refinish entire unit, or provide new units as required.

3.5 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to operate elevator.
- B. Check operation of each elevator with Owner's personnel present and before date of Substantial Completion. Determine that operation systems and devices are functioning properly.

END OF SECTION

SECTION 144600

MATERIAL LIFTS

(Part of Work of Section 140001 - ELEVATORS, Filed Sub-Bid Required)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Vertical material lift.
- B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council. Refer to Section 018110, SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 051200 - STRUCTURAL STEEL FRAMING for attachment plates, angle brackets, and other preparation of structural steel for fastening guide-rail brackets.

1.3 SUBMITTALS

- A. Product Data: Include capacities, sizes, performances, operations, safety features, finishes, and similar information. Include Product Data for enclosures, gates, and operation, control, and drive unit.
- B. Shop Drawings:
 - 1. Include plans, elevations, sections, and large-scale details indicating service at each landing, control panel layout, pit dimensions, coordination with building structure, relationships with other construction, and locations of equipment.
 - 2. Indicate loads imposed on building structure at points of support and power requirements.
- C. Samples for Verification: For exposed finishes; 3-inch- square Samples.
- D. Qualification Data: For Installer.

- E. Manufacturer Certificates: Signed by lift manufacturer certifying that hoistway, pit, and control panel layout and dimensions, as shown on Drawings, and electrical service, as shown and specified, are adequate for material lift being provided.
- F. Preinstallation Examination Report: Indicating dimensional discrepancies and conditions detrimental to performance or indicating that dimensions and conditions were found to be satisfactory.
- G. Sample Warranty: For special warranty.
- H. Operation and Maintenance Data: For material lifts to include in emergency, operation, and maintenance manuals.
- I. Inspection and Acceptance Certificates and Operating Permits: As required by authorities having jurisdiction, for normal, unrestricted material lift use.
- J. Operation and Maintenance Data: For material lifts to include in emergency, operation, and maintenance manuals.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Lift manufacturer or an authorized representative who is trained and approved by manufacturer with not less than five (5) years' experiences in the installation of vertical reciprocating lifts.
- B. Regulatory Requirements: Comply with ASME B20.1 Safety Code for Conveyors, Cableways, and Related Equipment, and applicable provisions of Pennsylvania Code for Elevators and Other Lifting Devices.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle materials, components and equipment in manufacturer's protective packaging. Store materials, components, and equipment off of ground, under cover, and in a dry location.

1.6 COORDINATION

- A. Coordinate installation of sleeves, block outs, and items that are embedded in concrete or masonry for lift equipment. Furnish templates and installation instructions and deliver to Project site in time for installation.
- B. Coordinate locations and dimensions of other work relating to materials lift including floor drains in pits; electrical service; and electrical outlets, lights, and switches in hoistway enclosure.

1.7 WARRANTY

- A. Manufacturer's Special Warranty: Manufacturer agrees to repair or replace material lifts that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:

- a. Structural failures including cracked or broken structural support members, load-bearing welds, and front and rear hinges.
 - b. Faulty operation of operators, control system, or hardware.
 - c. Deck plate failures including cracked plate or permanent deformation in excess of 1/4 inch between deck supports.
 - d. Hydraulic system failures including failure of hydraulic seals and cylinders.
2. Warranty Period for Structural Assembly: Life time of unit.
3. Warranty Period for Drive and Control System: One year from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis-of-Design Manufacturer: Subject to compliance with requirements, provide products that are manufactured by the following:

1. PFlow Industries, Inc.

2.2 MATERIAL LIFTS

- A. General: Manufacturer's post supported, hydraulic vertical reciprocating lift. Unless otherwise indicated, manufacturers' standard components shall be used, as included in standard vertical reciprocating lift and as required for complete system.
 1. Basis-of-Design Product: Series 21 VRC by PFlow.
 - a. Rated Load: Unless otherwise indicated, 6,000 lb. live load.
 - b. Rated Speed: 22 fpm.
 - c. Vertical Travel: Refer to drawings
 - d. Platform Size: Refer to drawings.
- B. Construction: Fabricate material lift from structural-steel shapes rigidly welded and reinforced for maximum strength, safety, and stability. Design assembly to withstand deformation during both operating and stored phases of service.
- C. Hydraulic Power Unit: Consisting of continuous duty, three phase motor, sized for rated live load and speed.
 1. Equip manifold with relief valve, check valve, and pressure-compensated flow-control valve, for safe lowering of loads and to prevent uncontrolled descent in case of hydraulic line failure.
- D. Lifting Means: Raising and lowering of the lift platform shall be provided by two (2) cylinders mounted on the unit. Transmission of the lifting force is achieved via steel roller chain attached to the cylinders and the lift platform. The cylinders are linked together by a heavy torsion bar to ensure that the lift platform remains level despite off-center loads.
 1. An adjustable mechanical stop and pressure switch act to limit the upward travel of the lift platform to a height flush and level with the upper floor. The pressure switch shall be

- designed and set to allow full buildup of hydraulic pressure to secure the lift platform in place and prevent bounce during loading or unloading.
2. Safety cams designed to prevent the lift platform from falling more than six (6) inches if tension is lost in the chains shall be mounted on the platform and connected to the lifting chains.
- E. Safety Enclosure: Guarding on all non-operating sides of the material lift shall be by shaftway walls.
- F. Lift Platform: Steel deck plate with 48-inch high guardrails and kickplates on non-operating sides and dropbars with safety chains on operating ends.
- G. Floor Level Gates: Swing type doors provided at operating sides of lift platform.
1. Provide each door with an electro-mechanical interlock to prevent opening of the gates unless the lift platform is present, and to prevent operation of the lift unless all gates are closed.
 2. Provide "No Rider" signs with lettering not less than 2-inch high.
- H. Inserts: Furnish required concrete and masonry inserts and similar anchorage devices for installing columns, hydraulic pump, and other components of work.

2.3 OPERATION

- A. Control Panel: Internally pre-wired main control panel with step-down transformer and field wiring terminal block.
- B. Controls: Momentary contact push button control stations with call, send, and mushroom style E-stop operators at each floor level for manual control of lift.
- C. The motor/pump unit shall be pre-wired to the main control panel

2.4 FINISH MATERIALS

- A. General: Manufacturer's standard baked-on factory finish unless otherwise indicated.
1. Color: Manufacturer's standard.
- B. Prior to painting, all dirt, mill scale, oil, and grease shall be removed from carbon steel surfaces by a combination of brushing, wiping, and use of solvents

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work. Verify critical dimensions and examine supporting structure and other conditions under which work is to be installed.
- B. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

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

3.2 INSTALLATION

- A. General: Install vertical reciprocating lift equipment as required for a complete installation.
 - 1. Rough-in electrical connections.
- B. Assemble and install units in accordance with manufacturer's printed installation instructions and approved shop drawings.
- C. Attach units securely to structural columns to floor of pit and braced to upper level floor framing.
- D. Locate controls either beside hoistway entrance.
- E. Lubricate operating parts of systems as recommended by manufacturers.

3.3 FIELD QUALITY CONTROL

- A. Acceptance Testing: On completion of material lift installation and before permitting use, perform acceptance tests as required and recommended by ASME B20.1 and by authorities having jurisdiction.
- B. Advise Owner, Architect, and authorities having jurisdiction in advance of dates and times that tests are to be performed.

3.4 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner to operate the material lift.
- B. Check operation of lift with Owner present before date of Substantial Completion. Determine that operation systems and devices are functioning properly.
 - 1. Perform maintenance during normal working hours.

END OF SECTION

SECTION 21 00 01
FIRE SUPPRESSION TRADE BID REQUIREMENTS

PART 1 - GENERAL

1.1 TRADE BID REQUIREMENTS

- A. Fire Protection Work includes the Work specified in the following Sections:
 - 1. All Division 21 Sections, Fire Protection
- B. Submit Sub-Bids in accordance with the provisions of Massachusetts General Laws, Chapter Law for CM at risk projects inclusive, as amended. The time and place of submission of Sub-Bids is set forth in the Instructions to Bidders.
- C. With each Bid, submit a bid deposit in the form of a bid bond, or a certified check on, or a treasurer's or cashier's check issued by, a responsible bank or trust company, payable to the **Town of Newton**, the Awarding Authority, in the amount of five percent of the Bid amount. A bid bond shall be (a) in a form satisfactory to the Awarding Authority, (b) with a surety company qualified to do business in the Commonwealth of Massachusetts and satisfactory to the Awarding Authority, and (c) conditioned upon the faithful performance by the principal of the agreements contained in the bid.
- D. Submit each Sub-Bid on a form furnished by the Awarding Authority.
- E. For the following class or classes of work, list on the Sub-Bid form the names of persons, firms and corporations furnishing to the Sub-Bidder labor or labor and materials for the class or classes or part thereof, the name of such class of work or part thereof, and the bid price for such class of work or part thereof:

Class of Work	Sections
1. Not Applicable	

- F. The work of this Sub-Bid is shown on Drawings:
FP0.01, FP0.02, ...
- G. Trade Bid Coordination:
 - 1. Sub-Bidders shall refer to the entire set of Drawings, including without limitation: the Work of other Filed Sub-Bids; and Work shown on architectural, civil, structural, mechanical, electrical, plumbing and fire protection and other Drawings; for proper coordination.
 - 2. Sub-Bidders shall review Procurement and Contracting Requirements including Conditions of the Contract and Division 01 General Requirements. Without limitation or restriction, Division 01 General Requirements contain requirements and assignments of responsibility between the general Contractor and Sub-Bidders for alternates, administration, delegated design, submittals, quality control, cutting and patching, hoisting, scaffolding, temporary services, demolition, warranties, contract closeout and other requirements, which the Sub-Bidder must carefully review to determine how its scope of work and its Sub-Bid price may be affected.

- H. Access Panels: For Work installed by the Fire Protection Trade Bid in concealed locations where access is required, furnish access panels per Section 08 31 10 "Access Doors and Frames" for installation by trade constructing surrounding Work.
- I. Alternates: Refer to Section 01 23 00 "Alternates" for scope of the Alternates and for administrative and procedural requirements applicable to Alternates.
- J. Penetration Firestopping and Fire Resistive Joint Systems: For Work installed by the Fire Suppression Trade Bidder in locations where penetrations in fire rated walls, horizontal assemblies, or smoke barriers is required. Refer to Section 07 84 10 "Penetration Firestopping" and Section 07 84 40 "Fire-Resistive Joint Systems."
- K. Resilient Ceiling Hangers: For Work installed by the Fire Suppression Trade Sub-Bidder in and above acoustically insulated/isolated rooms, provide resilient ceiling hangers per Section 09 2110 Gypsum Board assemblies.
- L. The Sub-Bidder selected to perform this work will be required to furnish a performance bond and a payment bond, each in the amount of 100 percent of the Trade Bid price.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 21 00 01

SECTION 21 05 00
COMMON WORK RESULTS FOR FIRE SUPPRESSION

PART 1 - GENERAL

1.1 TRADE BID REQUIREMENTS

- A. Work of this Section is part of the Fire Protection Trade Bid. Refer to Section 21 00 01 "Fire Protection Trade Bid Requirements" for additional information about this Trade Bid.

1.2 RELATED DOCUMENTS

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

1.3 SUMMARY

- A. This Section includes the following:
 - 1. Piping materials and installation instructions common to most piping systems.
 - 2. Mechanical sleeve seals.
 - 3. Sleeves.
 - 4. Escutcheons.
 - 5. Grout.
 - 6. Equipment installation requirements common to equipment sections.
 - 7. Painting and finishing.
 - 8. Concrete bases.
 - 9. Supports and anchorages.
 - 10. Fire stopping of fire suppression penetrations as specified in Section 07 84 13 "Penetration Fire stopping."

1.4 DEFINITIONS

- A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, 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.
- D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in chases.
- E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

1.5 SUBMITTALS

- A. Product Data: For the following:
 - 1. Mechanical sleeve seals.
 - 2. Escutcheons.
 - 3. Sleeves.

1.6 QUALITY ASSURANCE

- A. Provide Fire Protection throughout the facility which is compliant with all applicable NFPA standards, Massachusetts State Building Code, local ordinances/regulations/standards, Local Authorities Having Jurisdiction and Insurance Underwriter requirements.
- B. All products provided are to be UL Listed and FM Approved for the use intended by those standards (UL/FM).
- C. Electrical Characteristics for Fire-Suppression 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. Any Substitution of products or methods provided/undertaken are the sole responsibility of this subcontract. The remedy correcting any resulting detrimental effects due to any substituted items will be borne as part of this subcontract, at no additional cost to the owner. The remedy to correct such deficiencies will be as determined by the Architect.
- E. One manufacturer's product is to be provided for each category of products throughout the project, unless specific circumstances do not allow for this approach. Consult with the Architect/Engineer prior to bid to request deviation from this one-product contract requirement. No change order will be considered for failing to comply with this requirement. Any installation of non-compliant products will be removed and replaced under this section with compliant products at no additional cost to the owner.

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.

1.8 COORDINATION

- A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for fire-suppression 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. Coordinate requirements for access panels and doors for fire-suppression items requiring access that are concealed behind finished surfaces. Access panels and doors are specified in Division 08 Section "Access Doors and Frames."

PART 2 - PRODUCTS

2.1 PIPE, TUBE, AND FITTINGS

- A. Refer to individual Division 21 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.

2.2 JOINING MATERIALS

- A. Refer to individual Division 21 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. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.
- E. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

2.3 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.
 - 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: Composite material or carbon steel, include two for each sealing element.
 - 4. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.4 SLEEVES

- A. Galvanized-Steel Sheet: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

- B. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.
- C. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
- D. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.
- E. For interior wall, floor and ceiling penetrations, seal annular space between sleeve and pipe or pipe insulation using joint sealants appropriate for fire rating, size, depth, and location of joint shall be under division 078410 for Firestopping and Section 078440 for Fire Resistive Joint Sealants

2.5 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. One-Piece, Cast-Brass Type: With set screw.
 - 1. Finish: Polished chrome-plated
- D. One-Piece, Floor-Plate Type: Cast-iron floor plate.

2.6 GROUT

- A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.
 - 1. Characteristics: Post-hardening, volume-adjusting, nonstaining, 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 PIPING SYSTEMS - COMMON REQUIREMENTS

- A. Install piping according to the following requirements and Division 21 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. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.

- D. Install 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. All exposed piping in finished spaces (unless clearly indicated otherwise on the Contract Documents) will be installed as high as possible, tight to structure above. This exposed piping is to also be installed in a configuration as indicated on the Construction Documents. Fully coordinated Fabrication Drawings will be submitted to and approved by the Architect and Engineer prior to any fabrication or installation. Any non-conforming work will be made to conform to the Contract Documents and Architect's/Engineer's Fabrication Drawing comments by this Contractor at no additional cost to the Owner.
- F. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- G. Install piping to permit valve servicing.
- H. Install piping at a slope that will permit full drainage.
- I. Install piping free of sags and bends.
- J. Install fittings for changes in direction and branch connections.
- K. Select system components with pressure rating equal to or greater than system operating pressure.
- L. Install escutcheons for penetrations of walls, ceilings, and floors according to the following:
 - 1. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
 - 2. Chrome-Plated Piping: One-piece, cast-brass type with polished chrome-plated finish.
 - 3. Insulated Piping: One-piece, stamped-steel type with spring clips.
 - 4. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished chrome-plated finish.
 - 5. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, stamped-steel type and set screw.
 - 6. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass type with polished chrome-plated finish.
 - 7. Bare Piping in Equipment Rooms: One-piece, cast-brass type.
 - 8. Bare Piping at Floor Penetrations in Equipment Rooms: One-piece, floor-plate type.
- M. Sleeves are not required for core-drilled holes.
- N. Install sleeves for pipes passing through 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.
 - 2. Install sleeves in new walls and slabs as new walls and slabs are constructed.
 - 3. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:
 - a. Steel Pipe 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.
- O. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
 - 1. Install steel pipe for sleeves smaller than 6 inches in diameter.
 - 2. Install cast-iron "wall pipes" for sleeves 6 inches and larger in diameter.
 - 3. 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.
- P. Underground, Exterior-Wall Pipe Penetrations: Install 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.
- Q. Verify final equipment locations for roughing-in.
- R. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

3.2 PIPING JOINT CONSTRUCTION

- A. Join pipe and fittings according to the following requirements and Division 21 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. 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.

- E. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.
- F. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

3.3 PAINTING

- A. Painting of fire-suppression 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.

3.4 CONCRETE BASES

- A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.
 - 1. Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit.
 - 2. 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. Install 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, instructions, and directions furnished with items to be embedded.
 - 5. Install anchor bolts to elevations required for proper attachment to supported equipment.
 - 6. Install 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 "Miscellaneous Cast-in-Place Concrete."

3.5 ERECTION OF METAL SUPPORTS AND ANCHORAGES

- A. Refer to Division 05 Section "Metal Fabrications" for structural steel.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor fire-suppression materials and equipment.
- C. Field Welding: Comply with AWS D1.1.

3.6 GROUTING

- A. Mix and install grout for fire-suppression 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 21 05 00

SECTION 21 11 00
FACILITY FIRE-SUPPRESSION WATER-SERVICE PIPING

PART 1 - GENERAL

1.1 TRADE BID REQUIREMENTS

- A. Work of this Section is part of the Fire Protection Trade Bid. Refer to Section 21 00 01 "Fire Protection Trade Bid Requirements" for additional information about this Trade Bid.

1.2 RELATED DOCUMENTS

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

1.3 SUMMARY

- A. Section includes fire-suppression water-service piping and related components outside the building and service entrance piping into the building

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Coordination Drawings: For piping and specialties including relation to other services in same area, drawn to scale. Show piping and specialty sizes and valves, meter and specialty locations, and elevations.
- C. Fabrication Drawings: Produce and deliver stamped and signed fire protection fabrication shop drawings and supporting hydraulic calculations to the Architect for review and approval prior to any order, fabrication or installation of systems or components. Any resulting comments, deficiencies or conflicts with Architectural design intent will be corrected and re-submitted for approval prior to any work being undertaken. Fabrication drawings and calculations are also to be delivered to the Local Building Department, Fire Department and Insurance Underwriter for their review and approval prior to commencement of any work. As part of this process, assume the responsibility of Fire Protection Engineer of Record but under the direction of the Architect and the original Design Engineer.
- D. Field quality-control reports.

1.5 QUALITY ASSURANCE

- A. Regulatory Requirements:
 - 1. Comply with requirements of utility company supplying water. Include tapping of water mains and backflow prevention.
 - 2. Comply with standards of authorities having jurisdiction for fire-suppression water-service piping, including materials, hose threads, installation, and testing.
- B. Piping materials shall bear label, stamp, or other markings of specified testing agency.

- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- D. Comply with the "Approval Guide," published by FM Global, and UL's "Fire Protection Equipment Directory" for fire-service-main products.
- E. NFPA Compliance: Comply with NFPA 24 for materials, installations, tests, flushing, and valve and hydrant supervision for fire-suppression water-service piping.
- F. One manufacturer's product is to be provided for each category of products throughout the project, unless specific circumstances do not allow for this approach. Consult with the Architect/Engineer prior to bid to request deviation from this one-product contract requirement. No change order will be considered for failing to comply with this requirement. Any installation of non-compliant products will be removed and replaced under this section with compliant products at no additional cost to the owner.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Preparation for Transport: Prepare valves according to the following:
 - 1. Ensure that valves are dry and internally protected against rust and corrosion.
 - 2. Protect valves against damage to threaded ends and flange faces.
 - 3. Set valves in best position for handling. Set valves closed to prevent rattling.
- B. During Storage: Use precautions for valves according to the following:
 - 1. Do not remove end protectors unless necessary for inspection; then reinstall for storage.
 - 2. Protect from weather. Store indoors and maintain temperature higher than ambient dew point temperature. Support off the ground or pavement in watertight enclosures when outdoor storage is necessary.
- C. Handling: Use sling to handle valves and fire hydrants if size requires handling by crane or lift. Rig valves to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.
- D. Deliver piping with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe-end damage and to prevent entrance of dirt, debris, and moisture.
- E. Protect stored piping from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor when storing inside.
- F. Protect flanges, fittings, and specialties from moisture and dirt.
- G. Store plastic components protected from direct sunlight. Support to prevent sagging and bending.

1.7 PROJECT CONDITIONS

- A. Interruption of Existing Fire-Suppression Water-Service Piping: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water-distribution service according to requirements indicated:
 - 1. Notify Architect, Construction Manager and Owner no fewer than two days in advance of proposed interruption of service.

2. Do not proceed with interruption of service without approval from Architect, Construction Manager and Owner by written permission.
3. Coordinate with local Fire Department. Provide and implement an acceptable Impairment Plan for temporary fire protection/fire watch during any system shut-down. Provide as part of base bid. Additional Services will not be entertained for this scope.

1.8 COORDINATION

- A. Coordinate connection to water main with utility company.

PART 2 - PRODUCTS

2.1 DUCTILE-IRON PIPE AND FITTINGS

- A. Mechanical-Joint, Ductile-Iron Pipe: AWWA C151, with mechanical-joint bell and plain spigot end unless grooved or flanged ends are indicated.
 1. Mechanical-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
 2. Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron glands, rubber gaskets, and steel bolts.
- B. Push-on-Joint, Ductile-Iron Pipe: AWWA C151, Class 52, with push-on-joint bell and plain spigot end unless grooved or flanged ends are indicated.
 1. Push-on-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
 2. Gaskets: AWWA C111, rubber.
- C. Flanges: ASME 16.1, Class 125, cast iron..

2.2 SPECIAL PIPE FITTINGS

- A. Ductile-Iron Deflection Fittings:
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. EBAA Iron, Inc.
 2. Description: Compound, ductile-iron coupling fitting with sleeve and one or two flexing sections for up to 15-degree deflection, gaskets, and restrained-joint ends complying with AWWA C110 or AWWA C153. Include AWWA C111, ductile-iron glands, rubber gaskets, and steel bolts.
 3. Pressure Rating: 250 psig minimum.

2.3 JOINING MATERIALS

- A. Gaskets for Ferrous Piping: ASME B16.21, asbestos free.

2.4 PIPING SPECIALTIES

- A. Transition Fittings: Manufactured fitting or coupling same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.
- B. Tubular-Sleeve Pipe Couplings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following
 - a. Dresser, Inc.; Dresser Piping Specialties.
 - b. Viking Johnson.
2. Description: Metal, bolted, sleeve-type, reducing or transition coupling, with center sleeve, gaskets, end rings, and bolt fasteners, and with ends of same sizes as piping to be joined.
3. Standard: AWWA C219.
4. Center-Sleeve Material: Manufacturer's standard.
5. Gasket Material: Natural or synthetic rubber.
6. Pressure Rating: 200 psig minimum.
7. Metal Component Finish: Corrosion-resistant coating or material.

2.5 GATE VALVES

- A. UL-Listed and FM-Approved, OS&Y Ductile Iron/Cast Iron Gate Valves:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Crane Co.; Crane Valve Group; Crane Valves.
 - b. Milwaukee Valve Company.
 - c. Mueller Co.; Water Products Division.
 2. Description: Epoxy coated (inside and out) Cast Iron body, wedge and bonnet, and bronze stem.
 3. Standards: UL 262 and "Approval Guide," published by FM Global, listing.
 4. Pressure Rating: 175 psig minimum.
 5. End Connections: Threaded.

2.6 GATE VALVE ACCESSORIES AND SPECIALTIES

- A. Tapping-Sleeve Assemblies:
1. Description: Sleeve and valve compatible with drilling machine.
 - a. Standard: MSS SP-60.
 - b. Tapping Sleeve: Stainless steel 304L, two-piece bolted sleeve with flanged outlet for new branch connection. Include sleeve matching size and type of pipe material being tapped and with recessed flange for branch valve.
 - 1) Acceptable Manufacturers: Mueller, US Pipe, Romac
 - 2) Working pressure: 250 psi
 - c. Valve: AWWA, cast-iron, nonrising-stem, resilient-seated gate valve with one raised face flange mating tapping-sleeve flange and one mechanical.
- B. Valve Boxes: Comply with AWWA M44 for cast-iron valve boxes with a 6 inch cover. Include top section, top flange, adjustable extension of length required for depth of burial of valve, plug with lettering "WATER," and bottom section with base that fits over valve and with a barrel a minimum of 5-1/2 inches in outside diameter.
1. Operating Wrenches: Steel, tee-handle with one pointed end, stem of length to operate deepest buried valve, and socket matching valve operating nut.
 2. Products must be North American made by The Tyler Corporation, Bibby, or Mueller.
- C. Indicator Posts:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Clow Valve Company; a division of McWane, Inc.

- b. Crane Co.; Crane Valve Group; Stockham Division.
- c. Tyco Fire & Building Products LP.
- d. Kennedy Valve; a division of McWane, Inc.
- e. Mueller Co.; Water Products Division
- 2. Description: Vertical-type, cast-iron body with operating wrench, extension rod, and adjustable cast-iron barrel of length required for depth of burial of valve.
- 3. Standards: UL 789 and "Approval Guide," published by FM Global, listing.

2.7 FIRE HYDRANTS

- A. Dry-Barrel Fire Hydrants:
 - 1. Description: Freestanding, with one NPS 4-1/2 and two NPS 2-1/2 outlets, 5-1/4-inch main valve, drain valve, and NPS 6 mechanical-joint inlet. Include interior coating according to AWWA C550. Hydrant shall have cast-iron body, compression-type valve opening against pressure and closing with pressure.
 - a. Standard: AWWA C502.
 - b. Pressure Rating: 250 psig minimum.
 - c. Hydrant operating nut shall be turned to the LEFT (counter-clockwise) to open, and shall be NPS with a flat-to-point dimension of 1-2/1 inches. Confirm operating direction with Fire Department.
 - d. Basis of Design Product: Clow Medallion.

2.8 CHECK VALVES

- A. UL-Listed and FM-Approved Check Valves:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Globe Fire Sprinkler Corporation.
 - b. Kidde Fire Fighting.
 - c. Reliable Automatic Sprinkler Co., Inc.
 - d. Tyco Fire & Building Products LP.
 - e. Victaulic Company.
 - f. Viking Corporation.
 - g. Watts Water Technologies, Inc.
 - 2. Description: Swing-check type with pressure rating, rubber-face checks unless otherwise indicated, and ends matching piping.
 - 3. Standards: UL 312 and "Approval Guide," published by FM Global, listing.
 - 4. Pressure Rating: 175 psig and 250 psig depending on location.

2.9 SLEEVES

- A. Cast-Iron Wall-Pipe Sleeves: Cast or fabricated of cast iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.
- B. Galvanized-Steel-Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.
- C. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, standard-weight, zinc-coated, plain ends.

2.10 SLEEVE SEALS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Advance Products & Systems, Inc.
 - 2. Calpico, Inc.
 - 3. Metraflex, Inc.
 - 4. Pipeline Seal and Insulator, Inc.
- B. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.
- C. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
- D. Pressure Plates: Carbon steel.
- E. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements.

2.11 GROUT

- A. Standard: ASTM C 1107, Grade B, posthardening and volume adjusting, dry, hydraulic-cement grout.
- B. Characteristics: Nonshrink; recommended for interior and exterior applications.
- C. Design Mix: 5000-psi, 28-day compressive strength.
- D. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 EARTHWORK

- A. Comply with excavating, trenching, and backfilling requirements in Division 31 Section "Earth Moving."

3.2 PIPING INSTALLATION

- A. Comply with NFPA 24 for fire-service-main piping materials and installation.
- B. Install ductile-iron, water-service piping according to AWWA C600 and AWWA M41.
 - 1. Install encasement for piping according to ASTM A 674 or AWWA C105.
- C. Bury piping with depth of cover over top at least 60 inches, with top at least 12 inches below level of maximum frost penetration, and according to the following:
 - 1. In Loose Gravelly Soil and Rock: With at least 12 inches of additional cover.

- D. Install piping by tunneling or jacking, or combination of both, under streets and other obstructions that cannot be disturbed.
- E. Extend fire-suppression water-service piping and connect to water-supply source and building fire-suppression water-service piping systems at locations and pipe sizes indicated.
 - 1. Terminate fire-suppression water-service piping at building wall until building-water-piping systems are installed. Terminate piping with caps, plugs, or flanges as required for piping material. Make connections to building's fire-suppression water-service piping systems when those systems are installed.
- F. Install underground piping with restrained joints at horizontal and vertical changes in direction. Use restrained-joint piping, thrust blocks, anchors, tie-rods and clamps, and other supports.
- G. Comply with requirements in Division 21 Sections for fire-suppression-water piping inside the building.
- H. Comply with requirements in Division 22 Section "Domestic Water Piping" for potable-water piping inside the building.

3.3 JOINT CONSTRUCTION

- A. Install couplings, flanges, flanged fittings, unions, nipples, and transition and special fittings that have finish and pressure rating same as or higher than systems pressure rating for aboveground applications unless otherwise indicated.
- B. Install unions adjacent to each valve in tubing NPS 2 and smaller.
- C. Install flanges, flange adaptors, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 and larger end connections.
- D. Ream ends of tubes and remove burrs.
- E. Remove scale, slag, dirt, and debris from outside and inside of pipes, tubes, and fittings before assembly.
- F. Ductile-Iron Piping, Gasketed Joints for Fire-Service-Main Piping: UL 194.
- G. Ductile-Iron Piping, Grooved Joints: Cut-groove pipe. Assemble joints with grooved-end, ductile-iron-piping couplings, gaskets, lubricant, and bolts.
- H. Flanged Joints: Select appropriate gasket material in size, type, and thickness suitable for water service. Join flanges with bolts according to ASME B31.9.
- I. Do not use flanges or unions for underground piping.

3.4 ANCHORAGE INSTALLATION

- A. Anchorage, General: Install water-distribution piping with restrained joints. Anchorages and restrained-joint types that may be used include the following:
 - 1. Concrete thrust blocks.
 - 2. Locking mechanical joints.
 - 3. Set-screw mechanical retainer glands.

4. Bolted flanged joints.
 5. Pipe clamps and tie rods.
- B. Install anchorages for tees, plugs and caps, bends, crosses, valves, and hydrant branches in fire-suppression water-service piping according to NFPA 24 and the following:
1. Gasketed-Joint, Ductile-Iron, Water-Service Piping: According to AWWA C600.
 2. Gasketed-Joint, PVC Water-Service Piping: According to AWWA M23.
 3. Bonded-Joint Fiberglass, Water-Service Piping: According to AWWA M45.
- C. Apply full coat of asphalt or other acceptable corrosion-resistant material to surfaces of installed ferrous anchorage devices.

3.5 VALVE INSTALLATION

- A. UL-Listed and FM-Approved Gate Valves: Comply with NFPA 24. Install each underground valve and valves in vaults with stem pointing up and with vertical cast-iron indicator post.
- B. UL-Listed and FM-Approved Valves Other Than Gate Valves: Comply with NFPA 24.
- C. MSS Valves: Install as component of connected piping system.
- D. Support valves and piping, not direct buried, on concrete piers. Comply with requirements for concrete piers in Division 03 Section Miscellaneous Cast-in-Place Concrete."

3.6 CONNECTIONS

- A. Connect fire-suppression water-service piping to utility water main. Use service clamp.

3.7 SLEEVE INSTALLATION

- A. General Requirements: Install sleeves for pipes and tubes passing through penetrations in exterior walls.
1. Exception: Sleeves are not required for core-drilled holes.
- B. Cut sleeves to length for mounting flush with both surfaces.
- C. Install sleeves in new walls as they are constructed.
- D. For exterior wall penetrations below grade, seal annular space between sleeves and piping using sleeve seals.
- E. Seal space outside of sleeves in concrete walls with grout.
- F. Install the following sleeve materials:
1. Galvanized- steel pipe sleeves for pipes smaller than NPS 6
 2. Cast-iron wall-pipe or galvanized-steel pipe sleeves for pipes NPS 6 and larger.

3.8 SLEEVE SEAL INSTALLATION

- A. Install sleeve seals in sleeves in exterior concrete walls at fire-suppression water-service piping entries into the building.

- B. Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble sleeve seal components and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

3.9 FIELD QUALITY CONTROL

- A. Use test procedure prescribed by authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described below.
- B. Piping Tests: Conduct piping tests before joints are covered and after concrete thrust blocks have hardened sufficiently. Fill pipeline 24 hours before testing and apply test pressure to stabilize system. Use only potable water.
- C. Hydrostatic Tests: Test at not less than one-and-one-half times the working pressure for 24 hours.
 - 1. Increase pressure in 50-psig increments and inspect each joint between increments. Hold at test pressure for one hour; decrease to 0 psig. Slowly increase again to test pressure and hold for at least 24 hours. No leakage is allowed. Remake leaking joints with new materials and repeat test until leakage is within allowed limits.
- D. Prepare test and inspection reports.

3.10 IDENTIFICATION

- A. Install continuous underground warning tape during backfilling of trench for underground fire-suppression water-service piping. Locate below finished grade, directly over piping. Underground warning tapes are specified in Division 31 Section "Earth Moving."

3.11 CLEANING

- A. Clean fire-suppression water-service piping as follows:
 - 1. Purge new piping systems and parts of existing systems that have been altered, extended, or repaired before use.
 - 2. Use purging procedure prescribed by authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described in NFPA 24 for flushing of piping. Flush piping system with clean, potable water until dirty water does not appear at points of outlet.
- B. Prepare reports of purging activities.

3.12 PIPING SCHEDULE

- A. Underground fire-suppression water-service piping NPS 6 to NPS 12 shall be one of the following:
 - 1. Mechanical-joint, ductile-iron pipe; mechanical-joint, ductile- or gray-iron, standard-pattern or ductile-iron, compact-pattern fittings; glands, gaskets, and bolts; and gasketed joints.
- B. Aboveground fire-suppression water-service piping NPS 5 to NPS 12 shall be grooved-end, ductile-iron pipe; grooved-end, ductile-iron pipe appurtenances; and grooved joints.

- C. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:
- D. Underground fire-suppression water-service shutoff valves NPS 3 and larger shall be one of the following:
 - 1. 175-psig, UL-listed and FM-approved, iron, nonrising-stem gate valves.
- E. Indicator-post underground fire-suppression water-service valves NPS 3 and larger shall be 175-psig, UL-listed and FM-approved, iron, nonrising-stem gate valves with indicator-post flange.
- F. Standard-pressure, aboveground fire-suppression water-service shutoff valves NPS 3 and larger shall be one of the following:
 - 1. 175-psig, UL-listed and FM-approved, iron, OS&Y gate valves.
- G. Fire-suppression water-service check valves NPS 3 and larger shall be one of the following:
 - 1. UL-listed and FM-approved detector check valves. Verify with authorities having jurisdiction about any requirement for detector check valves prior to bid. No change order for this will be entertained.

END OF SECTION 21 11 00

SECTION 21 12 00
FIRE-SUPPRESSION STANDPIPES

PART 1 - GENERAL

1.1 TRADE BID REQUIREMENTS

- A. Work of this Section is part of the Fire Protection Trade Bid. Refer to Section 21 00 01 "Fire Protection Trade Bid Requirements" for additional information about this Trade Bid.

1.2 RELATED DOCUMENTS

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

1.3 SUMMARY

- A. Section Includes:
 - 1. Pipes, fittings, and specialties.
 - 2. Fire-protection valves.
 - 3. Hose connections.
 - 4. Fire-department connections.
 - 5. Alarm devices.
 - 6. Pressure gages.
 - 7. Recessed stainless steel fire department valve cabinets.
- B. Related Sections:
 - 1. Division 21 Section "Wet-Pipe Sprinkler Systems" for wet-pipe sprinkler piping.
 - 2. Division 28 Section "Digital, Addressable Fire-Alarm System" for alarm devices not specified in this Section.

1.4 DEFINITIONS

- A. Standard-Pressure Standpipe Piping: Fire-suppression standpipe piping designed to operate at working pressure 175 psig maximum.

1.5 SYSTEM DESCRIPTIONS

- A. Automatic Wet-Type, Class I Standpipe System: Includes NPS 2-1/2 hose connections. Has open water-supply valve with pressure maintained and is capable of supplying water demand.

1.6 PERFORMANCE REQUIREMENTS

- A. Standard-Pressure, Fire-Suppression Standpipe System Component: Listed for 175-psig minimum working pressure.
- B. Delegated Design: Design fire-suppression standpipes, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated. Perform hydrant flow test and use data for calculations.

- C. Fire-suppression standpipe design shall be approved by authorities having jurisdiction.
 - 1. Residual pressure at each hose-connection outlet is:
 - a. 65 psig.
- D. Seismic Performance: Fire-suppression standpipes shall withstand the effects of earthquake motions determined according to NFPA 13 and ASCE/SEI 7.

1.7 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. . Include plans, elevations, sections, details, and attachments to other work.
 - 1. Wiring Diagrams: For power, signal, and control wiring.
- C. Delegated-Design Submittal: For standpipe systems indicated to comply with performance requirements and design criteria, including calculations and analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- D. Coordination Drawings: Fire-suppression standpipes, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
 - 1. Plumbing systems piping.
 - 2. Process piping.
 - 3. HVAC ductwork and hydronic piping.
- E. Fabrication Drawings: As part of the Delegated-Design Submittal, produce and deliver stamped and signed fire protection fabrication shop drawings and supporting hydraulic calculations to the Architect for review and approval prior to any order, fabrication or installation of systems or components. Any resulting comments, deficiencies or conflicts with Architectural design intent will be corrected and re-submitted for approval prior to any work being undertaken. Fabrication drawings and calculations are also to be delivered to the Local Building Department, Fire Department and Insurance Underwriter for their review and approval prior to commencement of any work. As part of this process, assume the responsibility of Fire Protection Engineer of Record but under the direction of the Architect and the original Design Engineer. In areas where fire protection piping is exposed, the original design drawings are to be followed. If it is desired to deviate from the original design, meet with the architect to accomplish the aesthetic intent. The Architect will have final decision in this regard, and no additional cost shall be borne by the Owner or design team.
- F. Qualification Data: For qualified Installer.
- G. Approved Standpipe Drawings: Working plans, prepared according to NFPA 14, that have been approved by authorities having jurisdiction, including hydraulic calculations if applicable.
- H. Fire-hydrant flow test report.
- I. Field Test Reports and Certificates: Indicate and interpret test results for compliance with performance requirements and as described in NFPA 14. Include "Contractor's Material and Test Certificate for Aboveground Piping" and "Contractor's Material and Test Certificate for Underground Piping."
- J. Field quality-control reports.

- K. Operation and Maintenance Data: For fire-suppression standpipes specialties to include in emergency, operation, and maintenance manuals.

1.8 QUALITY ASSURANCE

- A. Installer Qualifications:
 - 1. Installer's responsibilities include designing, fabricating, and installing fire-suppression standpipes and providing professional engineering services needed to assume engineering responsibility. Base calculations on results of fire-hydrant flow test.
 - a. Engineering Responsibility: Preparation of working plans, calculations, and field test reports by a qualified professional engineer.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. NFPA Standards: Fire-suppression standpipe equipment, specialties, accessories, installation, and testing shall comply with NFPA 14, "Installation of Standpipe and Hose Systems."
- D. One manufacturer's product is to be provided for each category of products throughout the project, unless specific circumstances do not allow for this approach. Consult with the Architect/Engineer prior to bid to request deviation from this one-product contract requirement. No change order will be considered for failing to comply with this requirement. Any installation of non-compliant products will be removed and replaced under this section with compliant products at no additional cost to the owner.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

- A. Comply with requirements in Part 3 of this spec, "Piping Schedule" Article for applications of pipe, tube, and fitting materials, and for joining methods for specific services, service locations, and pipe sizes.

2.2 STEEL PIPE AND FITTINGS

- A. Standard Weight, Black-Steel Pipe (Galvanized between the fire department connection and check valve): ASTM A 53/A 53M, Type E, Grade B. Pipe ends may be factory or field formed to match joining method.
- B. Schedule 10, Black-Steel Pipe (Galvanized between the fire department connection and check valve): ASTM A 135 or ASTM A 795/A 795M, Schedule 10 in NPS 5 and smaller; and NFPA 13-specified wall thickness in NPS 6 to NPS 10, plain end.
- C. Standard-Weight, Black-Steel Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M, seamless steel pipe with threaded ends.
- D. Galvanized and Uncoated, Steel Couplings: ASTM A 865, threaded.
- E. Galvanized and Uncoated, Gray-Iron Threaded Fittings: ASME B16.4, Class 125, standard pattern.

- F. Malleable- or Ductile-Iron Unions: UL 860.
- G. Cast-Iron Flanges: ASME B16.1, Class 125.
- H. Steel Flanges and Flanged Fittings: ASME B16.5, Class 150.
- I. Grooved-Joint, Steel-Pipe Appurtenances:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Anvil International, Inc.
 - b. Tyco Fire & Building Products LP.
 - c. Victaulic Company.
 - 2. Pressure Rating: 250 psig minimum.
 - 3. Galvanized and Uncoated, Grooved-End Fittings for Steel Piping: ASTM A 47/A 47M, malleable-iron casting or ASTM A 536, ductile-iron casting; with dimensions matching steel pipe.
 - 4. Grooved-End-Pipe Couplings for Steel Piping: AWWA C606 and UL 213, rigid pattern, unless otherwise indicated, for steel-pipe dimensions. Include ferrous housing sections, EPDM-rubber gasket, and bolts and nuts.

2.3 PIPING JOINING MATERIALS

- A. Pipe-Flange Gasket Materials: AWWA C110, rubber, flat face, 1/8 inch thick or ASME B16.21, nonmetallic and asbestos free.
 - 1. Class 125, Cast-Iron Flanges and Class 150, Bronze Flat-Face Flanges: Full-face gaskets.
 - 2. Class 250, Cast-Iron Flanges and Class 300, Steel Raised-Face Flanges: Ring-type gaskets.
- B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.

2.4 LISTED FIRE-PROTECTION VALVES

- A. General Requirements:
 - 1. Valves shall be UL listed and FM approved.
 - 2. Minimum Pressure Rating for Standard-Pressure Piping: 175 psig.
 - 3. Minimum Pressure Rating for High-Pressure Piping: 300 psig.
- B. Bronze Butterfly Valves (for sizes 2" and smaller):
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Fivalco Inc.
 - b. Global Safety Products, Inc.
 - c. Milwaukee Valve Company.
 - 2. Standard: UL 1091.
 - 3. Body Material: Bronze.
 - 4. End Connections: Threaded.
- C. Iron Butterfly Valves (for sizes 2 1/2" and larger):
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. Milwaukee Valve Company.
 - b. Tyco Fire & Building Products LP.
 - c. Victaulic Company.
 2. Standard: UL 1091.
 3. Body Material: Cast or ductile iron.
 4. End Connections: Grooved.
- D. Check Valves:
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Globe Fire Sprinkler Corporation.
 - b. Potter Roemer.
 - c. Reliable Automatic Sprinkler Co., Inc.
 - d. Tyco Fire & Building Products LP.
 - e. Victaulic Company.
 - f. Viking Corporation.
 2. Standard: UL 312.
 3. Type: Swing check.
 4. Body Material: Cast iron.
 5. End Connections: Flanged or grooved.
- E. Bronze OS&Y Gate Valves:
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Crane Co.; Crane Valve Group
 - b. Milwaukee Valve Company.
 - c. NIBCO INC.
 2. Standard: UL 262.
 3. Body Material: Bronze.
 4. End Connections: Threaded.
- F. Iron OS&Y Gate Valves:
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Crane Co.; Crane Valve Group.
 - b. Tyco Fire & Building Products LP.
 - c. Watts Water Technologies, Inc.
 2. Standard: UL 262.
 3. Body Material: Cast or ductile iron.
 4. End Connections: Flanged or grooved.
- G. Indicating-Type Butterfly Valves:
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Anvil International, Inc.
 - b. Tyco Fire & Building Products LP.
 - c. Victaulic Company.
 2. Standard: UL 1091.
 3. Valves NPS 2 and Smaller:
 - a. Valve Type: Ball or butterfly.
 - b. Body Material: Bronze.
 - c. End Connections: Threaded.

4. Valves NPS 2-1/2 and Larger:
 - a. Valve Type: Butterfly.
 - b. Body Material: Cast or ductile iron.
 - c. End Connections: Flanged, grooved, or wafer.
5. Valve Operation: Integral electrical, 115-V ac, prewired, single or two-circuit, supervisory switch indicating device.

H. Non Rising Stem Gate Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Clow Valve Company; a division of McWane, Inc.
 - b. Crane Co.; Crane Valve Group; Stockham Division.
 - c. Mueller Co.; Water Products Division.
 - d. Tyco Fire & Building Products LP.
2. Standard: UL 262.
3. Body Material: Cast iron with indicator post flange.
4. Stem: Nonrising.
5. End Connections: Flanged or grooved.

2.5 TRIM AND DRAIN VALVES

A. General Requirements:

1. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
2. Pressure Rating: 250 psig minimum.

B. Angle Valves: Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Fire Protection Products, Inc.
2. United Brass Works, Inc.

C. Ball Valves: Subject to compliance with requirements, provide products by one of the following:

1. Conbraco Industries, Inc.; Apollo Valves.
2. NIBCO INC.
3. Potter Roemer.
4. Tyco Fire & Building Products LP.
5. Victaulic Company.
6. Watts Water Technologies, Inc.

D. Globe Valves: Subject to compliance with requirements, provide products by one of the following:

1. Fire Protection Products, Inc.
2. United Brass Works, Inc.

E. Plug Valves: Subject to compliance with requirements, provide products of one of the following:

1. Southern Manufacturing Group.

2.6 SPECIALTY VALVES

A. General Requirements:

1. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
2. Pressure Rating:
 - a. Standard-Pressure Piping Specialty Valves: 175 psig minimum.
 - b. High-Pressure Piping Specialty Valves: 250 psig minimum.
3. Body Material: Cast or ductile iron.
4. Size: Same as connected piping.
5. End Connections: Flanged or grooved.

B. Automatic (Ball Drip) Drain Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. AFAC Inc.
 - b. Reliable Automatic Sprinkler Co., Inc.
 - c. Tyco Fire & Building Products LP.
2. Standard: UL 1726.
3. Pressure Rating: 250 psig minimum.
4. Type: Automatic draining, ball check.
5. Size: NPS 3/4.
6. End Connections: Threaded.

2.7 HOSE CONNECTIONS

A. Nonadjustable-Valve Hose Connections:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Fire-End & Croker Corporation.
 - b. Fire Protection Products, Inc.
 - c. Guardian Fire Equipment, Inc.
 - d. Potter Roemer.
 - e. Tyco Fire & Building Products LP.
2. Standard: UL 668 hose valve for connecting fire hose.
3. Pressure Rating: 300 psig minimum.
4. Material: Brass or bronze.
5. Size: NPS 1-1/2 or NPS 2-1/2, as indicated.
6. Inlet: Female pipe threads.
7. Outlet: Male hose threads with lugged cap, gasket, and chain. Include hose valve threads according to NFPA 1963 and matching local fire-department threads.
8. Pattern: Angle or gate.
9. Finish: Rough brass or bronze.

2.8 FIRE-DEPARTMENT CONNECTIONS

A. Flush-Type, Fire-Department Connection:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Elkhart Brass Mfg. Company, Inc.
 - b. Guardian Fire Equipment, Inc.
 - c. Potter Roemer.
2. Standard: UL 405.

3. Type: Flush, for wall mounting.
4. Pressure Rating: 250 psig minimum.
5. Body Material: Corrosion-resistant metal.
6. Inlets: Brass with threads according to NFPA 1963 and matching local fire-department sizes and threads. Include extension pipe nipples, brass lugged swivel connections, and check devices or clappers.
7. Caps: Chrome plated brass, lugged type, with gasket and chain.
8. Escutcheon Plate: Rectangular, chrome plated brass, wall type.
9. Outlet: With pipe threads.
10. Body Style: Horizontal
11. Number of Inlets: 1.
12. Outlet Location: Back.
13. Escutcheon Plate Marking: Similar to "AUTO SPKR & STANDPIPE."
14. Finish: Rough brass or bronze.
15. Outlet Size: NPS 6.
16. Outlet Connection: STORZ connection as required by the local Fire Department.

B. ROOF MANIFOLD

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Elkhart Brass Mfg. Company, Inc.
 - b. Guardian Fire Equipment, Inc.
 - c. Potter Roemer.
2. Type: roof mounted free standing
3. Pressure rating: 250 psig minimum
4. Body material: Cast brass
5. Inlets: Brass with threads matching local fire department
6. Number of inlets: 2
7. Provide two fire department valves for fire department use.

2.9 ALARM DEVICES

A. Electrically Operated Alarm Bell:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Fire-Lite Alarms, Inc.; a Honeywell company.
 - b. Notifier; a Honeywell company.
 - c. Potter Electric Signal Company.
2. Standard: UL 464.
3. Type: Vibrating, metal alarm bell.
4. Size: 6-inch minimum diameter.
5. Finish: Red-enamel factory finish, suitable for outdoor use.

B. Water-Flow Indicators:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. McDonnell & Miller; ITT Industries.
 - b. Potter Electric Signal Company.
 - c. System Sensor; a Honeywell company.
 - d. Viking Corporation.
2. Standard: UL 346.

3. Water-Flow Detector: Electrically supervised.
4. Components: Two single-pole, double-throw circuit switches for isolated alarm and auxiliary contacts, 7 A, 125-V ac and 0.25 A, 24-V dc; complete with factory-set, field-adjustable retard element to prevent false signals and tamperproof cover that sends signal if removed.
5. Type: Paddle operated.
6. Pressure Rating: 250 psig.
7. Design Installation: Horizontal or vertical.

C. Pressure Switches:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Potter Electric Signal Company.
 - b. System Sensor; a Honeywell company.
 - c. Tyco Fire & Building Products LP.
 - d. Viking Corporation.
2. Standard: UL 346.
3. Type: Electrically supervised water-flow switch with retard feature.
4. Components: Single-pole, double-throw switch with normally closed contacts.
5. Design Operation: Rising pressure signals water flow.

D. Valve Supervisory Switches:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Fire-Lite Alarms, Inc.; a Honeywell company.
 - b. Kennedy Valve; a division of McWane, Inc.
 - c. Potter Electric Signal Company.
 - d. System Sensor; a Honeywell company.
2. Standard: UL 346.
3. Type: Electrically supervised.
4. Components: Single-pole, double-throw switch with normally closed contacts.
5. Design: Signals that controlled valve is in other than fully open position.

E. Indicator-Post Supervisory Switches:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Potter Electric Signal Company.
 - b. System Sensor; a Honeywell company.
2. Standard: UL 346.
3. Type: Electrically supervised.
4. Components: Single-pole, double-throw switch with normally closed contacts.
5. Design: Signals that controlled indicator-post valve is in other than fully open position.

2.10 PRESSURE GAUGES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. AMETEK; U.S. Gauge Division.
2. Ashcroft Inc.
3. Brecco Corporation.
4. WIKA Instrument Corporation.

- B. Standard: UL 393.
- C. Dial Size: 3-1/2- to 4-1/2-inch diameter.
- D. Pressure Gage Range: 0 to 250 psig minimum.
- E. Water System Piping Gage: Include "WATER" or "AIR/WATER" label on dial face.
- F. Air System Piping Gage: Include "AIR" or "AIR/WATER" label on dial face.

2.11 ESCUTCHEONS

- A. General: Manufactured ceiling, floor, and wall escutcheons and floor plates.
- B. One-Piece, Cast-Brass Escutcheons: Polished chrome-plated finish with set-screws.
- C. One-Piece, Deep-Pattern Escutcheons: Deep-drawn, box-shaped brass with chrome-plated finish.
- D. One-Piece Floor Plates: Cast-iron flange with holes for fasteners.
- E. Split-Casting Floor Plates: Cast brass with concealed hinge.

2.12 SLEEVES

- A. Cast-Iron Wall-Pipe Sleeves: Cast or fabricated of cast iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.
- B. Galvanized-Steel-Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.
- C. Molded-PE Sleeves: Reusable, PE, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.
- D. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, standard weight, zinc coated, plain ends.
- E. 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.
- F. For interior wall, floor and ceiling penetrations, seal annular space between sleeve and pipe or pipe insulation using joint sealants appropriate for fire rating, size, depth, and location of joint shall be under division 078410 for Firestopping and Section 078440 for Fire Resistive Joint Sealants.

2.13 SLEEVE SEALS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Calpico, Inc.
2. Metraflex, Inc.
3. Pipeline Seal and Insulator, Inc.

- B. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.

1. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
2. Pressure Plates: Carbon steel.
3. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements.

2.14 GROUT

- A. Standard: ASTM C 1107, Grade B, posthardening and volume adjusting, dry, hydraulic-cement grout.
- B. Characteristics: Nonshrink, and recommended for interior and exterior applications.
- C. Design Mix: 5000-psi, 28-day compressive strength.
- D. Packaging: Premixed and factory packaged.

2.15 FLOOR CONTROL STATIONS

- A. Floor control valve stations to be located above acoustical tile ceiling as located on the plans
- B. Provide lettering on floor control valves that state that each floor is a dual fed by two different floor control valve assemblies. Exact lettering to be approved by local fire department.

2.16 STAINLESS STEEL CABINETS

- A. Recessed stainless steel cabinets shall be provided for fire department valve and floor control stations. Refer to drawings for fire department valve and floor control stations.
- B. Door and frame shall be stainless steel and cabinets shall be recessed unit with square edges.
- C. Cabinet shall be 20 gauge Box, 20 gauge Tubular steel door with 18 gauge Frame and a continuous steel hinge (brass pin); steel corner seams welded and ground smooth; recessed, mounted cabinets shall be furnished with .125" (0.31 cam) radiused frame.
- D. The finish shall be coordinated with the architect.
- E. Provide lettering on door approved by local F.D.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Perform fire-hydrant flow test according to NFPA 14 and NFPA 291. Use results for system design calculations required in "Quality Assurance" Article.
- B. Report test results promptly and in writing.

3.2 EXAMINATION

- A. Examine roughing-in for hose connections and stations to verify actual locations of piping connections before installation.
- B. Examine walls and partitions for suitable thickness, fire- and smoke-rated construction, framing for hose-station cabinets, and other conditions where hose connections and stations are to be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 PIPING INSTALLATION

- A. Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Install piping as indicated, as far as practical.
 - 1. Deviations from approved working plans for piping require written approval from authorities having jurisdiction. File written approval with Architect before deviating from approved working plans.
- B. Piping Standard: Comply with requirements in NFPA 14 for installation of fire-suppression standpipe piping.
- C. Install seismic restraints on piping. Comply with requirements in NFPA 13 for seismic-restraint device materials and installation.
- D. Install listed fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.
- E. Install drain valves on standpipes. Extend drain piping to outside of building.
- F. Install automatic (ball drip) drain valves to drain piping between fire-department connections and check valves. Drain to floor drain or outside building.
- G. Install alarm devices in piping systems.
- H. Install hangers and supports for standpipe system piping according to NFPA 14. Comply with requirements in NFPA 13 for hanger materials.
- I. Install pressure gages on riser or feed main and at top of each standpipe. Include pressure gages with connection not less than NPS 1/4 and with soft-metal seated globe valve, arranged

for draining pipe between gage and valve. Install gages to permit removal, and install where they will not be subject to freezing.

- J. Fill wet-type standpipe system piping with water.
- K. Install pipe insulation on wet-type, fire-suppression standpipe piping in areas subject to freezing.

3.4 JOINT CONSTRUCTION

- A. Install couplings, flanges, flanged fittings, unions, nipples, and transition and special fittings that have finish and pressure ratings same as or higher than system's pressure rating for aboveground applications unless otherwise indicated.
- B. Install unions adjacent to each valve in pipes NPS 2 and smaller.
- C. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 and larger end connections.
- D. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- E. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.
- F. Flanged Joints: Select appropriate gasket material in size, type, and thickness suitable for water service. Join flanges with gasket and bolts according to ASME B31.9.
- G. 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.
- H. Steel-Piping, Cut-Grooved Joints: Cut square-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe joints.
- I. Steel-Piping, Roll-Grooved Joints: Roll rounded-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe grooved joints.
- J. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.

3.5 VALVE AND SPECIALTIES INSTALLATION

- A. Install listed fire-protection valves, trim and drain valves, specialty valves and trim, controls, and specialties according to NFPA 14, Insurance Underwriter and authorities having jurisdiction.

- B. Install listed fire-protection shutoff valves supervised-open, located to control sources of water supply except from fire-department connections. Install permanent identification signs indicating portion of system controlled by each valve.
- C. Install check valve in each water-supply connection. Install backflow preventers instead of check valves in potable-water-supply sources.
- D. Specialty Valves:
 - 1. General Requirements: Install in vertical position for proper direction of flow, in main supply to system.
 - 2. Alarm Valves: Install bypass check valve and retarding chamber drain-line connection.

3.6 HOSE-CONNECTION INSTALLATION

- A. Install hose connections adjacent to standpipes.
- B. Install freestanding hose connections for access and minimum passage restriction.
- C. Install NPS 2-1/2 hose connections with quick-disconnect NPS 2-1/2 by NPS 1-1/2 reducer adapter and flow-restricting device. Coordinate the type of threads on the fire department valves with the fire department.
- D. Install wall-mounted-type hose connections in cabinets. Include pipe escutcheons, with finish matching valves, inside cabinet where water-supply piping penetrates cabinet. Install valves at angle required for connection of fire hose. Comply with requirements for cabinets in Division 10 Section "Fire Extinguisher Cabinets."

3.7 FIRE-DEPARTMENT CONNECTION INSTALLATION

- A. Install wall-type, fire-department connections.
- B. Install automatic (ball drip) drain valve at each check valve for fire-department connection. Provide drain to exterior under fire department connection, 18" above grade.

3.8 ESCUTCHEON INSTALLATION

- A. Install escutcheons for penetrations of walls, ceilings, and floors.
- B. Escutcheons for New Piping:
 - 1. Piping with Fitting or Sleeve Protruding from Wall: One piece, deep pattern.
 - 2. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One piece, cast brass with polished chrome-plated finish.
 - 3. Bare Piping at Ceiling Penetrations in Finished Spaces: One piece, cast brass with polished chrome-plated finish.
 - 4. Bare Piping in Unfinished Service Spaces: One piece, stamped steel with set-screw or spring clips.
 - 5. Bare Piping in Equipment Rooms: One piece, stamped steel with set-screw or spring clips.
 - 6. Bare Piping at Floor Penetrations in Equipment Rooms: One-piece floor plate.

3.9 SLEEVE INSTALLATION

- A. General Requirements: Install sleeves for pipes and tubes passing through penetrations in floors, partitions, roofs, and walls.
- B. Sleeves are not required for core-drilled holes.
- C. Permanent sleeves are not required for holes formed by removable PE sleeves.
- D. Cut sleeves to length for mounting flush with both surfaces unless otherwise indicated.
- E. Install sleeves in new partitions, slabs, and walls as they are built.
- F. For interior wall penetrations, seal annular space between sleeve and pipe or pipe insulation using joint sealants appropriate for size, depth, and location of joint. Comply with requirements for joint sealants in Division 07 Section "Joint Sealants."
- G. For exterior wall penetrations above grade, seal annular space between sleeve and pipe using joint sealants appropriate for size, depth, and location of joint. Comply with requirements for joint sealants in Division 07 Section "Joint Sealants."
- H. For exterior wall penetrations below grade, seal annular space between sleeve and pipe using sleeve seals.
- I. Seal space outside of sleeves in concrete slabs and walls with grout.
- J. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation unless otherwise indicated.
- K. Install sleeve materials according to the following applications:
 - 1. Sleeves for Piping Passing through Concrete Floor Slabs: Galvanized-steel pipe.
 - 2. Sleeves for Piping Passing through Concrete Floor Slabs of Mechanical Equipment Areas or Other Wet Areas: Galvanized-steel pipe.
 - a. Extend sleeves 2 inches above finished floor level.
 - b. For pipes penetrating floors with membrane waterproofing, extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level. Comply with requirements for flashing in Division 07 Section "Sheet Metal Flashing and Trim."
 - 3. Sleeves for Piping Passing through Gypsum-Board Partitions:
 - a. Galvanized-steel-pipe sleeves for pipes smaller than NPS 6.
 - b. Galvanized-steel-sheet sleeves for pipes NPS 6 and larger.
 - c. Exception: Sleeves are not required for water-supply tubes and waste pipes for individual plumbing fixtures if escutcheons will cover openings.
 - 4. Sleeves for Piping Passing through Concrete Roof Slabs: Galvanized-steel pipe.
 - 5. Sleeves for Piping Passing through Exterior Concrete Walls:
 - a. Galvanized-steel-pipe sleeves for pipes smaller than NPS 6.

- b. Cast-iron wall pipe sleeves for pipes NPS 6 and larger.
 - c. Install sleeves that are large enough to provide 1-inch annular clear space between sleeve and pipe or pipe insulation when sleeve seals are used.
 - 6. Sleeves for Piping Passing through Interior Concrete Walls:
 - a. Galvanized-steel-pipe sleeves for pipes smaller than NPS 6.
 - b. Galvanized-steel-sheet sleeves for pipes NPS 6 and larger.
 - L. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestop materials and installations in Division 07 Section "Penetration Firestopping."
- 3.10 IDENTIFICATION
- A. Install labeling and pipe markers on equipment and piping according to requirements in NFPA 14.
 - B. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."
- 3.11 FIELD QUALITY CONTROL
- A. Perform tests and inspections.
 - B. Tests and Inspections:
 - 1. Leak Test: After installation, charge systems and test for leaks. Repair leaks and retest until no leaks exist.
 - 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 - 3. Flush, test, and inspect standpipe systems according to NFPA 14, "System Acceptance" Chapter.
 - 4. Energize circuits to electrical equipment and devices.
 - 5. Coordinate with fire-alarm tests. Operate as required.
 - 6. Verify that equipment hose threads are same as local fire-department equipment.
 - C. Fire-suppression standpipe system will be considered defective if it does not pass tests and inspections.
 - D. Prepare test and inspection reports.
- 3.12 DEMONSTRATION
- A. Train Owner's maintenance personnel to adjust, operate, and maintain specialty valves.
- 3.13 PIPING SCHEDULE
- A. Piping between Fire-Department Connections and Alarm Check Valves: Galvanized, standard-weight steel pipe with grooved ends; grooved-end fittings; grooved-end-pipe couplings; and grooved joints.

- B. Standard-pressure, wet-type, fire-suppression standpipe piping, NPS 4 and smaller, shall be one of the following:
 - 1. Standard-weight, black-steel pipe with cut- or roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
 - 2. Schedule 10, black-steel pipe with roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
- C. Standard-pressure, wet-type, fire-suppression standpipe piping, NPS 5 to NPS 8 shall be one of the following:
 - 1. Standard-weight, black-steel pipe with cut- or roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
 - 2. Schedule 10, black-steel pipe with roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.

END OF SECTION 21 12 00

SECTION 21 13 13
WET-PIPE SPRINKLER SYSTEMS

PART 1 - GENERAL

1.1 TRADE BID REQUIREMENTS

- A. Work of this Section is part of the Fire Protection Trade Bid. Refer to Section 21 00 01 "Fire Protection Trade Bid Requirements" for additional information about this Trade Bid.

1.2 RELATED DOCUMENTS

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

1.3 SUMMARY

- A. Section Includes:
 - 1. Pipes, fittings, and specialties.
 - 2. Fire-protection valves.
 - 3. Sprinklers.
 - 4. Alarm devices.
 - 5. Pressure gages.
 - 6. Backflow preventer.
- B. Related Sections:
 - 1. 21 05 00 "Common Work Results".
 - 2. 21 11 00 "Facility Fire-Suppression Water Service Piping".
 - 3. 21 12 00 "Fire-Suppression Standpipes".

1.4 DEFINITIONS

- A. Standard-Pressure Sprinkler Piping: Wet-pipe sprinkler system piping designed to operate at working pressure of 175 psig maximum.

1.5 SYSTEM DESCRIPTIONS

- A. Wet-Pipe Sprinkler System: Automatic sprinklers are attached to piping containing water and that is connected to water supply through alarm valve. Water discharges immediately from sprinklers when they are opened. Sprinklers open when heat melts fusible link or destroys frangible device. Hose connections are included.

1.6 PERFORMANCE REQUIREMENTS

- A. Standard-Pressure Piping System Component: Listed for 175-psig minimum working pressure.
- B. Delegated Design: Design sprinkler system(s), including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated on the drawing schedules.

- C. Sprinkler system design shall be approved by the Architect and authorities having jurisdiction prior to any fabrication, order or installation. The contractor shall confirm the Sprinkler Occupancy Hazard Classifications, Sprinkler Densities and Sprinkler Spacing with authority having jurisdiction and the Owner's insurance underwriter prior to submitting Bid, to confirm that the classifications listed are still applicable or if more stringent requirements are to be used for the Project. Please note, the list below is standard NFPA 13 criteria, and Owner's Insurance Underwriter criteria will take precedence, if more stringent.
1. Margin of Safety for Available Water Flow and Pressure: 10 psi, in addition to losses through water-service piping, valves, and backflow preventers.
 2. Sprinkler Occupancy Hazard Classifications:
 - a. Building Service Areas: Ordinary Hazard, Group 1.
 - b. Electrical and Mechanical Equipment Rooms: Ordinary Hazard, Group 1.
 - c. General Storage Areas: Ordinary Hazard, Group 1.
 - d. Libraries except Stack Areas: Light Hazard.
 - e. Platform: Ordinary Hazard, Group 1.
 - f. Laboratories and Gymnasium: Ordinary Hazard, Group 1.
 - g. Office, Classrooms, Cafeteria seating, Lobbies/Corridor and Public Areas: Light Hazard.
 - h. Restaurant/Cafeteria Service Areas: Ordinary Hazard, Group 1.
 3. Minimum Density for Automatic-Sprinkler Piping Design:
 - a. Light-Hazard Occupancy: 0.10 gpm over 1500-sq. ft. area.
 - b. Ordinary-Hazard, Group 1 Occupancy: 0.15 gpm over 1500-sq. ft. area.
 - c. Ordinary-Hazard, Group 2 Occupancy: 0.20 gpm over 1500-sq. ft. area.
 4. Maximum Protection Area per Sprinkler:
 - a. Office & Classroom Spaces: 225 sq. ft.
 - b. Storage Areas: 130 sq. ft.
 - c. Mechanical and Electrical Equipment Rooms: 130 sq. ft.
 - d. Other Areas: According to NFPA 13 or Insurance Underwriter recommendations, whichever is more stringent.
 5. Total Combined Hose-Stream Demand Requirement: According to NFPA 13 unless otherwise indicated:
 - a. Light-Hazard Occupancies: 100 gpm
 - b. Ordinary-Hazard Group 1 Occupancies: 250 gpm
 - c. Ordinary-Hazard Group 2 Occupancies: 250 gpm
- D. Seismic Performance: Sprinkler piping shall withstand the effects of earthquake motions determined according to NFPA 13 and ASCE/SEI 7-05 Category B.

1.7 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For wet-pipe sprinkler systems. Include plans, elevations, sections, details, and attachments to other work.
1. Wiring Diagrams: For power, signal, and control wiring.
- C. Delegated-Design Submittal: For sprinkler systems indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

- D. Coordination Drawings: Sprinkler systems, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
 - 1. Domestic water piping.
 - 2. HVAC ductwork and hydronic piping.
 - 3. Items penetrating finished ceiling including the following:
 - a. Lighting fixtures.
 - b. Air outlets and inlets.
 - c. Other ceiling-mounted devices
- E. Fabrication Drawings: As part of the Delegated-Design Submittal, produce and deliver stamped and signed fire protection fabrication shop drawings and supporting hydraulic calculations to the Architect for review and approval prior to any order, fabrication or installation of systems or components. Any resulting comments, deficiencies or conflicts with Architectural design intent will be corrected and re-submitted for approval prior to any work being undertaken. Fabrication drawings and calculations are also to be delivered to the Local Building Department, Fire Department and Insurance Underwriter for their review and approval prior to commencement of any work. As part of this process, assume the responsibility of Fire Protection Engineer of Record but under the direction of the Architect and the original Design Engineer. In areas where fire protection piping is exposed, the original design drawings are to be followed. If it is desired to deviate from the original design, meet with the architect to accomplish the aesthetic intent. The Architect will have final decision in this regard, and no additional cost shall be borne by the Owner or design team.
- F. Qualification Data: For qualified Installer.
- G. Approved Sprinkler Piping Drawings: Working plans, prepared according to Insurance Underwriter's criteria, NFPA 13, that have been approved by the Architect, Architect's Engineer and the authorities having jurisdiction, including hydraulic calculations. No work shall be commenced until all above named approvals have been gained. Any work undertaken prior to all approvals being gained is subject to removal/replacement/relocation at the Architect's discretion, and will be performed at no additional cost to the Owner. It is of particular concern to follow closely the design intent in finished spaces without ceilings or with partial ceilings with respect to pipe routing, aesthetics and pipe elevation.
- H. Fire-hydrant and/or fire pump flow test report.
- I. Field Test Reports and Certificates: Indicate and interpret test results for compliance with performance requirements and as described in NFPA 13. Include "Contractor's Material and Test Certificate for Aboveground Piping." Obtain a new flow test if test results are not available. The test results are required to be 12 months old or less.
- J. Field quality-control reports.
- K. Operation and Maintenance Data: For sprinkler specialties to include in emergency, operation, and maintenance manuals.

1.8 QUALITY ASSURANCE

- A. Installer Qualifications:
 - 1. Installer's responsibilities include designing, fabricating, and installing sprinkler systems and providing professional engineering services needed to assume engineering responsibility. Base calculations on results of fire-hydrant flow test.

- a. Engineering Responsibility: Preparation of working plans, calculations, and field test reports by a qualified professional engineer.
 - B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 - C. NFPA Standards: Sprinkler system equipment, specialties, accessories, installation, and testing shall comply with the following:
 - 1. NFPA 13, "Installation of Sprinkler Systems."
 - 2. NFPA 24, "Installation of Private Fire Service Mains and Their Appurtenances."
 - D. All system components: UL Listed and FM Approved.
 - E. One manufacturer's product is to be provided for each category of products throughout the project, unless specific circumstances do not allow for this approach. Consult with the Architect/Engineer prior to bid to request deviation from this one-product contract requirement. No change order will be considered for failing to comply with this requirement. Any installation of non-compliant products will be removed and replaced under this section with compliant products at no additional cost to the owner.
- 1.9 COORDINATION
- A. Coordinate layout and installation of sprinklers with other construction that penetrates ceilings, including light fixtures, HVAC equipment, and partition assemblies.
- 1.10 EXTRA MATERIALS
- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Sprinkler Cabinets: Finished, wall-mounted, steel cabinet with hinged cover, and with space for minimum of six spare sprinklers plus sprinkler wrench. Include number of sprinklers required by NFPA 13 and sprinkler wrench. Include separate cabinet with sprinklers and wrench for each type of sprinkler used on Project.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

- A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, and fitting materials, and for joining methods for specific services, service locations, and pipe sizes.

2.2 STEEL PIPE AND FITTINGS

- A. Standard Weight, Black-Steel Pipe for sizes 2" and smaller: ASTM A 53/A 53M. Pipe ends may be factory or field formed to match joining method.
- B. Schedule 10, Black-Steel Pipe for sizes 2 ½" and larger: ASTM A 135 or ASTM A 795/A 795M, Schedule 10
- C. Black-Steel Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M, standard-weight, seamless steel pipe with threaded ends.

- D. Steel Couplings: ASTM A 865, threaded.
- E. Gray-Iron Threaded Fittings: ASME B16.4, Class 125, standard pattern.
- F. Malleable- or Ductile-Iron Unions: UL 860.
- G. Steel Flanges and Flanged Fittings: ASME B16.1, Class 150.
- H. Grooved-Joint, Steel-Pipe Appurtenances:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Anvil International, Inc.
 - b. Tyco Fire & Building Products LP.
 - c. Victaulic Company.
 - 2. Pressure Rating: 175 psig minimum.
 - 3. Epoxy painted, Grooved-End Fittings for Steel Piping: ASTM A 47/A 47M, malleable-iron casting or ASTM A 536, ductile-iron casting; with dimensions matching steel pipe.
 - 4. Grooved-End-Pipe Couplings for Steel Piping: AWWA C606 and UL 213, rigid pattern, unless otherwise indicated, for steel-pipe dimensions. Include ferrous housing sections, EPDM-rubber gasket, and bolts and nuts.

2.3 PIPING JOINING MATERIALS

- A. Pipe-Flange Gasket Materials: AWWA C110, rubber, flat face, 1/8 inch thick.
 - 1. Class 125, Cast-Iron Flanges and Class 150, Bronze Flat-Face Flanges: Full-face gaskets.
 - 2. Class 250, Cast-Iron Flanges and Class 300, Steel Raised-Face Flanges: Ring-type gaskets.
- B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.

2.4 LISTED FIRE-PROTECTION VALVES

- A. General Requirements:
 - 1. Valves shall be UL listed and FM approved.
 - 2. Minimum Pressure Rating for Standard-Pressure Piping: 175 psig.
- B. Bronze Butterfly Valves (for sizes 2" and smaller):
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Fivalco Inc.
 - b. Global Safety Products, Inc.
 - c. Milwaukee Valve Company.
 - d. Victaulic Company.
 - 2. Standard: UL 1091.
 - 3. Body Material: Bronze.
 - 4. End Connections: Threaded.
- C. Iron Butterfly Valves (for sizes 2 1/2" and larger):
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Milwaukee Valve Company.

- b. Tyco Fire & Building Products LP.
 - c. Victaulic Company.
 - 2. Standard: UL 1091.
 - 3. Body Material: Cast or ductile iron.
 - 4. End Connections: Grooved.
- D. Check Valves:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Potter Roemer.
 - b. Reliable Automatic Sprinkler Co., Inc.
 - c. Tyco Fire & Building Products LP.
 - 2. Standard: UL 312.
 - 3. Type: Swing check.
 - 4. Body Material: Cast iron.
 - 5. End Connections: Flanged or grooved.
- E. Bronze OS&Y Gate Valves (2" and smaller):
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Crane Co.; Crane Valve Group
 - b. Milwaukee Valve Company.
 - c. NIBCO INC.
 - 2. Standard: UL 262.
 - 3. Body Material: Bronze.
 - 4. End Connections: Threaded.
- F. Iron OS&Y Gate Valves (2-1/2" and larger):
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Crane Co.; Crane Valve Group.
 - b. Tyco Fire & Building Products LP.
 - c. Watts Water Technologies, Inc.
 - 2. Standard: UL 262.
 - 3. Body Material: Cast or ductile iron.
 - 4. End Connections: Flanged or grooved.
- G. Indicating-Type Butterfly Valves:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Anvil International, Inc.
 - b. Tyco Fire & Building Products LP.
 - c. Victaulic Company.
 - 2. Standard: UL 1091.
 - 3. Valves NPS 2 and Smaller:
 - a. Valve Type: Ball or butterfly.
 - b. Body Material: Bronze.
 - c. End Connections: Threaded.
 - 4. Valves NPS 2-1/2 and Larger:
 - a. Valve Type: Butterfly.

- b. Body Material: Cast or ductile iron.
- c. End Connections: Flanged, grooved, or wafer.
- 5. Valve Operation: Integral electrical, 115-V ac, prewired, single or two-circuit, supervisory switch indicating device.

H. Non Rising Stem Gate Valves:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Clow Valve Company; a division of McWane, Inc.
 - b. Mueller Co.; Water Products Division.
 - c. Tyco Fire & Building Products LP.
- 2. Standard: UL 262.
- 3. Body Material: Cast iron with indicator post flange.
- 4. Stem: Nonrising.
- 5. End Connections: Flanged or grooved.

2.5 TRIM AND DRAIN VALVES

A. General Requirements:

- 1. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
- 2. Pressure Rating: 250 psig minimum.

B. Angle Valves: Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- 1. Fire Protection Products, Inc.
- 2. United Brass Works, Inc.

C. Ball Valves: Subject to compliance with requirements, provide products by one of the following:

- 1. Potter Roemer.
- 2. Tyco Fire & Building Products LP.
- 3. Victaulic Company.

D. Globe Valves: Subject to compliance with requirements, provide products by one of the following:

- 1. Fire Protection Products, Inc.
- 2. United Brass Works, Inc.

E. Plug Valves: Subject to compliance with requirements, provide products of one of the following:

- 1. Southern Manufacturing Group.

2.6 SPECIALTY VALVES

A. General Requirements:

- 1. Standard: UL's "Fire Protection Equipment Directory" listing and "Approval Guide," published by FM Global, listing.
- 2. Pressure Rating:
 - a. Standard-Pressure Piping Specialty Valves: 175 psig minimum.
- 3. Body Material: Cast or ductile iron.
- 4. Size: Same as connected piping.
- 5. End Connections: Flanged or grooved.

- B. Alarm Valves:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Reliable Automatic Sprinkler Co., Inc.
 - b. Tyco Fire & Building Products LP.
 - c. Victaulic Company.
 - 2. Standard: UL 193.
 - 3. Design: For horizontal or vertical installation.
 - 4. Include trim sets for bypass, drain, electrical sprinkler alarm switch, pressure gages and fill-line attachment with strainer.
 - 5. Drip Cup Assembly: Pipe drain with check valve to main drain piping.]
- C. Automatic (Ball Drip) Drain Valves:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. AFAC Inc.
 - b. Reliable Automatic Sprinkler Co., Inc.
 - c. Tyco Fire & Building Products LP.
 - 2. Standard: UL 1726.
 - 3. Pressure Rating: 175 psig minimum.
 - 4. Type: Automatic draining, ball check.
 - 5. Size: NPS 3/4.
 - 6. End Connections: Threaded.
 - 7. Escutcheon Plate: Rectangular, brass, wall type.
 - 8. Outlet: With pipe threads.
 - 9. Body Style: Horizontal.
 - 10. Number of Inlets: Per Fire Department Standards
 - 11. Outlet Location: Per plans, and per wall cavity behind connection.
 - 12. Escutcheon Plate Marking: Similar to "AUTO SPKR & STANDPIPE" or "AUTO SPKR", whichever is pertinent
 - 13. Finish: Rough brass or bronze.
 - 14. Outlet Size: Same size as piping indicated to it. Refer to plans for size(s).

2.7 SPRINKLER SPECIALTY PIPE FITTINGS

- A. Flow Detection and Test Assemblies:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Reliable Automatic Sprinkler Co., Inc.
 - b. Tyco Fire & Building Products LP.
 - c. Victaulic Company.
 - 2. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
 - 3. Pressure Rating: 175 psig minimum.
 - 4. Body Material: Cast- or ductile-iron housing with orifice, sight glass, and integral test valve.
 - 5. Size: Same as connected piping.
 - 6. Inlet and Outlet: Threaded.
- B. Sprinkler Inspector's Test Fittings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Tyco Fire & Building Products LP.
 - b. Victaulic Company.
 - c. Viking Corporation.
2. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
3. Pressure Rating: 175 psig minimum.
4. Body Material: Cast- or ductile-iron housing with sight glass.
5. Size: Same as connected piping.
6. Inlet and Outlet: Threaded.

2.8 SPRINKLERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Reliable Automatic Sprinkler Co., Inc.
 2. Tyco Fire & Building Products LP.
 3. Viking Corporation.
- B. General Requirements:
 1. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
 2. Pressure Rating for Automatic Sprinklers: 175 psig minimum.
- C. Automatic Sprinklers with Heat-Responsive Element:
 1. Nonresidential Applications: UL 199.
 2. Characteristics: Nominal 1/2-inch orifice with Discharge Coefficient K of 5.6, and for "Ordinary" temperature classification rating unless otherwise indicated or required by application.
 3. Provide quick response sprinkler heads.
- D. Sprinkler Finishes:
 1. Gloss White Concealed Cover Plates (except as specifically noted otherwise)
 2. Chrome plated.
 3. Bronze.
- E. Sprinkler Escutcheons: Materials, types, and finishes for the following sprinkler mounting applications. Escutcheons for concealed, flush, and recessed-type sprinklers are specified with sprinklers.
 1. Ceiling Mounting: Chrome-plated steel, one piece, flat or black.
 2. Sidewall Mounting: Chrome-plated steel, one piece, flat.
- F. Sprinkler Guards:
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Reliable Automatic Sprinkler Co., Inc.
 - b. Tyco Fire & Building Products LP.
 - c. Viking Corporation.
 2. Standard: UL 199.
 3. Type: Wire cage with fastening device for attaching to sprinkler.

2.9 ALARM DEVICES

- A. Alarm-device types shall match piping and equipment connections.
- B. Electrically Operated Alarm Bell:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Fire-Lite Alarms, Inc.; a Honeywell company.
 - b. Notifier; a Honeywell company.
 - c. Potter Electric Signal Company.
 - 2. Standard: UL 464.
 - 3. Type: Vibrating, metal alarm bell.
 - 4. Size: 10-inch diameter.
 - 5. Finish: Red-enamel factory finish, suitable for outdoor use.
- C. Water-Flow Indicators:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Potter Electric Signal Company.
 - b. System Sensor; a Honeywell company.
 - c. Viking Corporation.
 - 2. Standard: UL 346.
 - 3. Water-Flow Detector: Electrically supervised.
 - 4. Components: Two single-pole, double-throw circuit switches for isolated alarm and auxiliary contacts, 7 A, 125-V ac and 0.25 A, 24-V dc; complete with factory-set, field-adjustable retard element to prevent false signals and tamperproof cover that sends signal if removed.
 - 5. Type: Paddle operated.
 - 6. Pressure Rating: 250 psig
 - 7. Design Installation: Horizontal or vertical.
- D. Pressure Switches:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Potter Electric Signal Company.
 - b. System Sensor; a Honeywell company.
 - c. Tyco Fire & Building Products LP.
 - 2. Standard: UL 346.
 - 3. Type: Electrically supervised water-flow switch with retard feature.
 - 4. Components: Single-pole, double-throw switch with normally closed contacts.
 - 5. Design Operation: Rising pressure signals water flow.
- E. Valve Supervisory Switches:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Fire-Lite Alarms, Inc.; a Honeywell company.
 - b. Potter Electric Signal Company.
 - c. System Sensor; a Honeywell company.
 - 2. Standard: UL 346.
 - 3. Type: Electrically supervised.
 - 4. Components: Single-pole, double-throw switch with normally closed contacts.
 - 5. Design: Signals that controlled valve is in other than fully open position.

2.10 PRESSURE GAUGES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. AMETEK; U.S. Gauge Division.
 - 2. Ashcroft, Inc.
 - 3. Brecco Corporation.
 - 4. WIKA Instrument Corporation.
- B. Standard: UL 393.
- C. Dial Size: 3-1/2- to 4-1/2-inch diameter.
- D. Pressure Gage Range: 0 to 250 psig minimum.
- E. Water System Piping Gage: Include "WATER" or "AIR/WATER" label on dial face.
- F. Air System Piping Gage: Include "AIR" or "AIR/WATER" label on dial face.

2.11 ESCUTCHEONS

- A. General: Manufactured ceiling, floor, and wall escutcheons and floor plates.
- B. One-Piece, Cast-Brass Escutcheons: Polished chrome-plated finish with set-screws.
- C. One-Piece, Deep-Pattern Escutcheons: Deep-drawn, box-shaped brass with chrome-plated finish.
- D. One-Piece, Stamped-Steel Escutcheons: Chrome-plated finish with set-screw or spring clips.

2.12 SLEEVES

- A. Cast-Iron Wall Pipe Sleeves: Cast or fabricated of cast iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.
- B. Galvanized-Steel-Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.
- C. Molded-PE Sleeves: Reusable, PE, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.
- D. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, standard weight, zinc coated, plain ends.
- E. 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.

2.13 SLEEVE SEALS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Calpico, Inc.
2. Metraflex, Inc.
3. Pipeline Seal and Insulator, Inc.

- B. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.

1. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
2. Pressure Plates: Carbon steel.
3. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements.

2.14 GROUT

- A. Standard: ASTM C 1107, Grade B, posthardening and volume adjusting, dry, hydraulic-cement grout.
- B. Characteristics: Nonshrink, and recommended for interior and exterior applications.
- C. Design Mix: 5000-psi, 28-day compressive strength.
- D. Packaging: Premixed and factory packaged.

2.15 SPARE HEADS AND CABINETS

- A. Provide where directed by the Designer, a metal cabinet in the building containing spare sprinkler heads and wrenches.
- B. Cabinet shall have shelves for storing the spare sprinkler heads in an orderly manner. The shelf spaces shall be subdivided to segregate the sprinkler heads of each type and clearly identify them with approved markings. Cabinet shall have proper arrangements for hanging the wrenches. Wrenches shall be located so as to be readily accessible.
- C. Cabinet shall be dust tight and red in color, enameled finish. The outside of the cabinet door shall have painted on it in legible and clear lettering "Automatic Sprinklers - Reserve Supply", suitable standard instructions pertaining to the sprinkler systems and any other necessary information shall be fastened onto the inside of the cabinet door.
- D. Cabinet shall have shelves for storing the spare sprinkler heads in an orderly manner. The shelf spaces shall be subdivided to segregate the sprinkler heads of each type and clearly identify them with approved markings. Cabinet shall have proper arrangements for hanging the wrenches. Wrenches shall be located so as to be readily accessible.
- E. The cabinet size and number of each type spare sprinkler head shall conform to the National Fire Protection Association Pamphlet No. 13.

2.16 BACKFLOW PREVENTER

- A. Provide an FM approved, backflow preventer on the fire protection water service where indicated on the drawings. The BFP shall be full line size. Where the service entry is specifically sized, the BFP shall be the same size.

- B. The unit shall comply with all State and Water Authority requirements.
- C. Unit shall be Watts, Hersey, Beeco, Febco or equal, and be acceptable to the Water Authority and the Local Fire Department.
- D. The inlet and outlet gate valves shall be equipped with tamper switches.
- E. Spare Parts Kit: Furnish one [1] spare parts kit.
- F. Test Kit:
 - 1. Furnish one [1] Watts Model #TK-7 kit for use with double check type devices. Each kit shall be contained in its own carrying case.
- G. Double check valve assembly shall be Watts Model #709, bronze body construction through 2" in size and epoxy coated cast iron for 2 1/2" to 10", removable bronze seats, stainless steel internal parts, bronze-bodied ball valve test cocks, OS & Y stem gate valves with union or flanged connections between the valves and the device itself. Size as indicated on the Drawings. DEP equals will be accepted with proof of state approval.
- H. Where fire pumps are involved, the BFP shall be properly installed on the discharge.
- I. A State certified BFP installation certificate is required for the BFP installer.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Perform fire-hydrant flow test according to NFPA 13 and NFPA 291. Use results for system design calculations required in "Quality Assurance" Article.
- B. Report test results promptly and in writing.

3.2 PIPING INSTALLATION

- A. Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Install piping as indicated, as far as practical.
 - 1. Deviations from approved working plans for piping require written approval from authorities having jurisdiction. File written approval with Architect before deviating from approved working plans.
- B. Piping Standard: Comply with requirements for installation of sprinkler piping in NFPA 13.
- C. Install seismic restraints on piping. Comply with requirements for seismic-restraint device materials and installation in NFPA 13.
- D. Use listed fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.
- E. Install unions adjacent to each valve in pipes NPS 2 and smaller.

- F. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 and larger end connections.
- G. Install "Inspector's Test Connections" in sprinkler system piping, complete with shutoff valve, and sized and located according to NFPA 13.
- H. Install sprinkler piping with drains for complete system drainage.
- I. Install sprinkler control valves, test assemblies, and drain risers adjacent to standpipes when sprinkler piping is connected to standpipes.
- J. Install automatic (ball drip) drain valve at each check valve for fire-department connection, to drain piping between fire-department connection and check valve. Install drain piping to and spill over floor drain or to outside building.
- K. Install alarm devices in piping systems.
- L. Install hangers and supports for sprinkler system piping according to NFPA 13. Comply with requirements for hanger materials in NFPA 13.
- M. Install pressure gages on riser or feed main, at each sprinkler test connection, and at top of each standpipe. Include pressure gages with connection not less than NPS 1/4 and with soft metal seated globe valve, arranged for draining pipe between gage and valve. Install gages to permit removal, and install where they will not be subject to freezing.
- N. Fill sprinkler system piping with water.
- O. Install pipe insulation on sprinkler piping in areas subject to freezing.

3.3 JOINT CONSTRUCTION

- A. Install couplings, flanges, flanged fittings, unions, nipples, and transition and special fittings that have finish and pressure ratings same as or higher than system's pressure rating for aboveground applications unless otherwise indicated.
- B. Install unions adjacent to each valve in pipes NPS 2 and smaller.
- C. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 and larger end connections.
- D. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- E. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.
- F. Flanged Joints: Select appropriate gasket material in size, type, and thickness suitable for water service. Join flanges with gasket and bolts according to ASME B31.9.
- G. 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.
 - H. Steel-Piping, Cut-Grooved Joints: Cut square-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe joints.
 - I. Steel-Piping, Roll-Grooved Joints: Roll rounded-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe grooved joints.
 - J. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.
- 3.4 INSTALLATION OF COVER SYSTEM FOR SPRINKLER PIPING
- A. Install cover system, brackets, and cover components for sprinkler piping according to manufacturer's "Installation Manual" and with NFPA 13 for supports.
- 3.5 VALVE AND SPECIALTIES INSTALLATION
- A. Install listed fire-protection valves, trim and drain valves, specialty valves and trim, controls, and specialties according to NFPA 13 and authorities having jurisdiction.
 - B. Install listed fire-protection shutoff valves supervised open, located to control sources of water supply except from fire-department connections. Install permanent identification signs indicating portion of system controlled by each valve.
 - C. Install double check valve assembly in the water-supply connection.
 - D. Specialty Valves:
 1. General Requirements: Install in vertical position for proper direction of flow, in main supply to system.
 2. Alarm Valves: Include bypass check valve and retarding chamber drain-line connection.
- 3.6 SPRINKLER INSTALLATION
- A. Install sprinklers in suspended ceilings in center of narrow dimension of acoustical ceiling panels.
 - B. Install in alignment in gypsum board ceilings and soffits.
- 3.7 ESCUTCHEON INSTALLATION
- A. Install escutcheons for penetrations of walls, ceilings, and floors.
 - B. Escutcheons for New Piping:
 1. Piping with Fitting or Sleeve Protruding from Wall: One piece, deep pattern.
 2. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One piece, cast brass with polished chrome-plated finish.
 3. Bare Piping at Ceiling Penetrations in Finished Spaces: One piece, cast brass with polished chrome-plated finish.

4. Bare Piping in Unfinished Service Spaces: One piece, stamped steel with set-screw or spring clips.
5. Bare Piping in Equipment Rooms: One piece, stamped steel with set-screw or spring clips.
6. Bare Piping at Floor Penetrations in Equipment Rooms: One-piece floor plate.

3.8 SLEEVE INSTALLATION

- A. General Requirements: Install sleeves for pipes and tubes passing through penetrations in floors, partitions, roofs, and walls.
- B. Sleeves are not required for core-drilled holes.
- C. Permanent sleeves are not required for holes formed by removable PE sleeves.
- D. Cut sleeves to length for mounting flush with both surfaces unless otherwise indicated.
- E. Install sleeves in new partitions, slabs, and walls as they are built.
- F. For exterior wall penetrations below grade, seal annular space between sleeve and pipe using sleeve seals.
- G. Seal space outside of sleeves in concrete slabs and walls with grout.
- H. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation unless otherwise indicated.
- I. Install sleeve materials according to the following applications:
 1. Sleeves for Piping Passing through Gypsum-Board Partitions:
 - a. Galvanized-steel-pipe sleeves for pipes smaller than NPS 6.
 - b. Galvanized-steel-sheet sleeves for pipes NPS 6 and larger.
 - c. Exception: Sleeves are not required for water-supply tubes and waste pipes for individual plumbing fixtures if escutcheons will cover openings.
 2. Sleeves for Piping Passing through Interior Concrete Walls:
 - a. Galvanized-steel-pipe sleeves for pipes smaller than NPS 6.
 - b. Galvanized-steel-sheet sleeves for pipes NPS 6 and larger.

3.9 SLEEVE SEAL INSTALLATION

- A. Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble sleeve seal components and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.10 IDENTIFICATION

- A. Install labeling and pipe markers on equipment and piping according to requirements in NFPA 13.
- B. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

3.11 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections:
 - 1. Leak Test: After installation, charge systems and test for leaks. Repair leaks and retest until no leaks exist.
 - 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 - 3. Flush, test, and inspect sprinkler systems according to NFPA 13, "Systems Acceptance" Chapter.
 - 4. Energize circuits to electrical equipment and devices.
 - 5. Coordinate with fire-alarm tests. Operate as required.
- C. Sprinkler piping system will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.

3.12 CLEANING

- A. Clean dirt and debris from sprinklers.
- B. Remove and replace sprinklers with paint other than factory finish.

3.13 DEMONSTRATION

- A. Train Owner's maintenance personnel to adjust, operate, and maintain specialty valves.

3.14 PIPING SCHEDULE

- A. Sprinkler specialty fittings may be used, downstream of control valves, instead of specified fittings.
- B. Standard-pressure, wet-pipe sprinkler system, NPS 2 and smaller shall be one of the following:
 - 1. Standard-weight (schedule 40), black-steel pipe with threaded ends; uncoated, gray-iron threaded fittings; and threaded joints.
- C. Standard-pressure, wet-pipe sprinkler system, NPS 2-1/2 and larger, shall be one of the following:
 - 1. Schedule 10, black-steel pipe with roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.

3.15 SPRINKLER SCHEDULE

- A. Use sprinkler types in subparagraphs below for the following applications:
 - 1. Rooms without Ceilings: Upright sprinklers
 - 2. Rooms with Suspended Ceilings: Pendent, recessed, flush, or concealed sprinklers as indicated.
 - 3. Wall Mounting: Sidewall sprinklers.
 - 4. Spaces Subject to Freezing: Upright, sidewall or dry pendent sprinklers.
 - 5. Special Applications: Extended-coverage, flow-control, and quick-response sprinklers where indicated.

- B. Provide sprinkler types in subparagraphs below with finishes indicated.
1. Concealed Sprinklers: Rough brass, with factory-painted gloss white cover plate.
 2. Flush Sprinklers: Bright chrome, with painted white escutcheon.
 3. Recessed Sprinklers: Bright chrome, with bright chrome escutcheon
 4. Upright, Pendent and Sidewall Sprinklers: Chrome plated in finished spaces exposed to view; rough bronze in unfinished spaces not exposed to view; wax coated where exposed to acids, chemicals, or other corrosive fumes. Provide wire cages in gymnasium, mechanical, and storage rooms.

END OF SECTION 21 13 13

SECTION 22 00 00
PLUMBING TRADE CONTRACTOR REQUIREMENTS

PART 1 - GENERAL

1.1 TRADE CONTRACT REQUIREMENTS

- A. The Plumbing Trade Contract includes the Work specified in the following Sections:
1. Division 22 "Plumbing" Sections.
 2. Division 00 and Division 01 sections.
- B. Submit Bids in accordance with the provision of the Massachusetts General Laws (MGL), Chapter 149A for CM at risk projects inclusive, as amended. The time and place of submission of Bids is set forth in the Instruction to Bidders.
- C. With each Bid, submit a bid deposit in the form of a bid bond, or a certified check on, or a treasurer's or cashier's check issued by, a responsible bank or trust company, payable to the **Town of Newton**, the Awarding Authority, in the amount of five percent of the Bid amount. A bid bond shall be (a) in a form satisfactory to the Awarding Authority, (b) with a surety company qualified to do business in the Commonwealth of Massachusetts and satisfactory to the Awarding Authority, and (c) conditioned upon the faithful performance by the principal of the agreements contained in the bid.
- D. Submit each Sub-Contract on a form furnished by the Awarding Authority.
- E. For the following class or classes of work, list on the Trade Contract form the names of persons, firms and corporations furnishing to the Trade Contractor labor or labor and materials for the class or classes or part thereof, the name of such class of work or part thereof, and the bid price for such class of work or part thereof:

Class of Work	Sections
1. Plumbing Piping Insulation:	22 07 00 – Plumbing Insulation

- F. The work of this Trade Contract is shown on Drawings:
1. P- .
- G. Trade Contract Coordination:
1. Bidders shall refer to the entire set of Drawings, including without limitation: the Work of other Trade Contracts; and Work shown on architectural, civil, structural, mechanical, electrical, plumbing and fire protection and other Drawings; for proper coordination.
 2. Bidders shall review Procurement and Contracting Requirements including Conditions of the Contract and Division 01 General Requirements. Without limitation or restriction, Division 01 General Requirements contain requirements and assignments of responsibility between the general Contractor and Bidders for alternates, administration, delegated design, submittals, quality control, cutting and patching, hoisting, scaffolding, temporary services, warranties, contract closeout and other requirements, which the Bidder must carefully review to determine how its scope of work and its Trade Contract price may be affected.

- H. Access Panels: For Work installed by the Plumbing Trade Contractor in concealed locations where access is required, furnish access panels per Section 08 31 10 "Access Doors and Frames" for installation by trade constructing surrounding Work.
- I. Alternates: Refer to Section 01 23 00 "Alternates" for scope of the Alternates and for administrative and procedural requirements applicable to Alternates.
- J. Phasing: Refer to Division 01 Section "Construction Phasing" for the requirements of phasing the Work.
- K. Resilient Ceiling Hangers: For Work installed by the Plumbing Filed Sub-Bidder in and above acoustically insulated/isolated rooms, provide resilient ceiling hangars per Section 09 21 10 Gypsum Board Assemblies."
- L. The Trade Contractor selected to perform this work will be required to furnish a performance bond and a payment bond, each in the amount of 100 percent of the Trade Contract.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 22 00 00

SECTION 22 05 00
COMMON WORK RESULTS FOR PLUMBING

PART 1 - GENERAL

1.1 TRADE CONTRACT REQUIREMENTS

- A. Work of this Section is part of the Plumbing Trade Contract. Refer to Section 22 00 01 "Plumbing Trade Contractor Requirements" for additional information about this Trade Contract.

1.2 RELATED DOCUMENTS

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

1.3 SUMMARY

- A. This Section includes the following:
 - a. Piping materials and installation instructions common to most piping systems.
 - b. Transition fittings.
 - c. Dielectric fittings.
 - d. Mechanical sleeve seals.
 - e. Sleeves.
 - f. Escutcheons.
 - g. Grout.
 - h. Electric Heat Tracing

1.4 DEFINITIONS

- A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspace, 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.
- D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in chases.
- E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.
- F. The following are industry abbreviations for plastic materials:
 - 1. CPVC: Chlorinated polyvinyl chloride plastic.
 - 2. PE: Polyethylene plastic.
 - 3. ABS: Acrylonitrile-butadiene-styrene plastic.
 - 4. PVC: Polyvinyl chloride plastic.

- G. The following are industry abbreviations for rubber materials:
 - 1. EPDM: Ethylene-propylene-diene terpolymer rubber.
 - 2. NBR: Acrylonitrile-butadiene rubber.

1.5 SUBMITTALS

- A. Product Data: For the following:
 - 1. Transition fittings.
 - 2. Dielectric fittings.
 - 3. Mechanical sleeve seals.
 - 4. Escutcheons.
- B. LEED Submittals:
 - 1. Complete "Sustainable Materials Attributes Submittal Form" attached to Section 01 81 13 "Sustainable Design Requirements".
 - 2. Provide supporting documentation for Materials and Resources and Low Emitting Materials, as required in Section 01 81 13, from manufacturer for materials attributes data submitted.
 - 1. Environmental Product Declaration: For each product.
 - 2. Chain-of-Custody Certificates: For FSC certified wood products. Include statement of costs and qualifications of manufacturers and vendors.
 - 3. Health Product Declaration: For each product.
 - 4. Laboratory Test Reports: Verify that the following products comply with the testing and product requirements of the California Department of Public Health's (CDPH) "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers", or South Coast Air Quality Management District (SCAQMD) Rule 1113:
 - a. Sealants.
 - b. Paints and coatings.
 - 5. Product Data: For the following, including VOC content:
 - a. Sealants.
 - b. Paints and coatings.
 - 6. Statement of Volume: for wet-applied products installed in the field.
 - 7. Verify that the following products comply with Ultra Low Emitting Formaldehyde and No Added Urea Formaldehyde (ULEF or NAUF) requirements:
 - a. For composite wood products, verify that product contains no urea formaldehyde, as defined in the California Air Resources Board's (CARB) "Airborne Toxic Control Measure to Reduce Formaldehyde Emissions from Composite Wood Products" or shall be made with no added formaldehyde.
 - C. Welding certificates.

1.6 QUALITY ASSURANCE

- A. Provide Plumbing and Gas fitting throughout the facility which is compliant with applicable NFPA standards, Massachusetts State Building Code, Massachusetts State Plumbing and gas Codes (latest Edition), local ordinances/regulations/standards, local Authorities Having Jurisdiction and Insurance Underwriter requirements.
- B. Products provided are to be Approved products by the Massachusetts State Board of Plumbing Examiners and Gas Fitters. As part of the product submittal process, Provide in each submittal the Approval number, and statement that the approved product is still valid and in force.

- C. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."
- D. 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.
- E. 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.
- F. Substitution of products or methods provided/undertaken are the sole responsibility of this subcontract. The remedy correcting resulting detrimental effects due to substituted items will be borne as part of this subcontract, at no additional cost to the owner. The remedy to correct such deficiencies will be as determined by the Architect.
- G. Plumbing Products which come into contact with water supply shall comply with NSF/ANSI Standard 372, concerning lead content. Wetted piping, parts, components and equipment shall be deemed "Lead-Free" according to NSF/ANSI Standard 61.
- H. One manufacturer's product is to be provided for each category of products throughout the project, unless specific circumstances do not allow for this approach. Consult with the Architect/Engineer prior to bid to request deviation from this one-product contract requirement. No change order will be considered for failing to comply with this requirement. Installation of non-compliant products will be removed and replaced under this section with compliant products at no additional cost to the owner.

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. Coordinate requirements for access panels and doors for plumbing items requiring access that are concealed behind finished surfaces. 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. 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.
 - 2. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
 - 3. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.
 - 4. 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. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated; and AWS A5.8, BAg1, silver alloy for refrigerant piping, unless otherwise indicated.
- F. 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.
 - 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. Flexible Transition Couplings for Underground Nonpressure Drainage Piping: ASTM C 1173 with elastomeric sleeve, ends same size as piping to be joined, and corrosion-resistant metal band 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.
- 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-Flange Kits: Companion-flange assembly for field assembly. Include flanges, full-face- or ring-type neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.
1. Manufacturers:
 - a. Advance Products & Systems, Inc.
 - b. Calpico, Inc.
 - c. Central Plastics Company.
 - d. Pipeline Seal and Insulator, Inc.
 2. Separate companion flanges and steel bolts and nuts shall have 150- or 300-psig minimum working pressure where required to suit system pressures.
- F. 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.
- G. 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.
 - b. 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.
 - 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: Composite, Include two for each sealing element.
 - 4. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.7 SLEEVES

- A. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.
- B. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
- C. Underdeck Clamp: Clamping ring with set screws.
- D. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.
- E. For interior wall, floor and ceiling penetrations, seal annular space between sleeve and pipe or pipe insulation using joint sealants appropriate for fire rating, size, depth, and location of joint shall be under division 078410 for Firestopping and Section 078440 for Fire Resistive Joint Sealants

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. One-Piece, Cast-Brass Type: With set screw.
 - 1. Finish: Polished chrome-plated
- D. One-Piece, Stamped-Steel Type: With set screw or spring clips and chrome-plated finish.
- E. One-Piece, Floor-Plate Type: Cast-iron floor plate.

2.9 GROUT

- A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.
 - 1. Characteristics: Post-hardening, volume-adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
 - 2. Design Mix: 5000-psi, 28-day compressive strength.
 - 3. Packaging: Premixed and factory packaged.

2.10 VALVE TAGS, NAMEPLATES, AND CHARTS

- A. Valves on pipes of every description shall have neat circular brass valve tags at least 1-1/2 in. in diameter attached with brass hook to each valve stem. Stamp on these valve tags, in letters as large as practical, the number of the valve and the service, such as "H.W., C.W., GAS", for hot water, cold water, and gas respectively. The numbers for each service shall be consecutive. Where valves are located above ACT ceilings, furnish and install valve finder ceiling tack, tack shall be minimum 7/8 in. diameter with 1/2 in. steel point, color as determined by Owner.
- B. Valves on tanks and pumps shall be numbered by 3 in. red metal discs with white numbers 2 in. high, secured to stem of valves by means of small solid link brass chain, to correspond to numbers indicated for valves on the Record Drawings and on two (2) printed detailed lists. These printed lists shall state the numbers and locations of each valve and the fixture or group of fixtures which it controls, and other necessary information such as requiring the opening or closing of another valve or valves when one valve is to be opened and closed, and shall be prepared in form to meet approval of the Architect, and shall be framed under glass.
- C. Nameplates, catalog numbers, and rating identifications shall be securely attached to Electrical and Mechanical equipment with screws or rivets. Adhesives or cements will not be permitted.

2.11 PIPE MARKER IDENTIFICATION SYSTEM

- A. Mark piping installed under this Section and at Access Panels with a marking system in basic colors conforming to those specified in ANSI/ASME A-13.1. Markings shall indicate pipe content and direction of flow. Markers shall be applied at valves and tee joints, and on straight runs of pipe at every 20 ft.-0 in. on center.
- B. Markers shall be vinyl snap-around pipe type system. Adhesive markings are not acceptable.
- C. Clearly mark potable and non-potable water system with 4-inch-wide colored bands, with arrow for direction of flow, every twenty-five (25) feet on center on piping installed

whether it is concealed or exposed and also on both sides of floor and/or wall penetrations. Mark potable water green and non-potable yellow. Within 6 in. of each band identify with letter "Potable C.W.", Non-Potable H.W." Color of letter shall match banding.

2.12 ELECTRIC HEAT TRACE:

- A. Acceptable manufacturers:
 - 1. Raychem XL Trace Edge
 - 2. Thermon
 - 3. Delta Therm
- B. Furnish and install a UL listed system of heaters and components for pipe freeze protection the water temperature for the non potable hot water piping.
- C. Manufacturer shall submit catalog cuts showing materials and performance along with detailed shop drawings indicating pipe to be heat traced, splices, power connections and other components for the Engineer's approval.
- D. The self-regulating cable shall consist of two (2) 14 AWG nickel plated copper bus wires embedded in a crosslinked parallel conductive polymer as the heating element.
- E. The heater shall vary its output all along its length to maintain the selected temperature of the system 115° F and operate on 120 volt, single phase power.
- F. The heater shall be tinned copper braid covered by a radiation cross linked polyolefin dielectric jacket.
- G. Power retention of the heating element shall be a minimum of 90% after 1000 hours of exposure in an oven at 185° F while energized or 300 cycles between 50° F and 212° F.
- H. Power connection, end seal, splice and tee components shall be applied in the field.
- I. Manufacturer shall have more than 10 years experience with self regulating heating cables for temperature maintenance of domestic hot water.
- J. Measure the heater circuit continuity and the insulation resistance between the braid and bus wires with a 2500-Vdc megohmmeter (meggar).
- K. The tests should be performed after the pipe insulation has been installed and prior to installation of wall or ceiling panels and shall be witnessed by the Construction Manager and the manufacturer or the manufacturer's representative.
- L. The heater circuit shall be continuous and meggar readings shall be at least 20 megohms regardless of heater length. Circuits yielding unacceptable readings must be repaired or replaced.
- M. The heater shall be a single cable for all pipe sizes.
- N. Provide circuit breaker with 30 MA ground fault protection.
- O. Electric heat trace system manufacturer shall furnish shop drawings for each system including cable layout, load chart and circuit description.
- P. Refer to the manufacturer's guide for design details, insulation requirements, maximum circuit lengths and accessory information.

PART 3 - EXECUTION

3.1 PIPING SYSTEMS - COMMON REQUIREMENTS

- A. Install 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. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.
- D. Install 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. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- F. Install piping to permit valve servicing.
- G. Install piping at indicated slopes.
- H. Install piping free of sags and bends.
- I. Install fittings for changes in direction and branch connections.
- J. Install piping to allow application of insulation.
- K. Select system components with pressure rating equal to or greater than system operating pressure.
- L. Install escutcheons for penetrations of walls, ceilings, and floors according to the following:
 - 1. New Piping:
 - 1. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
 - 2. Chrome-Plated Piping: One-piece, cast-brass type with polished chrome-plated finish.
 - 3. Insulated Piping: One-piece, stamped-steel type with spring clips.
 - 4. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished chrome-plated finish.
 - 5. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece cast-brass type with polished chrome-plated finish.
 - 6. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass type with rough-brass finish.
 - 7. Bare Piping in Equipment Rooms: One-piece, cast-brass type.
 - 8. Bare Piping at Floor Penetrations in Equipment Rooms: One-piece, 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.
- O. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs.

- P. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.
1. Cut sleeves to length for mounting flush with both surfaces.
 2. 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.
 3. Install sleeves in new walls and slabs as new walls and slabs are constructed.
 4. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:
 - a. Steel Pipe Sleeves: For pipes smaller than NPS 6.
 - b. Steel Sheet Sleeves: For pipes NPS 6 and larger, penetrating gypsum-board partitions.
 5. 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.
 - a. Seal space outside of sleeve fittings with grout.
 6. 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. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
1. Install steel pipe for sleeves smaller than 6 inches in diameter.
 2. Install cast-iron "wall pipes" for sleeves 6 inches and larger in diameter.
 3. 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. Underground, Exterior-Wall Pipe Penetrations: Install 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.
- S. Verify final equipment locations for roughing-in.
- T. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

3.2 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. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.
- F. 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.
- G. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.
- H. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.
- I. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.
 - 1. Plain-End Pipe and Fittings: Use butt fusion.
 - 2. Plain-End Pipe and Socket Fittings: Use socket fusion.

3.3 PIPING CONNECTIONS

- A. Make connections according to the following, unless otherwise indicated:
 - 1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
 - 2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.
 - 3. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.
 - 4. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

3.4 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

- A. Install equipment to allow maximum possible headroom unless specific mounting heights are indicated.
- B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.
- C. Install plumbing equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.

- D. Install equipment to allow right of way for piping installed at required slope.

3.5 ACCESS PANELS

- A. Provide access panels as required to access valves, water hammer arrestors, clean outs and similar appurtenances. Provide panels in accordance with section 083113.

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.

3.7 CHLORINATION

- A. Upon completion of the Plumbing Work, thoroughly chlorinate the entire domestic water system before putting the same in service. Chlorinate all work in the presence of the Architect and/or Engineer. The chlorinating agent shall be as a solution of sodium hypochlorite. Water shall be fed slowly into the new line with chlorine in the proper amount to produce a dosage of 50 PPM. Open and close all valves while the system is being chlorinated.
- B. After the sterilization agent has been applied for 24 hours, pay for an independent testing agency to test for residual chlorine and for the presence of bacteria. A residual of not more than 5 PPM shall be required in all parts of the line.
- C. If the test shows 5 PPM or greater of residual chlorine, flush out the system until all traces of the chemical used are removed.
- D. Provide testing reports from an independent testing agency.

3.8 SCAFFOLDS AND STAGING

- A. General: Plumbing Sub Contractors shall obtain required permits for, and provide scaffolds, staging, and other similar raised platforms, required to access their Work as specified in Section 01 50 00 - Temporary Facilities and Controls and herein.
- B. Scaffolding and staging required for use by this Plumbing Sub Contractor pursuant to requirements of Section 01 50 00 - Temporary Facilities and Controls shall be furnished, erected, maintained in a safe condition, and dismantled when no longer required, by this Plumbing Sub Contract requiring such scaffolding.
- C. Plumbing Sub Contractor is responsible to provide, maintain and remove at dismantling, all tarpaulins and similar protective measures necessary to cover scaffolding for inclement weather conditions other than those required to be provided, maintained and removed by the General Contractor pursuant to MGL (Refer to Section 01 50 00 - Temporary Facilities and Controls and as additionally required for dust control).
- D. General Contractor is responsible to provide enclosures required for temporary heat; refer to Section 01 50 00 - Temporary Facilities and Controls.

- E. Furnishing portable ladders and mobile platforms of all required heights, which may be necessary to perform the work of this trade, are the responsibility of this Plumbing Sub Contractor.

3.9 CONCRETE BASES

- A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project. Refer to Division 03 Section "Cast-in-Place Concrete (or Miscellaneous Cast-in-Place Concrete.)" for concrete bases.
 - 1. 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.
 - 2. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
 - 3. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 4. Install anchor bolts to elevations required for proper attachment to supported equipment.
 - 5. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

3.10 ERECTION OF METAL SUPPORTS AND ANCHORAGES

- A. Refer to Division 05 Section "Metal Fabrications" for structural steel.
- 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.

3.11 ERECTION OF WOOD SUPPORTS AND ANCHORAGES

- A. Cut, fit, and place wood grounds, nailers, blocking, and anchorages to support, and anchor plumbing materials and equipment.
- B. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.
- C. Attach to substrates as required to support applied loads.

3.12 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.

3.13 ADJUSTING

- A. Balance hot water re-circulating systems such that fixtures, equipment and outlets requiring domestic hot water will flow hot water in a satisfactory timeframe. Hot water temperature and timeframe will be as determined by the Architect, Engineer and Owner; typically delivered at full design temperature within 10 seconds. Provide initial and final balancing, as well criteria required toward balancing these systems. Provide shop drawings which show flow characteristics (gpm) downstream of each valve, and the percentage open setting for each balancing valve. Shop drawing must be keyed in on plans for reference. After final balancing, deficiencies, as determined by the Architect, Engineer or Owner are to be made compliant and acceptable under this section at no additional cost to these entities.

3.14 OPERATION AND MAINTENANCE TRAINING REQUIREMENTS

- A. Refer to Specification section 017900 Demonstration and Training
- B. Training Preparation Conference: Convene a training preparation conference to include Owner's operation and maintenance personnel and commissioning agent.
- C. Training Modules: Develop an instruction program that includes individual training modules for each system, subsystem, and equipment.
- D. Train the Owner's maintenance personnel on troubleshooting procedures, and servicing and preventative maintenance schedules and procedures.

END OF SECTION 22 05 00

SECTION 22 05 13
COMMON MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT

PART 1 - GENERAL

1.1 TRADE CONTRACT REQUIREMENTS

- A. Work of this Section is part of the Plumbing Trade Contractor. Refer to Section 22 00 00 "Plumbing Trade Contractor Requirements" for additional information about this Trade Contract.

1.2 RELATED DOCUMENTS

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

1.3 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.

1.4 SUBMITTALS

- A. Product Data: For the following:
 - 1. Transition fittings.
 - 2. Dielectric fittings.
 - 3. Mechanical sleeve seals.
 - 4. Escutcheons.
- B. LEED Submittals:
 - 1. Complete "Sustainable Materials Attributes Submittal Form" attached to Section 01 81 13 "Sustainable Design Requirements".
 - 2. Provide supporting documentation for Materials and Resources and Low Emitting Materials, as required in Section 01 81 13, from manufacturer for materials attributes data submitted.
 - a. Environmental Product Declaration: For each product.
 - b. Chain-of-Custody Certificates: For FSC certified wood products. Include statement of costs and qualifications of manufacturers and vendors.
 - c. Health Product Declaration: For each product.
 - d. Laboratory Test Reports: Verify that the following products comply with the testing and product requirements of the California Department of Public Health's (CDPH) "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers", or South Coast Air Quality Management District (SCAQMD) Rule 1113:
 - 1) Sealants.
 - 2) Paints and coatings.
 - e. Product Data: For the following, including VOC content:
 - 1) Sealants.
 - 2) Paints and coatings.
 - f. Statement of Volume: for wet-applied products installed in the field.

- g. Verify that the following products comply with Ultra Low Emitting Formaldehyde and No Added Urea Formaldehyde (ULEF or NAUF) requirements:
 - 1) For composite wood products, verify that product contains no urea formaldehyde, as defined in the California Air Resources Board's (CARB) "Airborne Toxic Control Measure to Reduce Formaldehyde Emissions from Composite Wood Products" or shall be made with no added formaldehyde.

1.5 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: Energy efficient, as defined in NEMA MG 1.
- C. Multispeed Motors: Variable torque or separate winding for each speed.
 - 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.
- D. Rotor: Random-wound, squirrel cage.
- E. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.
- F. Temperature Rise: Match insulation rating.
- G. Insulation: Class B for general purpose motors, Class F for high efficiency motors.
- H. Code Letter Designation:
 - 1. Motors 15 HP and Larger: NEMA starting Code F or Code G.

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2. Motors Smaller than 15 HP: Manufacturer's standard starting characteristic.

2.4 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 05 13

SECTION 22 05 16
EXPANSION FITTINGS AND LOOPS FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 TRADE CONTRACT REQUIREMENTS

- A. Work of this Section is part of the Plumbing Trade Contract. Refer to Section 22 00 00 "Plumbing Trade Contractor Requirements" for additional information about this Trade Contract.

1.2 RELATED DOCUMENTS

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

1.3 SUMMARY

- A. This Section includes the following:
 - a. Flexible pipe connections.
 - b. Expansion joints and compensators.
 - c. Pipe loops, offsets, and swing joints
- B. Related Sections:
 - 1. Division 22 Section "Common Work Results for Plumbing" for codes, standards, and other general requirements.
 - 2. Division 22 Section "Domestic Water Piping" for domestic water piping inside the building.
 - 3. Division 22 Section "Hangers and Supports for Plumbing Equipment and Piping".

1.4 SUBMITTALS

- A. Product Data: For the following:
 - 1. Transition fittings.
 - 2. Dielectric fittings.
 - 3. Mechanical sleeve seals.
 - 4. Escutcheons.
- B. LEED Submittals:
 - 1. Complete "Sustainable Materials Attributes Submittal Form" attached to Section 01 81 13 "Sustainable Design Requirements".
 - 2. Provide supporting documentation for Materials and Resources and Low Emitting Materials, as required in Section 01 81 13, from manufacturer for materials attributes data submitted.
 - 1. Environmental Product Declaration: For each product.
 - 2. Chain-of-Custody Certificates: For FSC certified wood products. Include statement of costs and qualifications of manufacturers and vendors.
 - 3. Health Product Declaration: For each product.
 - 4. Laboratory Test Reports: Verify that the following products comply with the testing and product requirements of the California Department of Public Health's (CDPH) "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers", or South Coast Air Quality Management District (SCAQMD) Rule 1113:

- a. Sealants.
 - b. Paints and coatings.
 - 5. Product Data: For the following, including VOC content:
 - a. Sealants.
 - b. Paints and coatings.
 - 6. Statement of Volume: for wet-applied products installed in the field.
 - 7. Verify that the following products comply with Ultra Low Emitting Formaldehyde and No Added Urea Formaldehyde (ULEF or NAUF) requirements:
 - a. For composite wood products, verify that product contains no urea formaldehyde, as defined in the California Air Resources Board's (CARB) "Airborne Toxic Control Measure to Reduce Formaldehyde Emissions from Composite Wood Products" or shall be made with no added formaldehyde.
- C. Welding certificates.

PART 2 - PRODUCTS

2.1 EXPANSION LOOPS JOINTS

- A. Flexible-Hose Expansion Fittings:
- 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Metraflex, Inc- "Metraloop".
 - b. Flex-Hose Co., Inc.
 - c. Flexicraft Industries.
 - 2. Description: Manufactured assembly with inlet and outlet elbow fittings and two flexible-metal-hose legs joined by long-radius, 180-degree return bend or center section of flexible hose.
 - 3. Potable water piping and components shall comply with NSF 14 and NSF 61.
 - 4. Sanitary flexible expansion joints shall comply with IAPMO IGC 304.
 - 5. Elbows: 304 Stainless Steel long radius 90° elbows.
 - 6. Flexible Hose: 321 Stainless Steel hose, 304 Stainless Steel braid and interlocking liner.
 - 7. Brass cleanout plugs (2)
 - 8. +- 8" of movement.
 - 9. 150 PSI working pressure at 70°F.
 - 10. Flexible Hose: Corrugated-metal inner hoses and braided outer sheaths.
 - 11. 304 Stainless Steel long radius 90° elbows.
 - 12. Expansion Fittings for Copper Tubing NPS 2 and Smaller: Copper-alloy fittings with solder-joint end connections.
 - a. Bronze hoses and single-braid bronze sheaths with 450 psig at 70 deg F and 340 psig at 450 deg F ratings.
 - 13. Expansion Fittings for Copper Tubing NPS 2-1/2 to NPS 4: Copper-alloy fittings with threaded end connections.
 - a. Stainless-steel hoses and single-braid, stainless-steel sheaths with 300 psig at 70 deg F and 225 psig at 450 deg F ratings.

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14. Expansion Fittings for Steel Piping NPS 2 and Smaller: Stainless-steel fittings with threaded end connection.
 - a. Stainless-steel hoses and single-braid, stainless-steel sheaths with 450 psig at 70 deg F and 325 psig at 600 deg F ratings.
15. Expansion Fittings for Steel Piping NPS 2-1/2 to NPS 6: Stainless-steel fittings with flanged end connections.
 - a. Stainless-steel hoses and single-braid, stainless-steel sheaths with 200 psig at 70 deg F and 145 psig at 600 deg F ratings.

2.2 ALIGNMENT GUIDES AND ANCHORS

A. Alignment Guides:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Metraflex, Inc.
 - b. Flex-Hose Co., Inc.
 - c. Hyspan Precision Products, Inc.
 - d. Adscos Manufacturing LLC.
 - e. U.S. Bellows, Inc.
2. Description: Steel, factory-fabricated alignment guide, with bolted two-section outer cylinder and base for attaching to structure; with two-section guiding spider for bolting to pipe.

B. Anchor Materials:

1. Steel Shapes and Plates: ASTM A36/A 36M.
2. Bolts and Nuts: ASME B18.10 or ASTM A 183, steel hex head.
3. Washers: ASTM F 844, steel, plain, flat washers.
4. Mechanical Fasteners: Insert-wedge-type stud with expansion plug anchor for use in hardened Portland cement concrete, with tension and shear capacities appropriate for application.
 - a. Stud: Threaded, zinc-coated carbon steel.
 - b. Expansion Plug: Zinc-coated steel.
 - c. Washer and Nut: Zinc-coated steel.
5. Chemical Fasteners: Insert-type-stud, bonding-system anchor for use with hardened Portland cement concrete, with tension and shear capacities appropriate for application.
 - a. Bonding Material: ASTM C 881/C 881M, Type IV, Grade 3, two-component epoxy resin suitable for surface temperature of hardened concrete where fastener is to be installed.
 - b. Stud: ASTM A 307, zinc-coated carbon steel with continuous thread on stud unless otherwise indicated.
 - c. Washer and Nut: Zinc-coated steel.

PART 3 - EXECUTION

3.1 EXPANSION FITTING INSTALLATION

- A. Install mechanical expansion fittings at a minimum of every 100 feet on straight runs of piping and where specifically indicated on drawings.
- B. Install flexible hose mechanical expansion joints and/or expansion loops in piping crossing building expansion joints. Coordinate locations with Architectural and Structural drawings.
- C. Install expansion fittings of sizes matching sizes of piping in which they are installed.

3.2 PIPE LOOP AND SWING CONNECTION INSTALLATION

- A. Connect risers and branch connections to mains with at least five pipe fittings including tee in main.

3.3 ALIGNMENT-GUIDE AND ANCHOR INSTALLATION

- A. Install alignment guides to guide expansion and to avoid end-loading and torsional stress.
- B. Install one guide on each side of pipe expansion fittings and loops. Install guides nearest to expansion fitting not more than four pipe diameters from expansion joint.
- C. Install second guide(s) at 10 to 14 pipe diameters from first guide. Install intermediate guides spaced at the following distances for the indicated pipe size:
 - 1. 1 inch pipe: 11 feet
 - 2. 1-1/4 inch pipe: 14 feet
 - 3. 1-1/2 inch pipe: 17 feet
 - 4. 2 inch pipe: 23 feet
 - 5. 2-1/2 inch pipe: 27 feet
 - 6. 3 inch pipe: 33 feet
 - 7. 4 inch pipe: 37 feet
- D. Attach guides to pipe and secure guides to building structure.
- E. Install anchors at locations to prevent stresses from exceeding those permitted by ASME B31.9 and to prevent transfer of loading and stresses to connected equipment.
- F. Anchor Attachments:
 - 1. Anchor Attachment to Black Steel Pipe: Attach with pipe hangers. Use MSS SP-69, Type 42.
 - 2. Anchor Attachment to Copper Tubing: Attach with pipe hangers. Use MSS SP-69, Type 24, U-bolts bolted to anchor.
- G. Fabricate and install steel anchors by welding steel shapes, plates, and bars. Comply with ASME B31.9 and AWS D1.1/D1.1M.
 - 1. Anchor Attachment to Steel Structural Members: Attach by welding.

2. Anchor Attachment to Concrete Structural Members: Attach by fasteners. Follow fastener manufacturer's written instructions.
- H. Use grout to form flat bearing surfaces for guides and anchors attached to concrete.

END OF SECTION 22 05 16

SECTION 22 05 19
METERS AND GAGES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 TRADE CONTRACT REQUIREMENTS

- A. Work of this Section is part of the Plumbing Trade Contract. Refer to Section 22 00 00 "Plumbing Trade Contractor Requirements" for additional information about this Trade Contract.

1.2 RELATED DOCUMENTS

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

1.3 SUMMARY

- A. Section Includes:
 - 1. Thermometers.
 - 2. Gages.
 - 3. Test plugs.
 - 4. Water Meters and Sub-meters
 - 5. Gas Sub Meters
- B. Related Sections:
 - 1. Division 22 Section "Domestic Water Piping" for domestic and fire-protection water service meters inside the building.

1.4 DEFINITIONS

- A. CR: Chlorosulfonated polyethylene synthetic rubber.
- B. EPDM: Ethylene-propylene-diene terpolymer rubber.

1.5 SUBMITTALS

- A. Product Data: For each type of product indicated; include performance curves.
- B. LEED Submittals:
 - 1. Complete "Sustainable Materials Attributes Submittal Form" attached to Section 01 81 13 "Sustainable Design Requirements".
 - 2. Provide supporting documentation for Materials and Resources and Low Emitting Materials, as required in Section 01 81 13, from manufacturer for materials attributes data submitted.
 - a. Environmental Product Declaration: For each product.
 - b. Chain-of-Custody Certificates: For FSC certified wood products. Include statement of costs and qualifications of manufacturers and vendors.
 - c. Health Product Declaration: For each product.
 - d. Laboratory Test Reports: Verify that the following products comply with the testing and product requirements of the California Department of Public Health's (CDPH) "Standard Method for the Testing and Evaluation of Volatile Organic Chemical

Emissions from Indoor Sources Using Environmental Chambers", or South Coast Air Quality Management District (SCAQMD) Rule 1113:

- 1) Sealants.
 - 2) Paints and coatings.
 - e. Product Data: For the following, including VOC content:
 - 1) Sealants.
 - 2) Paints and coatings.
 - f. Statement of Volume: for wet-applied products installed in the field.
 - g. Verify that the following products comply with Ultra Low Emitting Formaldehyde and No Added Urea Formaldehyde (ULEF or NAUF) requirements:
 - 1) For composite wood products, verify that product contains no urea formaldehyde, as defined in the California Air Resources Board's (CARB) "Airborne Toxic Control Measure to Reduce Formaldehyde Emissions from Composite Wood Products" or shall be made with no added formaldehyde.
- C. Shop Drawings: Schedule for thermometers and gages indicating manufacturer's number, scale range, and location for each.
- D. One manufacturer's product is to be provided for each category of products throughout the project unless specific circumstances do not allow for this approach. Consult with the Architect/Engineer prior to bid to request deviation from this one-product contract requirement. No change order will be considered for failing to comply with this requirement. Installation of non-compliant products will be removed and replaced under this section with compliant products at no additional cost to the owner.

PART 2 - PRODUCTS

2.1 METAL-CASE, LIQUID-IN-GLASS THERMOMETERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following
1. Palmer - Wahl Instruments Inc.
 2. Terice, H. O. Co.
 3. Weiss Instruments, Inc.
- B. Case: Die-cast aluminum 7 inches long.
- C. Tube: Red or blue reading, organic-liquid filled, with magnifying lens.
- D. Tube Background: Satin-faced, nonreflective aluminum with permanently etched scale markings.
- E. Window: Glass
- F. Connector: Rigid, straight type
- G. Stem: Copper-plated steel, aluminum, or brass for thermowell installation and of length to suit installation.
- H. Accuracy: Plus or minus 1 percent of range or plus or minus 1 scale division to maximum of 1.5 percent of range.

2.2 DIRECT-MOUNTING, VAPOR-ACTUATED DIAL THERMOMETERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following
 - 1. Marsh Bellofram.
 - 2. Weiss Instruments, Inc.
 - 3. Weksler Instruments Operating Unit; Dresser Industries; Instrument Div.
- B. Case: Dry type, drawn steel or cast aluminum, 4-1/2-inch diameter.
- C. Element: Bourdon tube or other type of pressure element.
- D. Movement: Mechanical, connecting element and pointer.
- E. Dial: Satin-faced, nonreflective aluminum with permanently etched scale markings.
- F. Pointer: Red metal.
- G. Window: Glass
- H. Ring: Metal
- I. Connector: Adjustable type, 180 degrees in vertical plane, 360 degrees in horizontal plane, with locking device
- J. Thermal System: Liquid-bulb in copper-plated steel, aluminum, or brass stem for thermowell installation and of length to suit installation.
- K. Accuracy: Plus or minus 1 percent of range or plus or minus 1 scale division to maximum of 1.5 percent of range.

2.3 REMOTE-MOUNTING, VAPOR-ACTUATED DIAL THERMOMETERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following
 - 1. Ashcroft Commercial Instrument Operations; Dresser Industries; Instrument Div.
 - 2. Marsh Bellofram.
 - 3. Tel-Tru Manufacturing Company.
 - 4. Weiss Instruments, Inc.
- B. Case: Case: Dry type, drawn steel or cast aluminum, 4-1/2-inch diameter with holes for panel mounting.
- C. Element: Bourdon tube or other type of pressure element.
- D. Movement: Mechanical, connecting element and pointer.
- E. Dial: Satin-faced, nonreflective aluminum with permanently etched scale markings.
- F. Pointer: Red metal.
- G. Window: Glass

- H. Ring: Metal
- I. Connector: Bottom union type.
- J. Thermal System: Liquid-filled bulb in copper-plated steel, aluminum, or brass stem for thermowell installation and of length to suit installation.
- K. Accuracy: Plus or minus 1 percent of range or plus or minus 1 scale division to maximum of 1.5 percent of range.

2.4 BIMETALLIC-ACTUATED DIAL THERMOMETERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following
 - 1. Eugene Ernst Products Co.
 - 2. Marsh Bellofram.
 - 3. Weiss Instruments, Inc.
- B. Description: Direct-mounting, bimetallic-actuated dial thermometers complying with ASME B40.3.
- C. Case: Dry type, stainless steel with 3-inch diameter.
- D. Element: Bimetal coil.
- E. Dial: Satin-faced, nonreflective aluminum with permanently etched scale markings.
- F. Pointer: Red metal.
- G. Window: Glass
- H. Ring: Stainless steel.
- I. Connector: Adjustable angle type.
- J. Stem: Metal, for thermowell installation and of length to suit installation.
- K. Accuracy: Plus or minus 1 percent of range or plus or minus 1 scale division to maximum of 1.5 percent of range.

2.5 THERMOWELLS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following
 - 1. Ernst Gage Co.
 - 2. Palmer - Wahl Instruments Inc.
 - 3. Weiss Instruments, Inc.
- B. Manufacturers: Same as manufacturer of thermometer being used.
- C. Description: Pressure-tight, socket-type metal fitting made for insertion into piping and of type, diameter, and length required to hold thermometer.

2.6 PRESSURE GAGES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following
 - 1. Ernst Gage Co.
 - 2. Marsh Bellofram.
 - 3. Weiss Instruments, Inc.
- B. Direct-Mounting, Dial-Type Pressure Gages: Indicating-dial type complying with ASME B40.100.
 - 1. Case: Dry type, drawn steel or cast aluminum, 4-1/2-inch diameter.
 - 2. Pressure-Element Assembly: Bourdon tube, unless otherwise indicated.
 - 3. Pressure Connection: Brass, NPS 1/4, bottom-outlet type unless back-outlet type is indicated.
 - 4. Movement: Mechanical, with link to pressure element and connection to pointer.
 - 5. Dial: Satin-faced, nonreflective aluminum with permanently etched scale markings.
 - 6. Pointer: Red metal.
 - 7. Window: Glass
 - 8. Ring: Metal
 - 9. Accuracy: Grade A, plus or minus 1 percent of middle half scale.
 - 10. Vacuum-Pressure Range: 30-in. Hg of vacuum to 15 psig of pressure
 - 11. Range for Fluids under Pressure: Two times operating pressure.
- C. Pressure-Gage Fittings:
 - 1. Valves: NPS 1/4 brass or stainless-steel needle type.
 - 2. Snubbers: ASME B40.5, NPS 1/4 brass bushing with corrosion-resistant, porous-metal disc of material suitable for system fluid and working pressure.

2.7 TEST PLUGS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following
 - 1. Flow Design, Inc.
 - 2. Terice, H. O. Co.
 - 3. Watts Industries, Inc.; Water Products Div.
- B. Description: Corrosion-resistant brass or stainless-steel body with core inserts and gasketed and threaded cap, with extended stem for units to be installed in insulated piping.
- C. Minimum Pressure and Temperature Rating: 500 psig at 200 deg F
- D. Core Inserts: One or two self-sealing rubber valves.
 - 1. Insert material for water service at 20 to 200 deg F shall be CR.
 - 2. Insert material for water service at minus 30 to plus 275 deg F be EPDM.
- E. Test Kit: Furnish one test kit(s) containing one pressure gage and adaptor, one thermometer, and carrying case. Pressure gage, adapter probes, and thermometer sensing elements shall be of diameter to fit test plugs and of length to project into piping.
 - 1. Pressure Gage: Small bourdon-tube insertion type with 2- to 3-inch diameter dial and probe. Dial range shall be 0 to 200 psig
 - 2. High-Range Thermometer: Small bimetallic insertion type with 1- to 2-inch- diameter dial and tapered-end sensing element. Dial ranges shall be 0 to 220 deg F
 - 3. Carrying case shall have formed instrument padding.

2.8 BUILDING WATER SERVICE METER

- A. Manufacturers:
 - 1. Subject to compliance with requirements, provide products by the following or approved equal:
 - a. Badger Meter, Inc.
 - b. Mueller Company; Water Products Division.
 - c. Schlumberger Limited; Water Division.
- B. Coordinate type of water meter and remote registration system with Local Water Department and Authority Having Jurisdiction.
- C. Compound-Type Water Meters:
 - 1. Description:
 - a. Standard: AWWA C702.
 - b. Pressure Rating: 150-psig working pressure.
 - c. Body Design: With integral mainline and bypass meters; totalization meter.
 - d. Registration: In gallons or cubic feet as required by utility company.
 - e. Case: Bronze.
 - f. Pipe Connections: Flanged.
- D. Shut-off valves shall be installed on both sides of the meter and a strainer shall be installed on the inlet side of the meter after the inlet shut-off valve. Provide bypass per local requirements
- E. Remote Registration Systems: Specified water meter type, modified to include factory- or field-installed, self-contained, pulsing- type, generating system transmitter. Include low-voltage connecting wiring, totalizing device, and remote wall register.
 - 1. Encoder-Type, Remote-Registration System: AWWA C707; meter-mounted transmitter; totalizing device; 2- or 3-conductor connecting wire; weatherproof, outdoor, remote receptacle for automatic reading and billing; and conforming to utility standards.
- F. Water meters are to include dry contacts and made compatible with the building BMS (Bacnet) system. Provide devices required for accurate meter remote reading/report to BMS (Bacnet) system.

2.9 ULTRA SONIC WATER SUB METERS (SM1, SM2 & SM3)

- A. Manufacturers:
 - 1. Subject to compliance with requirements, provide products by the following or approved equal:
 - a. Spire Metering, Inc 280W-CI
 - b. SHENITECH STUF
 - c. Dynasonics
- B. Refer to drawing P0.01 for sub meter application.
- C. Provide water meter for flow measurement of potable water supply to the school facility and shall be capable to integrate with building control management system.
- D. Design of the water meter shall use transit-time ultrasonic technology along with transducers to provide for flow totalizing (gallons used) and flow rate (gpm) in real time. The ultrasonic water meter shall be consists of a flow-cell, a pair of ultrasonic flow transducers and an integrator.

- E. Water meter (s) shall BE capable for +2% accurate flow measurement of clean liquids, suitable for liquids that contain small amounts of suspended solids or particle in sizes smaller than 100 um in order to make a measurement. The meter shall be able to operate in temperatures ranging from 32°F to 212°F and come equipped with a device that emits pulse signals.
- F. Indication for flow rate and flow accumulator shall be displayed in English (US) units.
- G. The input/output interfaces and RD485 port to integrate with building management system.
- H. Enclosure shall be weather-resistant, NEMA 4X or IP65. It shall be constructed of stainless steel
- I. Water meters are to include dry contacts and made compatible with the building BMS (Bacnet) system. Provide devices required for accurate meter remote reading/report to BMS (Bacnet) system.
- J. Shut-off valves shall be installed on both sides of the meter. Provide bypass with shut off valve around water sub meter.

PART 3 - EXECUTION

3.1 THERMOMETER APPLICATIONS

- A. Install liquid-in-glass thermometers in the outlet of water heating equipment.
- B. Install dry -case-type, vapor actuated dial thermometers at suction and discharge of pump.
- C. Provide the following temperature ranges for thermometers:
 - 1. Domestic Hot Water: 30 to 180 deg F, with 2-degree scale divisions

3.2 GAGE APPLICATIONS

- A. Install dry-case-type pressure gage on the incoming domestic water line as the water service enters the building.
- B. Install dry-case-type pressure gages for discharge of each pressure-reducing valve.
- C. Install dry-case-type pressure gages at the inlet and outlet of water heating equipment.
- D. Install dry case-type pressure gages at suction and discharge of each pump.

3.3 INSTALLATIONS

- A. Install direct-mounting thermometers and adjust vertical and tilted positions.
- B. Install remote-mounting dial thermometers on panel, with tubing connecting panel and thermometer bulb supported to prevent kinks. Use minimum tubing length.
- C. Install thermowells with socket extending to center of pipe and in vertical position in piping tees where thermometers are indicated.

- D. Install direct-mounting pressure gages in piping tees with pressure gage located on pipe at most readable position.
- E. Install remote-mounting pressure gages on panel.
- F. Install needle-valve and snubber fitting in piping for each pressure gage.
- G. Install test plugs in tees in piping within 6" of gages and thermometers.
- H. Install permanent indicators on walls or brackets in accessible and readable positions.
- I. Install connection fittings for attachment to portable indicators in accessible locations.
- J. Install thermometers and gages adjacent to machines and equipment to allow service and maintenance for thermometers, gages, machines, and equipment.
- K. Adjust faces of thermometers and gages to proper angle for best visibility.
- L. Field calibrate gages and thermometers and provide calibration report.
- M. Thermometers and gauges shall be installed as to be easily visible from ground level.

3.4 WATER SUB METERS

- A. Provide adequate support for meters and install per manufacturer's recommendations.
- B. Provide manufacturer recommended straight pipe lengths to avoid turbulence and ensure accurate metering.

3.5 OPERATION AND MAINTENANCE TRAINING REQUIREMENTS

- A. Refer to Specification section 017900 Demonstration and Training
- B. Training Preparation Conference: Convene a training preparation conference to include Owner's operation and maintenance personnel and commissioning agent.
- C. Training Modules: Develop an instruction program that includes individual training modules for each system, subsystem, and equipment.
- D. Train the Owner's maintenance personnel on troubleshooting procedures, and servicing and preventative maintenance schedules and procedures.

END OF SECTION 22 05 19

SECTION 22 05 23
GENERAL-DUTY VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 TRADE CONTRACT REQUIREMENTS

- A. Work of this Section is part of the Plumbing Trade Contract. Refer to Section 22 00 00 "Plumbing Trade Contractor Requirements" for additional information about this Trade Contract.

1.2 RELATED DOCUMENTS

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

1.3 SUMMARY

- A. Section Includes:
 - 1. Bronze ball valves.
 - 2. Circuit Balancing Valves
 - 3. Iron ball valves.
 - 4. Iron, single-flange butterfly valves.
 - 5. Bronze swing check valves.
 - 6. Iron swing check valves.
 - 7. Bronze gate valves.
 - 8. Backwater valves.
- B. Related Sections:
 - 1. Division 22 plumbing piping Sections for specialty valves applicable to those Sections only.
 - 2. Division 22 Section "Identification for Plumbing Piping and Equipment" for valve tags and schedules.
 - 3. Division 33 water distribution piping Sections for general-duty and specialty valves for site construction piping.

1.4 DEFINITIONS

- 1. CWP: Cold working pressure.
- 2. EPDM: Ethylene propylene copolymer rubber.
- 3. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.
- 4. NRS: Nonrising stem.
- 5. OS&Y: Outside screw and yoke.
- 6. RS: Rising stem.
- 7. SWP: Steam working pressure.

1.5 SUBMITTALS

- A. Product Data: For each type of valve indicated.
- B. LEED Submittals:
 - 1. Complete "Sustainable Materials Attributes Submittal Form" attached to Section 01 81 13 "Sustainable Design Requirements".

2. Provide supporting documentation for Materials and Resources and Low Emitting Materials, as required in Section 01 81 13, from manufacturer for materials attributes data submitted.
 - a. Environmental Product Declaration: For each product.
 - b. Chain-of-Custody Certificates: For FSC certified wood products. Include statement of costs and qualifications of manufacturers and vendors.
 - c. Health Product Declaration: For each product.
 - d. Laboratory Test Reports: Verify that the following products comply with the testing and product requirements of the California Department of Public Health's (CDPH) "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers", or South Coast Air Quality Management District (SCAQMD) Rule 1113:
 - 1) Sealants.
 - 2) Paints and coatings.
 - e. Product Data: For the following, including VOC content:
 - 1) Sealants.
 - 2) Paints and coatings.
 - f. Statement of Volume: for wet-applied products installed in the field.
 - g. Verify that the following products comply with Ultra Low Emitting Formaldehyde and No Added Urea Formaldehyde (ULEF or NAUF) requirements:
 - 1) For composite wood products, verify that product contains no urea formaldehyde, as defined in the California Air Resources Board's (CARB) "Airborne Toxic Control Measure to Reduce Formaldehyde Emissions from Composite Wood Products" or shall be made with no added formaldehyde.

1.6 QUALITY ASSURANCE

- A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.
- B. ASME Compliance:
 1. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
 2. ASME B31.1 for power piping valves.
 3. ASME B31.9 for building services piping valves.
- C. NSF Compliance: Plumbing Products which come into contact with water supply (wetted parts) shall comply with NSF/ANSI Standard 372, concerning lead content. Wetted piping, parts, components and equipment shall be deemed "Lead-Free" according to NSF/ANSI Standard 61. Addendum No.4 for valve materials for potable-water service.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Prepare valves for shipping as follows:
 1. Protect internal parts against rust and corrosion.
 2. Protect threads, flange faces, grooves, and weld ends.
 3. Set angle, gate, and globe valves closed to prevent rattling.
 4. Set ball and plug valves open to minimize exposure of functional surfaces.
 5. Set butterfly valves closed or slightly open.
 6. Block check valves in either closed or open position.
- B. Use the following precautions during storage:
 1. Maintain valve end protection.
 2. Store valves indoors and maintain at higher than ambient dew point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

- C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

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. Valves in Insulated Piping: With 2-inch stem extensions and the following features:
 - 1. Gate Valves: With rising stem.
 - 2. 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.
 - 3. Butterfly Valves: With extended neck.
- D. Valve-End Connections:
 - 1. Flanged: With flanges according to ASME B16.1 for iron valves.
 - 2. Grooved: With grooves according to AWWA C606.
 - 3. Solder Joint: With sockets according to ASME B16.18.
 - 4. Threaded: With threads according to ASME B1.20.1.
- E. Valve Bypass and Drain Connections: MSS SP-45.

2.2 BRONZE BALL VALVES

- A. Three-Piece, Full-Port, Lead free, Bronze Ball Valves with Stainless-Steel Trim:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Conbraco Industries, Inc.; Apollo Valves.
 - b. Milwaukee Valve Company.
 - c. NIBCO INC.
 - 2. Description:
 - a. Standard: MSS SP-110.
 - b. SWP Rating: 150 psig.
 - c. CWP Rating: 600 psig.
 - d. Body Design: Three piece.
 - e. Body Material: Bronze.
 - f. Ends: Threaded. (or solder for domestic water service, 2" and smaller)
 - g. Seats: PTFE or TFE.
 - h. Stem: Stainless steel.
 - i. Ball: Stainless steel, vented.
 - j. Port: Full.

2.3 CIRCUIT BALANCING VALVES

- A. Three-Piece, Full-Port, Bronze Ball Valves with Stainless-Steel Trim:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Caleffi 1324

- b. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
- c. NIBCO INC.
- d. ThermOmega Tech
- 2. Description:
 - a. SWP Rating: 150 psig.
 - b. CWP Rating: 600 psig.
 - c. Body Material: Copper alloy.
 - d. Ends: Threaded.
 - e. Seats: Ductile iron or copper alloy
 - f. Stem: EPDM
 - g. Ball: Teflon packing, brass packing nut, blowout proof stem, vented.
 - h. Strainer: 20 mesh stainless steel
- 3. An option to standard balancing valves listed above are "Circuit Solver" (#CSUA) assemblies by ThermOmega Tech, complete with union and dual ball valves. Provide dielectric fittings upstream and downstream of device.

2.4 IRON BALL VALVES

- A. Class 125, Iron Ball Valves:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American Valve, Inc.
 - b. Conbraco Industries, Inc.; Apollo Valves.
 - c. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
 - 2. Description:
 - a. Standard: MSS SP-72.
 - b. CWP Rating: 200 psig
 - c. Body Design: Split body.
 - d. Body Material: ASTM A 126, gray iron.
 - e. Ends: Flanged.
 - f. Seats: PTFE or TFE.
 - g. Stem: Stainless steel.
 - h. Ball: Stainless steel.
 - i. Port: Full.

2.5 IRON, SINGLE-FLANGE BUTTERFLY VALVES

- A. 200 CWP, Iron, Single-Flange Butterfly Valves with EPDM Seat and Aluminum-Bronze Disc:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Conbraco Industries, Inc.; Apollo Valves.
 - b. NIBCO INC.
 - c. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
 - 2. Description:
 - a. Standard: MSS SP-67, Type I.
 - b. CWP Rating: 200 psig
 - c. Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
 - d. Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.
 - e. Seat: EPDM.
 - f. Stem: One- or two-piece stainless steel.
 - g. Disc: Aluminum bronze.

2.6 BRONZE SWING CHECK VALVES

- A. Class 125, Bronze Swing Check Valves with Bronze Disc:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American Valve, Inc.
 - b. Crane Co
 - c. Milwaukee Valve Company.
 - 2. Description:
 - a. Standard: MSS SP-139.
 - b. CWP Rating: 200 psig
 - c. Body Design: Horizontal flow.
 - d. Body Material: ASTM B 62, bronze.
 - e. Ends: Threaded (or solder for domestic water service, sizes 2" and smaller).
 - f. Disc: Bronze.

2.7 IRON SWING CHECK VALVES

- A. Class 125, Iron Swing Check Valves with Metal Seats:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Crane Co
 - b. NIBCO INC.
 - c. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
 - 2. Description:
 - a. Standard: MSS SP-71, Type I.
 - b. CWP Rating: 200 psig
 - c. Body Design: Clear or full waterway.
 - d. Body Material: ASTM A 126, gray iron with bolted bonnet.
 - e. Ends: Flanged.
 - f. Trim: Bronze.
 - g. Gasket: Asbestos free.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.
- B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.
- C. Examine threads on valve and mating pipe for form and cleanliness.
- D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.
- E. Do not attempt to repair defective valves; replace with new valves.

3.2 VALVE INSTALLATION

- A. Install 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. Install valves in horizontal piping with stem at or above center of pipe.
- D. Install valves in position to allow full stem movement.
- E. Install check valves for proper direction of flow and as follows:
 - 1. Swing Check Valves: In horizontal position with hinge pin level.

3.3 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.
- B. Balance hot water re-circulating systems such that fixtures, equipment and outlets requiring domestic hot water will flow hot water in a satisfactory timeframe. Hot water temperature and timeframe will be as determined by the Architect, Engineer and Owner; typically delivered at full design temperature within 10 seconds (immediately, for low-flow lavatories). Provide initial and final balancing, as well as criteria required toward balancing these systems. Provide shop drawings which show flow characteristics (gpm) downstream of each valve, and the percentage open setting for each balancing valve. Shop drawing must be keyed in on plans for reference. After final balancing, deficiencies, as determined by the Architect, Engineer or Owner are to be made compliant and acceptable under this section at no additional cost to these entities.

3.4 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

- A. If valve applications are not indicated, use the following:
 - 1. Shutoff Service: Ball, butterfly valves.
 - 2. Butterfly Valve Dead-End Service: Single-flange (lug) type.
 - 3. Throttling Service: Ball valves or butterfly valves.
 - 4. Balancing Valves: Circuit balancing type
 - 5. Pump-Discharge Check Valves:
 - a. NPS 2 and Smaller: Bronze swing check valves with bronze disc.
 - b. NPS 2-1/2 and Larger for Domestic Water: Iron swing check valves with lever and weight or with spring or iron, center-guided, metal seat check valves.
 - c. NPS 2-1/2 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 classes or CWP ratings may be substituted.
- C. Select valves, except wafer types, with the following end connections:
 - 1. For Copper Tubing, NPS 2 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 to NPS 4: Flanged ends except where threaded valve-end option is indicated in valve schedules below.
 - 3. For Copper Tubing, NPS 5 and Larger: Flanged ends.
 - 4. For Steel Piping, NPS 2 and Smaller: Threaded ends.
 - 5. For Steel Piping, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve-end option is indicated in valve schedules below.
 - 6. For Steel Piping, NPS 5 and Larger: Flanged ends.
 - 7. For Grooved-End Copper Tubing and Steel Piping: Valve ends may be grooved.

3.5 DOMESTIC, HOT- AND COLD-WATER VALVE SCHEDULE

- A. Pipe NPS 2 and Smaller:
 - 1. Bronze Valves: May be provided with solder-joint ends instead of threaded ends.
 - 2. Ball Valves: Three piece, full port, bronze with bronze trim.
 - 3. Bronze Swing Check Valves: Class 125, bronze disc.
 - 4. Bronze Gate Valves: Class 125, NRS or RS.
- B. Pipe NPS 2-1/2 and Larger:
 - 1. Iron Ball Valves: Class 150.
 - 2. Iron, Single-Flange Butterfly Valves: 200 CWP, EPDM seat, aluminum-bronze disc.
 - 3. Iron Swing Check Valves: Class 125 or Class 250, metal seats.
 - 4. Iron Gate Valves: Class 125 or Class 250, NRS

3.6 SANITARY-WASTE AND STORM-DRAINAGE BACKWATER VALVE SCHEDULE

- A. Pipe 2" to 10": Horizontal flapper type, bronze fixed swing-check
- B. Pipe 3" to 6": Vertical ball float

END OF SECTION 22 05 23

SECTION 22 05 29
HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 TRADE CONTRACT REQUIREMENTS

- A. Work of this Section is part of the Plumbing Trade Contract. Refer to Section 22 00 01 "Plumbing Trade Contractor Requirements" for additional information about this Trade Contract.

1.2 RELATED DOCUMENTS

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

1.3 SUMMARY

- A. This Section includes the following hangers and supports for plumbing system piping and equipment:
 - 1. Steel pipe hangers and supports.
 - 2. Trapeze pipe hangers.
 - 3. Metal framing systems.
 - 4. Thermal-hanger shield inserts.
 - 5. Fastener systems.
 - 6. Pipe stands.
 - 7. Pipe positioning systems.
 - 8. Equipment supports.
- B. Related Sections include the following:
 - 1. Division 05 Section "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.

1.4 DEFINITIONS

- A. MSS: Manufacturers Standardization Society for The Valve and Fittings Industry Inc.
- B. Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."

1.5 PERFORMANCE REQUIREMENTS

- A. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
- B. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
- C. Design seismic-restraint hangers and supports for piping and equipment and obtain approval from authorities having jurisdiction.

1.6 SUBMITTALS

- A. Product Data: For the following:
 - 1. Steel pipe hangers and supports.
 - 2. Trapeze pipe hangers.
 - 3. Metal framing systems.
 - 4. Thermal-hanger shield inserts.
 - 5. Fastener systems.
 - 6. Pipe stands.
 - 7. Pipe positioning systems.
- B. LEED Submittals:
 - 1. Complete "Sustainable Materials Attributes Submittal Form" attached to Section 01 81 13 "Sustainable Design Requirements".
 - 2. Provide supporting documentation for Materials and Resources and Low Emitting Materials, as required in Section 01 81 13, from manufacturer for materials attributes data submitted.
 - a. Environmental Product Declaration: For each product.
 - b. Chain-of-Custody Certificates: For FSC certified wood products. Include statement of costs and qualifications of manufacturers and vendors.
 - c. Health Product Declaration: For each product.
 - d. Laboratory Test Reports: Verify that the following products comply with the testing and product requirements of the California Department of Public Health's (CDPH) "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers", or South Coast Air Quality Management District (SCAQMD) Rule 1113:
 - 1) Sealants.
 - 2) Paints and coatings.
 - e. Product Data: For the following, including VOC content:
 - 1) Sealants.
 - 2) Paints and coatings.
 - f. Statement of Volume: for wet-applied products installed in the field.
 - g. Verify that the following products comply with Ultra Low Emitting Formaldehyde and No Added Urea Formaldehyde (ULEF or NAUF) requirements:
 - 1) For composite wood products, verify that product contains no urea formaldehyde, as defined in the California Air Resources Board's (CARB) "Airborne Toxic Control Measure to Reduce Formaldehyde Emissions from Composite Wood Products" or shall be made with no added formaldehyde.
- C. Welding certificates.

1.7 QUALITY ASSURANCE

- A. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel." AWS D1.4, "Structural Welding Code--Reinforcing Steel."

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 STEEL PIPE HANGERS AND SUPPORTS

- A. Description: MSS SP-58, Types 1 through 58, factory-fabricated components. Refer to Part 3 "Hanger and Support Applications" Article for where to use specific hanger and support types.
- B. Manufacturers:
 1. B-Line Systems, Inc.; a division of Cooper Industries.
 2. Grinnell Corp.
 3. Tolco Inc.
- C. Galvanized, Metallic Coatings: Pregalvanized or hot dipped.
- D. Nonmetallic Coatings: Plastic coating, jacket, or liner.
- E. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion for support of bearing surface of piping.

2.3 TRAPEZE PIPE HANGERS

- A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural-steel shapes with MSS SP-58 hanger rods, nuts, saddles, and U-bolts.

2.4 METAL FRAMING SYSTEMS

- A. Description: MFMA-3, shop- or field-fabricated pipe-support assembly made of steel channels and other components.
- B. Manufacturers:
 1. B-Line Systems, Inc.; a division of Cooper Industries.
 2. Tolco Inc.
 3. Unistrut Corp.; Tyco International, Ltd.
- C. Coatings: Manufacturer's standard finish unless bare metal surfaces are indicated.
- D. Nonmetallic Coatings: Plastic coating, jacket, or liner.

2.5 THERMAL-HANGER SHIELD INSERTS

- A. Description: 100-psig minimum, compressive-strength insulation insert encased in sheet metal shield.
- B. Manufacturers:
 1. Carpenter & Paterson, Inc.
 2. Pipe Shields, Inc.
 3. Rilco Manufacturing Company, Inc.
- C. Insulation-Insert Material for Cold Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate or ASTM C 552, Type II cellular glass with vapor barrier.
- D. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate or ASTM C 552, Type II cellular glass.

- E. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.
- F. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.
- G. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.6 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.
 - 1. Manufacturers:
 - a. Hilti, Inc.
 - b. ITW Ramset/Red Head.
 - c. Masterset Fastening Systems, Inc.
- B. Mechanical-Expansion Anchors: Insert-wedge-type zinc-coated steel, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
 - 1. Manufacturers:
 - a. B-Line Systems, Inc.; a division of Cooper Industries.
 - b. Hilti, Inc.
 - c. ITW Ramset/Red Head.

2.7 PIPE STAND FABRICATION

- A. Pipe Stands, General: Shop or field-fabricated assemblies made of manufactured corrosion-resistant components to support roof-mounted piping.
- B. Compact Pipe Stand: One-piece plastic unit with integral-rod-roller, pipe clamps, or V-shaped cradle to support pipe, for roof installation without membrane penetration.
 - 1. Manufacturers:
 - a. ERICO/Michigan Hanger Co.
 - b. MIRO Industries.
- C. Low-Type, Single-Pipe Stand: One-piece plastic base unit with plastic roller, for roof installation without membrane penetration.
 - 1. Manufacturers:
 - a. MIRO Industries.
- D. Curb-Mounting-Type Pipe Stands: Shop- or field-fabricated pipe support made from structural-steel shape, continuous-thread rods, and rollers for mounting on permanent stationary roof curb.

2.8 PIPE POSITIONING SYSTEMS

- A. Description: IAPMO PS 42, system of metal brackets, clips, and straps for positioning piping in pipe spaces for plumbing fixtures for commercial applications.
- B. Manufacturers:
 - 1. C & S Mfg. Corp.
 - 2. HOLDRITE Corp.; Hubbard Enterprises.
 - 3. Samco Stamping, Inc.

2.9 EQUIPMENT SUPPORTS

- A. Description: Welded, shop- or field-fabricated equipment support made from structural-steel shapes.

2.10 MISCELLANEOUS MATERIALS

- A. Structural Steel: ASTM A 36/A 36M, 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.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT APPLICATIONS

- A. Specific hanger and support requirements are specified 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. Use hangers and supports with galvanized, metallic coatings for piping and equipment that will not have field-applied finish.
- D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- E. Use padded hangers for piping that is subject to scratching.
- F. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated stationary pipes, NPS 1/2 to NPS 30.
 - 2. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes, NPS 3/4 to NPS 24, requiring clamp flexibility and up to 4 inches of insulation.
 - 3. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes, NPS 1/2 to NPS 24, if little or no insulation is required.
 - 4. Pipe Hangers (MSS Type 5): For suspension of pipes, NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.
 - 5. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated stationary pipes, NPS 3/4 to NPS 8.
 - 6. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8.
 - 7. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8.
 - 8. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 2.
 - 9. Split Pipe-Ring with or without Turnbuckle-Adjustment Hangers (MSS Type 11): For suspension of noninsulated stationary pipes, NPS 3/8 to NPS 8.

10. Extension Hinged or 2-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated stationary pipes, NPS 3/8 to NPS 3.
 11. U-Bolts (MSS Type 24): For support of heavy pipes, NPS 1/2 to NPS 30.
 12. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
 13. Pipe Saddle Supports (MSS Type 36): For support of pipes, NPS 4 to NPS 36, with steel pipe base stanchion support and cast-iron floor flange.
 14. Pipe Stanchion Saddles (MSS Type 37): For support of pipes, NPS 4 to NPS 36, with steel pipe base stanchion support and cast-iron floor flange and with U-bolt to retain pipe.
 15. Adjustable, Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes, NPS 2-1/2 to NPS 36, if vertical adjustment is required, with steel pipe base stanchion support and cast-iron floor flange.
- G. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers, NPS 3/4 to NPS 20.
 2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers, NPS 3/4 to NPS 20, if longer ends are required for riser clamps.
- H. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install 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.
 3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
 4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
 5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.
- I. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
 2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joint 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. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
 8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
 9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
 10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
 11. Malleable Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
 12. Welded-Steel Brackets: For support of pipes from below, or for suspending from above by using clip and rod. Use 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.
- 13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
- 14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
- 15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.
- J. 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: For supporting insulated pipe.
- K. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
 - 2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
 - 3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41 roll hanger with springs.
 - 4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
 - 5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from hanger.
 - 6. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from base support.
 - 7. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from trapeze support.
 - 8. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:
 - a. Horizontal (MSS Type 54): Mounted horizontally.
 - b. Vertical (MSS Type 55): Mounted vertically.
 - c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.
- L. Comply with MSS SP-69 for trapeze pipe hanger selections and applications that are not specified in piping system Sections.
- M. Comply with MFMA-102 for metal framing system selections and applications that are not specified in piping system Sections.
- N. Use mechanical-expansion anchors instead of building attachments where required in concrete construction.
- O. Use pipe positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

3.2 HANGER AND SUPPORT INSTALLATION

- A. Steel Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.
- B. 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 above for individual pipe hangers.
 - 2. Field fabricate from ASTM A 36/A 36M, steel shapes selected for loads being supported. Weld steel according to AWS D1.1.
- C. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.
- D. Fastener System Installation:
 - 1. Install 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. 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.
- E. Pipe Positioning System Installation: Install support devices to make rigid supply and waste piping connections to each plumbing fixture. Refer to Division 22 Section "Plumbing Fixtures" for plumbing fixtures.
- F. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.
- G. Install hangers and supports to allow controlled thermal and seismic 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.
- H. Install lateral bracing with pipe hangers and supports to prevent swaying.
- I. Install building attachments within concrete slabs or attach to structural steel.
 - 1. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.
 - 2. Install additional attachments at piping services partially or fully buried and below unexcavated slab on grade floors.
- J. Load Distribution: Install hangers and supports so piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- K. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.9 (for building services piping) are not exceeded.
- L. Insulated Piping: Comply with the following:
 - 1. Attach clamps and spacers to piping.

- a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
 - b. Do not exceed pipe stress limits according to ASME B31.9 for building services piping.
 2. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
 3. 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.
 - d. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.
 - e. NPS 16 to NPS 24: 24 inches long and 0.105 inch thick.
 4. Pipes NPS 8 and Larger: Include wood inserts.
 5. Insert Material: Length at least as long as protective shield.
- M. The spacing for hangers for horizontal piping shall be in accordance with the following:
1. Cast Iron Soil Pipe: 5 ft.-0 in. at the hubs for 5 ft. lengths. For 10 ft. lengths, use one (1) hanger at the hub and one (1) at midpoint of the length. Install cast iron pipe in accordance with CISPI Handbook - latest edition.
 2. Copper Tubing: 6 ft.-0 in. o.c. for 1-1/4 in. and smaller, and 10 ft.-0 in. o.c. for 1-1/2 in. and larger.
 3. Steel Pipe: 10 ft.-0 in. o.c. for 1-1/2 in. and over; 8 ft. - 0 in. for 1-1/4 in.; 6 ft. - 0 in. for 1 in. and smaller.
 4. Polypropylene waste: 4 ft.-0 in. o.c.
- N. Hanger rod diameter shall be as follows:

Pipe Size	Rod Diameter
1/2 in. thru 2 in.	3/8 in.
2-1/2 in. and 3 in.	1/2 in.
4 in. and 5 in.	5/8 in.
6 in.	3/4 in.
8 in. and over	7/8 in.

3.3 METAL FABRICATIONS

- A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers.
- B. Fit exposed connections together to form hairline joints.

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 1-1/2 inches.

3.5 PAINTING

- A. Touch Up: 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.
- B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 22 05 29

SECTION 22 05 53
IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 TRADE CONTRACT REQUIREMENTS

- A. Work of this Section is part of the Plumbing Trade Contract. Refer to Section 22 00 00 "Plumbing Trade Contractor Requirements" for additional information about this Trade Contract.

1.2 RELATED DOCUMENTS

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

1.3 SUMMARY

- A. Section Includes:
1. Equipment labels.
 2. Warning signs and labels.
 3. Pipe labels.
 4. Valve tags.
 5. Warning tags.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. LEED Submittals:
1. Complete "Sustainable Materials Attributes Submittal Form" attached to Section 01 81 13 "Sustainable Design Requirements".
 2. Provide supporting documentation for Materials and Resources and Low Emitting Materials, as required in Section 01 81 13, from manufacturer for materials attributes data submitted.
 - a. Environmental Product Declaration: For each product.
 - b. Chain-of-Custody Certificates: For FSC certified wood products. Include statement of costs and qualifications of manufacturers and vendors.
 - c. Health Product Declaration: For each product.
 - d. Laboratory Test Reports: Verify that the following products comply with the testing and product requirements of the California Department of Public Health's (CDPH) "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers", or South Coast Air Quality Management District (SCAQMD) Rule 1113:
 - 1) Sealants.
 - 2) Paints and coatings.
 - e. Product Data: For the following, including VOC content:
 - 1) Sealants.
 - 2) Paints and coatings.
 - f. Statement of Volume: for wet-applied products installed in the field.
 - g. Verify that the following products comply with Ultra Low Emitting Formaldehyde and No Added Urea Formaldehyde (ULEF or NAUF) requirements:

- 1) For composite wood products, verify that product contains no urea formaldehyde, as defined in the California Air Resources Board's (CARB) "Airborne Toxic Control Measure to Reduce Formaldehyde Emissions from Composite Wood Products" or shall be made with no added formaldehyde.
 - C. Samples: For color, letter style, and graphic representation required for each identification material and device.
 - D. Equipment Label Schedule: Include a listing of equipment to be labeled with the proposed content for each label.
 - E. Valve numbering scheme.
 - F. Valve Schedules: For each piping system to include in maintenance manuals and for installation on wall of water room (laminated schedule for wall installation).
 - G. Laminated system single line diagram identifying valve tags (for installation on wall of water room).
 - H. One manufacturer's product is to be provided for each category of products throughout the project, unless specific circumstances do not allow for this approach. Consult with the Architect/Engineer prior to bid to request deviation from this one-product contract requirement. No change order will be considered for failing to comply with this requirement. Installation of non-compliant products will be removed and replaced under this section with compliant products at no additional cost to the owner.
- 1.5 COORDINATION
- A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
 - B. Coordinate installation of identifying devices with locations of access panels and doors.
 - C. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

- A. Metal Labels for Equipment:
 1. Material and Thickness: Stainless steel, or Aluminum, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
 2. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch
 3. 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.
 4. Fasteners: Stainless-steel rivets.
 5. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

- B. 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.
- C. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch (A4) 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 2-1/2 by 3/4 inch
- F. 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.
- G. Fasteners: Stainless-steel rivets.
- 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. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to partially cover circumference of pipe and to attach to pipe without fasteners or adhesive.
- C. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.
- D. 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 1-1/2 inches high.

2.4 VALVE TAGS

- A. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers.
 - 1. Tag Material: Brass, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
 - 2. Fasteners: Brass wire-link or beaded chain; or S-hook.

- B. Valve Schedules: For each piping system, on 8-1/2-by-11-inch bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.
 - 1. Valve-tag schedule shall be included in operation and maintenance data.

2.5 WARNING TAGS

- A. Warning Tags: Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with matte finish suitable for writing.
 - 1. Size: Approximately 4 by 7 inches
 - 2. Fasteners: Brass grommet and wire
 - 3. Nomenclature: Large-size primary caption such as "DANGER," "CAUTION," or "DO NOT OPERATE."
 - 4. Color: Yellow background with black lettering.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 EQUIPMENT LABEL INSTALLATION

- A. Install or permanently fasten labels on each major item of mechanical equipment.
- B. Locate equipment labels where accessible and visible.

3.3 PIPE LABEL INSTALLATION

- A. 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 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
 - 7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.
 - 8. In areas where exposed pipe will be painted, locate labels such that they will not be painted.
- B. Pipe Label Color Schedule:
 - 1. Domestic Cold Water Piping:
 - a. Letter Color: Black
 - b. Background Color: Green
 - 2. Domestic Hot Water and Hot Water Return Piping:

- a. Letter Color: Black
 - b. Background Color: Yellow
- 3. Non Potable Water Piping:
 - a. Letter Color: Black
 - b. Background Color: Purple
- 4. Sanitary Waste and Storm Drainage and Overflow Piping:
 - a. Letter Color: Black
 - b. Background Color: Green
- 5. Vent Piping:
 - a. Letter Color: Black
 - b. Background Color: Yellow
- 6. Special Waste Water Piping:
 - a. Letter Color: Black
 - b. Background Color: Orange

3.4 VALVE-TAG INSTALLATION

- A. Install tags on valves and control devices in piping systems, except check valves; valves within factory-fabricated equipment units; shutoff valves; faucets; convenience and lawn-watering hose connections; and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.
- B. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following subparagraphs:
 - 1. Valve-Tag Size and Shape: Minimum 1-1/2 inches, round
 - 2. Valve-Tag Color: Natural
 - 3. Letter Color: Black

3.5 WARNING-TAG INSTALLATION

- A. Write required message on, and attach warning tags to, equipment and other items where required.

END OF SECTION 22 05 53

SECTION 22 07 00
PLUMBING INSULATION

PART 1 - GENERAL

1.1 TRADE CONTRACT REQUIREMENTS

- A. Work of this Section is part of the Plumbing Trade Contract. Refer to Section 22 00 01 "Plumbing Trade Contractor Requirements" for additional information about this Trade Contract.

1.2 RELATED DOCUMENTS

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

1.3 SUMMARY

- A. Section Includes:
 - 1. Insulation Materials for plumbing piping
 - 2. Adhesives.
 - 3. Mastics.
 - 4. Sealants.
 - 5. Factory-applied jackets.
 - 6. Field-applied fabric-reinforcing mesh.
 - 7. Field-applied cloths.
 - 8. Field-applied jackets.
 - 9. Tapes.
 - 10. Securements.
 - 11. Corner angles.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated. Include thermal conductivity, thickness, and jackets (both factory and field applied).
- B. LEED Submittals:
 - 1. Complete "Sustainable Materials Attributes Submittal Form" attached to Section 01 81 13 "Sustainable Design Requirements".
 - 2. Provide supporting documentation for Materials and Resources and Low Emitting Materials, as required in Section 01 81 13, from manufacturer for materials attributes data submitted.
 - a. Environmental Product Declaration: For each product.
 - b. Chain-of-Custody Certificates: For FSC certified wood products. Include statement of costs and qualifications of manufacturers and vendors.
 - c. Health Product Declaration: For each product.
 - d. Laboratory Test Reports: Verify that the following products comply with the testing and product requirements of the California Department of Public Health's (CDPH) "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers", or South Coast Air Quality Management District (SCAQMD) Rule 1113:
 - 1) Sealants.
 - 2) Paints and coatings.

- e. Product Data: For the following, including VOC content:
 - 1) Sealants.
 - 2) Paints and coatings.
- f. Statement of Volume: for wet-applied products installed in the field.
- g. Verify that the following products comply with Ultra Low Emitting Formaldehyde and No Added Urea Formaldehyde (ULEF or NAUF) requirements:
 - 1) For composite wood products, verify that product contains no urea formaldehyde, as defined in the California Air Resources Board's (CARB) "Airborne Toxic Control Measure to Reduce Formaldehyde Emissions from Composite Wood Products" or shall be made with no added formaldehyde.

C. Qualification Data: For qualified IEQC2.1 Installer.

D. Field quality-control reports.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.
- B. 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.

1.6 COORDINATION

- A. Coordinate size and location of supports, hangers, and insulation shields specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."
- B. Coordinate clearance requirements with piping Installer for piping insulation application and equipment Installer for equipment insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.
- C. Coordinate installation and testing of heat tracing.

1.7 SCHEDULING

- A. Schedule insulation application after pressure testing and other applicable tests. Insulation application may begin on segments that have satisfactory test results.
- B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

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. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.
- D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.
- E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
- F. Cellular Glass: Inorganic, incombustible, foamed or cellulated glass with annealed, rigid, hermetically sealed cells. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
 - 1. Products: Subject to compliance with requirements, provide one of the following available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Cell-U-Foam Corporation; Ultra-CUF.
 - b. Pittsburgh Corning Corporation; Foamglas Super K.
 - 2. Block Insulation: ASTM C 552, Type I.
 - 3. Special-Shaped Insulation: ASTM C 552, Type III.
 - 4. Board Insulation: ASTM C 552, Type IV.
 - 5. Preformed Pipe Insulation with Factory-Applied ASJ-SSL: Comply with ASTM C 552, Type II, Class 2.
 - 6. Factory fabricate shapes according to ASTM C 450 and ASTM C 585.
- G. Flexible Elastomeric: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials and Type II for sheet materials.
 - 1. Products: Subject to compliance with requirements, provide one of the following available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Aeroflex USA Inc.; Aerocel.
 - b. Armacell LLC; AP Armaflex.
 - c. RBX Corporation; Insul-Sheet 1800 and Insul-Tube 180.
- H. Mineral-Fiber, Preformed Pipe Insulation:
 - 1. Products: Subject to compliance with requirements, provide one of the following available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Knauf Insulation; 1000 deg. Pipe Insulation.
 - b. Manson Insulation Inc.; Alley-K.
 - c. Owens Corning; Fiberglas Pipe Insulation.
 - 2. Type I, 850 deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ-SSL. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
 - 3. Provide insulations with PVC covering for insulated systems located within mechanical room, piping in exposed ceiling area.

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. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Childers Brand; H. B. Fuller Construction Products.
 - b. Eagle Bridges - Marathon Industries.
 - c. Foster Brand; H. B. Fuller Construction Products.
 - d. Mon-Eco Industries, Inc.
 2. Adhesive: As recommended by mineral fiber manufacturer and with a VOC content of **80** g/L or less.
 3. Adhesives and sealants 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."
- C. Phenolic Adhesive: Solvent-based resin adhesive, with a service temperature range of minus 75 to plus 300 deg F.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Childers Brand; H. B. Fuller Construction Products.
 - b. Foster Brand; H. B. Fuller Construction Products.
 2. Adhesive: As recommended by phenolic manufacturer and with a VOC content of **[50]** g/L or less.
 3. Adhesives and sealants 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."
- D. ASJ Adhesive, and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Childers Brand; H. B. Fuller Construction Products.
 - b. Eagle Bridges - Marathon Industries.
 - c. Foster Brand; H. B. Fuller Construction Products.
 - d. Mon-Eco Industries, Inc.
 2. Adhesives shall have a VOC content of **80** g/L or less.
 3. Adhesives and sealants 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."

E. PVC Jacket Adhesive: Compatible with PVC jacket.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Dow Corning Corporation.
 - b. Johns Manville; a Berkshire Hathaway company.
 - c. P.I.C. Plastics, Inc.
 - d. Speedline Corporation.
2. Adhesive: As recommended by Adhesive - PVC Jacket manufacturer and with a VOC content of **50** g/L or less.
3. Adhesives and sealants 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."

2.3 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 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- B. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.
 1. Mastics: As recommended by insulation manufacturer and with a VOC content of **50** g/L or less.
 2. Mastics 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."

2.4 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-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.
 2. PVDC Jacket for Indoor Applications: 4-mil- thick, white PVDC biaxially oriented barrier film with a permeance at 0.02 perms when tested according to ASTM E 96 and with a flame-spread index of 5 and a smoke-developed index of 20 when tested according to ASTM E 84.
 - a. Products: Subject to compliance with requirements, provide the following:
 - 1) Dow Chemical Company (The); Saran 540 Vapor Retarder Film and Saran 560 Vapor Retarder Film or approved equal..
 3. PVDC Jacket for Outdoor Applications and Entire Crawl Space: 6-mil- thick, white PVDC biaxially oriented barrier film with a permeance at 0.01 perms when tested according to ASTM E 96 and with a flame-spread index of 5 and a smoke-developed index of 25 when tested according to ASTM E 84.
 - a. Products: Subject to compliance with requirements, provide:
 - 1) Dow Chemical Company (The); Saran 540 Vapor Retarder Film and Saran 560 Vapor Retarder Film or approved equal.

4. PVDC-SSL Jacket: PVDC jacket with a self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip.
 - a. Products: Subject to compliance with requirements, provide the following:
 - 1) Dow Chemical Company (The); Saran 540 Vapor Retarder Film and Saran 560 Vapor Retarder Film or approved equal.

2.5 SEALANTS

A. Joint Sealants for Cellular-Glass and Phenolic Products:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Childers Brand; H. B. Fuller Construction Products.
 - b. Eagle Bridges - Marathon Industries.
 - c. Foster Brand; H. B. Fuller Construction Products.
 - d. Mon-Eco Industries, Inc.
 - e. Pittsburgh Corning Corporation.
2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Permanently flexible, elastomeric sealant.
4. Service Temperature Range: Minus 100 to plus 300 deg F .
5. Color: White or gray.
6. Sealant shall have a VOC content of 420 g/L or less.
7. Sealant 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."

B. FSK and Metal Jacket Flashing Sealants:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Childers Brand; H. B. Fuller Construction Products.
 - b. Eagle Bridges - Marathon Industries.
 - c. Foster Brand; H. B. Fuller Construction Products.
 - d. Mon-Eco Industries, Inc.
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: Aluminum.
6. Sealant shall have a VOC content of 420 g/L or less.
7. Sealant 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."

C. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Childers Brand; H. B. Fuller Construction Products.
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. Sealant shall have a VOC content of 420 g/L or less.
7. Sealant 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."

2.6 FIELD-APPLIED JACKETS

- A. Provide PVC jackets to all insulated piping systems in mechanical space areas.
- B. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.
- C. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.
 1. Products: Subject to compliance with requirements, provide one of the following available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. P.I.C. Plastics, Inc.; FG Series.
 - b. Proto PVC Corporation; LoSmoke.
 - c. Speedline Corporation; SmokeSafe.
 2. Adhesive: As recommended by jacket material manufacturer.
 3. Color: White
 4. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.
 - a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.Factory-fabricated tank heads and tank side panels

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.
 1. Verify that systems and equipment to be insulated have been tested and are free of defects.
 2. Verify that surfaces to be insulated are clean and dry.
 3. 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.
- B. Surface Preparation: Clean and prepare surfaces to be insulated. Before insulating, apply a corrosion coating to insulated surfaces as follows:
 - 1. Stainless Steel: Coat 300 series stainless steel with epoxy primer 5 mils thick and an epoxy finish 5 mils thick if operating in a temperature range between 140 and 300 deg F. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
 - 2. Carbon Steel: Coat carbon steel operating at a service temperature between 32 and 300 deg F with an epoxy coating. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
- C. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.
- D. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

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 equipment and piping including fittings, valves, and specialties.
- B. Install 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. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- 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. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

3.5 GENERAL PIPE 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. Install 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.
 - 4. Install 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. Install 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. Install 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.
 - 4. Install insulation to flanges as specified for flange insulation application.

3.6 FINISHES

- A. Equipment and Pipe Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Division 09 painting Sections.
 - 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. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.
- C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.
- D. Do not field paint aluminum or stainless-steel jackets.

3.9 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.

3.1 INTERIOR PIPING INSULATION SCHEDULE

- A. Domestic Cold Water:
 - 1. Insulation shall be the following:
 - a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1/2 inch thick.

- B. Domestic Hot and Recirculated Hot Water:
 - 1. Insulation shall be the following:
 - a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
- C. Stormwater and Overflow: For all pipe sizes, insulation shall be the following:
 - a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1/2 inch thick.
- D. Roof Drain and Overflow Drain Bodies: For all pipe sizes, insulation shall be the following:
 - 1. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
- E. Exposed Sanitary Drains, Domestic Water, Domestic Hot Water, and Stops for Plumbing Fixtures for People with Disabilities: For all pipe sizes, insulation shall be one of the following:
 - 1. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1/8 inch thick.
 - 2. Closed Cell Vinyl : Preformed, 1/8 inch thick, bacteria/fungus resistant.
- F. Underground Outdoor Kitchen Waste Drainage Piping For all pipe sizes, insulation shall be the following:
 - 1. Cellular foam Pipe Insulation, Type I: 2" inch thick.
- G. Condensate and Equipment Drain Water below 60 Deg F: For all pipe sizes, insulation shall be the following:
 - 1. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1/2 inch thick.
- H. Floor Drains, Traps, and Sanitary Drain Piping within 10 Feet of Drain Receiving Condensate and Equipment Drain Water below 60 Deg F: For all pipe sizes, insulation shall be the following:
 - 1. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1/2 inch thick.

3.2 INDOOR, 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. If more than one material is listed, selection from materials listed is Contractor's option.
- C. Piping, Concealed:
 - 1. None.
- D. Exposed piping in Occupied Space, Piping at exposed ceiling, Mechanical room and as indicated on the drawing:
 - 1. PVC: white, 20 mils thick.

Encase outdoor exterior piping insulation with .016" thick aluminum jacket with weatherproof construction.

END OF SECTION 22 07 00

SECTION 22 11 16
DOMESTIC WATER PIPING

PART 1 - GENERAL

1.1 TRADE CONTRACT REQUIREMENTS

- A. Work of this Section is part of the Plumbing Trade Contract. Refer to Section 22 00 01 "Plumbing Trade Contractor Requirements" for additional information about this Trade Contract.

1.2 RELATED DOCUMENTS

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

1.3 SUMMARY

- A. Section Includes:
 - 1. Under-building slab, aboveground domestic water pipes, tubes, fittings, and specialties inside the building.
 - 2. Encasement for piping.
 - 3. Specialty valves.
 - 4. Flexible connectors.
 - 5. Escutcheons.
 - 6. Sleeves and sleeve seals.
 - 7. Wall penetration systems.

1.4 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Domestic water piping and support and installation shall withstand effects of earthquake motions determined according to ASCE/SEI 7.

1.5 SUBMITTALS

- A. Product Data: For the following products:
 - 1. Specialty valves.
 - 2. Transition fittings.
 - 3. Dielectric fittings.
 - 4. Flexible connectors.
 - 5. Water meters.
 - 6. Backflow preventers and vacuum breakers.
 - 7. Escutcheons.
 - 8. Sleeves and sleeve seals.
 - 9. Water penetration systems.
- B. LEED Submittals:
 - 1. Complete "Sustainable Materials Attributes Submittal Form" attached to Section 01 81 13 "Sustainable Design Requirements".
 - 2. Provide supporting documentation for Materials and Resources and Low Emitting Materials, as required in Section 01 81 13, from manufacturer for materials attributes data submitted.
 - a. Environmental Product Declaration: For each product.

- b. Chain-of-Custody Certificates: For FSC certified wood products. Include statement of costs and qualifications of manufacturers and vendors.
 - c. Health Product Declaration: For each product.
 - d. Laboratory Test Reports: Verify that the following products comply with the testing and product requirements of the California Department of Public Health's (CDPH) "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers", or South Coast Air Quality Management District (SCAQMD) Rule 1113:
 - 1) Sealants.
 - 2) Paints and coatings.
 - e. Product Data: For the following, including VOC content:
 - 1) Sealants.
 - 2) Paints and coatings.
 - f. Statement of Volume: for wet-applied products installed in the field.
 - g. Verify that the following products comply with Ultra Low Emitting Formaldehyde and No Added Urea Formaldehyde (ULEF or NAUF) requirements:
 - 1) For composite wood products, verify that product contains no urea formaldehyde, as defined in the California Air Resources Board's (CARB) "Airborne Toxic Control Measure to Reduce Formaldehyde Emissions from Composite Wood Products" or shall be made with no added formaldehyde.
 - C. Coordination Drawings: For piping in equipment rooms and other congested areas, drawn to scale, on which the following items are shown and coordinated with each other, using input from Installers of the items involved:
 - 1. Fire-suppression-water piping.
 - 2. Domestic water piping.
 - 3. HVAC hydronic piping.
 - D. Field quality-control reports.
- 1.6 QUALITY ASSURANCE
- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
 - B. Comply with NSF 372 for potable domestic water piping and components.
 - C. To assure uniformity and compatibility of piping components in grooved piping systems, grooved products utilized shall be supplied by one manufacturer. Grooving tools shall be supplied by the same manufacturer as the grooved components.
 - D. One manufacturer's product is to be provided for each category of products throughout the project, unless specific circumstances do not allow for this approach. Consult with the Architect/Engineer prior to bid to request deviation from this one-product contract requirement. No change order will be considered for failing to comply with this requirement. Installation of non-compliant products will be removed and replaced under this section with compliant products at no additional cost to the owner.
- 1.7 COORDINATION
- A. Coordinate sizes and locations of concrete bases with actual equipment provided.

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 and Type K for underground pipe.
 - 1. Cast-Copper Solder-Joint Fittings: ASME B16.18, pressure fittings.
 - 2. Wrought-Copper Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.
 - 3. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.
 - 4. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.
 - 5. Grooved-Joint Copper-Tube Appurtenances:
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following
 - 1) Anvil International.
 - 2) Shurjoint Piping Products.
 - 3) Victaulic Company.
 - b. Copper Grooved-End Fittings: ASTM B 75 copper tube or ASTM B 584 bronze castings. Flaring of tube and fitting ends to IPS dimensions is not permitted.
 - c. Grooved-End-Tube Couplings: Copper-tube dimensions and design similar to AWWA C606. Include ferrous housing sections, cast with offsetting, angle-pattern bolt pads and coated with copper-colored enamel; EPDM- synthetic rubber gaskets (UL classified and NSF-61), suitable for hot and cold water, and bolts and nuts.
- B. Soft Copper Tube: ASTM B 88, Type K water tube, annealed temper. ((for 1.5" and smaller piping below slab)
 - 1. Copper Brazed-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.

2.3 DUCTILE-IRON PIPE AND FITTINGS (for 4" piping below slab)

- A. Push-on-Joint, Ductile-Iron Pipe: AWWA C151, with push-on-joint bell and plain spigot end unless grooved or flanged ends are indicated.
 - 1. Standard-Pattern, Push-on-Joint Fittings: AWWA C110, ductile or gray iron.
 - a. Gaskets: AWWA C111, rubber.

2.4 PIPING JOINING MATERIALS

- A. Pipe-Flange Gasket Materials: AWWA C110, rubber, flat face, 1/8 inch thick or ASME B16.21, nonmetallic and asbestos free, unless otherwise indicated; 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. Include water-flushable flux according to ASTM B 813.
- D. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.

2.5 SPECIALTY VALVES

- A. Comply with requirements in Division 22 Section "General-Duty Valves for Plumbing Piping" for general-duty metal valves.
- B. Comply with requirements in Division 22 Section "Domestic Water Piping Specialties" for balancing valves, drain valves, backflow preventers, and vacuum breakers.

2.6 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.

2.7 DIELECTRIC FITTINGS

- A. General Requirements: Assembly of copper alloy and ferrous materials or ferrous material body with separating nonconductive insulating material suitable for system fluid, pressure, and temperature.
- B. Dielectric Unions:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Hart Industries International, Inc.
 - b. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
 - c. Zurn Plumbing Products Group; Wilkins Water Control Products.
 - 2. Description:
 - a. Pressure Rating: 150 psig at 180 deg F.
 - b. End Connections: Solder-joint copper alloy and threaded ferrous.
- C. Dielectric Flanges:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Capitol Manufacturing Company.
 - b. EPCO Sales, Inc.
 - c. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
 - 2. Description:
 - a. Factory-fabricated, bolted, companion-flange assembly.
 - b. Pressure Rating: 150 psig minimum.
 - c. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.
- D. Dielectric Couplings:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Calpico, Inc.
 - b. Lochinvar Corporation.
- E. Dielectric Nipples (not allowed)

2.8 FLEXIBLE CONNECTORS

- 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. Flexicraft Industries.
 - 2. Flex-Weld, Inc.
 - 3. Metraflex, Inc.

2.9 ESCUTCHEONS

- A. General: Manufactured ceiling, floor, and wall escutcheons and floor plates.
- B. One Piece, Cast Brass: Polished, chrome-plated finish with setscrews.
- C. One Piece, Stamped Steel: Chrome-plated finish with setscrew or spring clips.
- D. Split Casting, Cast Brass: Polished, chrome-plated or rough-brass finish with concealed hinge and setscrew.
- E. Split Plate, Stamped Steel: Chrome-plated finish with concealed hinge, setscrew or spring clips.
- F. One-Piece Floor Plates: Cast-iron flange with holes for fasteners.
- G. Split-Casting Floor Plates: Cast brass with concealed hinge.

2.10 SLEEVES

- A. Cast-Iron Wall Pipes: Fabricated of cast iron, and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.
- B. Galvanized-Steel-Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.
- C. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc-coated, with plain ends.
- D. 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 setscrews.
- E. For interior wall, floor and ceiling penetrations, seal annular space between sleeve and pipe or pipe insulation using joint sealants appropriate for fire rating, size, depth, and location of joint shall be under division 078410 for Firestopping and Section 078440 for Fire Resistive Joint Sealants

2.11 SLEEVE SEALS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Advance Products & Systems, Inc.
 - 2. Calpico, Inc.
 - 3. Metraflex, Inc.
 - 4. Pipeline Seal and Insulator, Inc.

- B. Description: Modular sealing element unit, designed for field assembly, used to fill annular space between pipe and sleeve.
 - 1. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
 - 2. Pressure Plates: Carbon steel.
 - 3. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, of length required to secure pressure plates to sealing elements.

2.12 GROUT

- A. Standard: ASTM C 1107, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
- B. Characteristics: Nonshrink; recommended for interior and exterior applications.
- C. Design Mix: 5000-psi, 28-day compressive strength.
- D. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 EARTHWORK

- A. Refer to Division 31 Section "Earth Moving" for excavating, trenching, and backfilling.

3.2 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. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- B. Install copper tubing under building slab according to CDA's "Copper Tube Handbook."
- C. Install ductile-iron piping under building slab with restrained joints according to AWWA C600 and AWWA M41.
- D. Install underground copper tube and ductile-iron pipe in PE encasement according to ASTM A 674 or AWWA C105.
- E. Install shutoff valve, hose-end drain valve, strainer, pressure gage, and test tee with valve, inside the building at each domestic water service entrance. Comply with requirements in Division 22 Section "Meters and Gages for Plumbing Piping" for pressure gages and Division 22 Section "Domestic Water Piping Specialties" for drain valves and strainers.
- F. Install shutoff valve immediately upstream of each dielectric fitting.
- G. Install water-pressure-reducing valves downstream from shutoff valves. Comply with requirements in Division 22 Section "Domestic Water Piping Specialties" for pressure-reducing valves.
- H. Install domestic water piping level with 0.25 percent slope downward toward drain and plumb.

- I. Rough-in domestic water piping for water-meter installation according to utility company's requirements.
- J. Install seismic restraints on piping. Comply with requirements in Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment" for seismic-restraint devices.
- K. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.
- L. Install 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.
- M. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.
- N. Install piping adjacent to equipment and specialties to allow service and maintenance.
- O. Install piping to permit valve servicing.
- P. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than system pressure rating used in applications below unless otherwise indicated.
- Q. Install piping free of sags and bends.
- R. Install fittings for changes in direction and branch connections.
- S. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.
- T. Install pressure gages on suction and discharge piping from each plumbing pump and packaged booster pump. Comply with requirements in Division 22 Section "Meters and Gages for Plumbing Piping" for pressure gages.
- U. Install thermostats in hot-water circulation piping. Comply with requirements in Division 22 Section "Domestic Water Pumps" for thermostats.
- V. Install thermometers on outlet piping from each water heater. Comply with requirements in Division 22 Section "Meters and Gages for Plumbing Piping" for thermometers.

3.3 JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.
- C. Brazed Joints: Join copper tube and fittings according to CDA's "Copper Tube Handbook," "Brazed Joints" Chapter.
- D. Soldered Joints: 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. Copper-Tubing Grooved Joints: Roll groove end of tube. Assemble coupling with housing, gasket, lubricant, and bolts. Join copper tube and grooved-end fittings according to AWWA C606 for roll-grooved joints. The gasket style and elastomeric material (grade) shall be verified as suitable for the intended service as specified. Grooved end shall be clean and free from indentations, projections and roll marks in the area from pipe end to groove for proper gasket sealing. A factory trained field representative shall provide on-site training to contractor's field personnel in the installation of grooved piping products. Factory trained representative shall periodically review the product installation. Contractor shall remove and replace improperly installed products.
- F. Ductile-Iron-Piping Grooved Joints: Cut groove end of pipe. Assemble coupling with housing, gasket, lubricant, and bolts. Join ductile-iron pipe and grooved-end fittings according to AWWA C606 for ductile-iron-pipe, cut-grooved joints.
- G. 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.
- H. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.

3.4 VALVE INSTALLATION

- A. General-Duty Valves: Comply with requirements in Division 22 Section "General-Duty Valves for Plumbing Piping" for valve installations.
- B. Install shutoff valve close to water main on each branch and riser serving plumbing fixtures or equipment, on each water supply to equipment, and on each water supply to plumbing fixtures that do not have supply stops. Use ball valves.
- C. Install drain valves for equipment at base of each water riser, at low points in horizontal piping, and where required to drain water piping. Drain valves are specified in Division 22 Section "Domestic Water Piping Specialties."
 - 1. Hose-End Drain Valves: At low points in water mains, risers, and branches.
 - 2. Stop-and-Waste Drain Valves: Instead of hose-end drain valves where indicated.
- D. Install balancing valve in each hot-water circulation return branch. Set balancing valves partly open to restrict but not stop flow. Use circuit setters. Comply with requirements in Division 22 Section "Domestic Water Piping Specialties" for balancing valves.

3.5 TRANSITION FITTING INSTALLATION

- A. Install transition couplings at joints of dissimilar piping.
- B. Transition Fittings in Underground Domestic Water Piping:
 - 1. NPS 2 and Larger: Sleeve-type coupling.

3.6 DIELECTRIC FITTING INSTALLATION

- A. Install dielectric waterway fittings in piping at connections of dissimilar metal piping and tubing.
- B. Dielectric Fittings for NPS 2 and Smaller: Use dielectric couplings or unions.
- C. Dielectric Fittings for NPS 2-1/2 to NPS 4: Use dielectric flanges.

3.7 WATER METER INSTALLATION

- A. Rough-in domestic water piping, and install water meters according to utility company's requirements.
- B. Install water meters according to AWWA M6, utility company's requirements, and the following:
- C. Install water meters with shutoff valves and pressure gages on water-meter inlet and outlet and on valved bypass around meter (unless prohibited by the AHJ). Support meters, valves, and piping on brick or concrete piers.
- D. Provide strainer upstream of water meter.
- E. Install remote registration system according to standards of utility company and of authorities having jurisdiction.

3.8 HANGER AND SUPPORT INSTALLATION

- A. Comply with requirements in Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment" for seismic-restraint devices.
- B. Comply with requirements in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment" for pipe hanger and support products and installation.
 - 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.
 - 3. Base of Vertical Piping: MSS Type 52, spring hangers.
- C. Support vertical piping and tubing at base and at each floor.
- D. Rod diameter may be reduced one size for double-rod hangers, to a minimum of 3/8 inch.
- E. Install 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 5: 10 feet with 1/2-inch rod.
 - 6. NPS 6: 10 feet with 5/8-inch rod.
 - 7. NPS 8: 10 feet with 3/4-inch rod.
- F. Install supports for vertical copper tubing every 10 feet.
- G. Support piping and tubing not listed in this article according to MSS SP-69 and manufacturer's written instructions.

3.9 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to equipment and machines to allow service and maintenance.

- C. Connect domestic water piping to water-service piping with shutoff valve; extend and connect to the following:
 - 1. Plumbing Fixtures: Cold- and hot-water supply piping in sizes indicated, but not smaller than required by plumbing code. Comply with requirements in Division 22 plumbing fixture Sections for connection sizes.
 - 2. Equipment: Cold- and hot-water supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection. Use flanges instead of unions for NPS 2-1/2 and larger.

3.10 ESCUTCHEON INSTALLATION

- A. Install escutcheons for penetrations of walls, ceilings, and floors.
- B. Comply with requirements of Division 22 Section "Common Work Results for Plumbing" for type of escutcheons.

3.11 SLEEVE INSTALLATION

- A. General Requirements: Install sleeves for pipes and tubes passing through penetrations in floors, partitions, roofs, and walls.
- B. Sleeves are not required for core-drilled holes.
- C. Permanent sleeves are not required for holes formed by removable PE sleeves.
- D. Cut sleeves to length for mounting flush with both surfaces unless otherwise indicated.
- E. Install sleeves in new partitions, slabs, and walls as they are built.
- F. For interior wall penetrations, seal annular space between sleeve and pipe or pipe insulation using joint sealants appropriate for size, depth, and location of joint. Comply with requirements in Division 07 Section "Joint Sealants" for joint sealants.
- G. Seal space outside of sleeves in concrete slabs and walls with grout.
- H. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation unless otherwise indicated.
- I. Install sleeve materials according to the following applications:
 - 1. Sleeves for Piping Passing through Concrete Floor Slabs: Steel pipe.
 - 2. Sleeves for Piping Passing through Concrete Floor Slabs of Mechanical Equipment Areas or Other Wet Areas: Steel pipe.
 - a. Extend sleeves 2 inches above finished floor level.
 - b. For pipes penetrating floors with membrane waterproofing, extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level. Comply with requirements in Division 07 Section "Sheet Metal Flashing and Trim" for flashing.
 - 3. Sleeves for Piping Passing through Gypsum-Board Partitions:
 - a. Steel pipe sleeves for pipes smaller than NPS 6.
 - b. Galvanized-steel sheet sleeves for pipes NPS 6 and larger.
 - c. Exception: Sleeves are not required for water supply tubes and waste pipes for individual plumbing fixtures if escutcheons will cover openings.
 - 4. Sleeves for Piping Passing through Interior Concrete Walls:
 - a. Steel pipe sleeves for pipes smaller than NPS 6.
 - b. Galvanized-steel sheet sleeves for pipes NPS 6 and larger.
- J. Fire-Barrier Penetrations: Firestopping is done by Section 078410. Coordinate penetrations with the firestopping contractor.

3.12 SLEEVE SEAL INSTALLATION

- A. Install sleeve seals in sleeves in exterior concrete walls at water-service piping entries into building.
- B. Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble sleeve seal components and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.13 IDENTIFICATION

- A. Identify system components. Comply with requirements in Division 22 Section "Identification for Plumbing Piping and Equipment" for identification materials and installation.
- B. Label pressure piping with system operating pressure.

3.14 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Piping Inspections:
 - 1. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
 - 2. 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:
 - a. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
 - b. Final Inspection: Arrange final inspection for authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
 - 3. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.
 - 4. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
- C. Piping Tests:
 - 1. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
 - 2. 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.
 - 3. 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.
 - 4. 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 to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
 - 5. Repair leaks and defects with new materials and retest piping or portion thereof until satisfactory results are obtained.
 - 6. Prepare reports for tests and for corrective action required.
- D. Domestic water piping will be considered defective if it does not pass tests and inspections.
- E. Prepare test and inspection reports.

3.15 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 ball-type balancing valves in hot-water-circulation return piping to provide flow of hot water 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. Close drain valves and replace drain plugs.
 - 7. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.
 - 8. Check plumbing specialties and verify proper settings, adjustments, and operation.

3.16 CLEANING

- A. Clean and disinfect potable and non-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 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 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. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.
- B. Clean non-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 procedures prescribed by authorities having jurisdiction or; if methods are not prescribed, follow procedures described below:
 - a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
 - b. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.
- C. Prepare and submit reports of purging and disinfecting activities.
- D. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

3.17 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, grooved couplings and unions may be used for aboveground piping joints unless otherwise indicated.
- C. Fitting Option: Brazed joints may be used on aboveground copper tubing.
- D. Aboveground domestic water piping (potable and non-potable) shall be the following:
 - 1. Hard copper tube, ASTM B 88, Type L; cast- or wrought- copper solder-joint fittings; and soldered joints for pipe sizes.
 - 2. Hard copper tube, ASTM B 88, Type L; Grooved-Joint Copper-Tube fittings similar to Victaulic can be used for piping 2 ½" and larger.
- E. Under-building-slab, domestic water shall be:
 - 1. Soft copper tube, ASTM B 88, Type K wrought-copper solder-joint fittings; and brazed joints for 1.5" and smaller pipe.
 - 2. Hard copper tube, ASTM B 88, Type K Copper for larger pipe; Grooved-Joint
- F. Under-building-slab, domestic water, NPS 4 to NPS 8 shall be:
 - 1. Push-on-joint, ductile-iron pipe; standard- or compact pattern push-on-joint fittings; and gasketed joints.
- G. Trap Primer Piping
 - 1. Trap primer piping from Primer to floor drain Type 'K' soft rolled copper tubing with swaged ends

3.18 VALVE SCHEDULE

- A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:
 - 1. Shutoff Duty: Use ball valves.
 - 2. Balancing Duty: Use ball valves for piping NPS 2 and smaller. Use butterfly or ball valves with flanged ends for piping NPS 2-1/2 and larger.
 - 3. Hot-Water Circulation Piping, Balancing Duty: Calibrated or Memory-stop balancing valves.
 - 4. Drain Duty: Hose-end drain valves.
- B. Use check valves to maintain correct direction of domestic water flow to and from equipment.
- C. Iron or bronze grooved-end valves may be used with grooved-end piping.

END OF SECTION 22 11 16

SECTION 22 11 19
DOMESTIC WATER PIPING SPECIALTIES

PART 1 - GENERAL

1.1 TRADE CONTRACT REQUIREMENTS

- A. Work of this Section is part of the Plumbing Trade Contract. Refer to Section 22 00 00 "Plumbing Trade Contractor Requirements" for additional information about this Trade Contract.

1.2 RELATED DOCUMENTS

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

1.3 SUMMARY

- A. This Section includes the following domestic water piping specialties: Vacuum breakers.
 - 1. Backflow preventers.
 - 2. Water pressure-reducing valves.
 - 3. Balancing valves.
 - 4. Temperature-actuated water mixing valves.
 - 5. Strainers.
 - 6. Outlet boxes.
 - 7. Hose bibbs.
 - 8. Wall hydrants.
 - 9. Drain valves.
 - 10. Water hammer arresters.
 - 11. Air vents.
 - 12. Trap-seal primer systems.
- B. Related Sections include the following:
 - 1. Division 22 Section "Meters and Gages for Plumbing Piping" for thermometers, pressure gages, and flow meters in domestic water piping.
 - 2. Division 22 Section "Domestic Water Piping" for water meters.

1.4 PERFORMANCE REQUIREMENTS

- A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig, unless otherwise indicated.

1.5 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. LEED Submittals:
 - 1. Complete "Sustainable Materials Attributes Submittal Form" attached to Section 01 81 13 "Sustainable Design Requirements".
 - 2. Provide supporting documentation for Materials and Resources and Low Emitting Materials, as required in Section 01 81 13, from manufacturer for materials attributes data submitted.
 - a. Environmental Product Declaration: For each product.

- b. Chain-of-Custody Certificates: For FSC certified wood products. Include statement of costs and qualifications of manufacturers and vendors.
 - c. Health Product Declaration: For each product.
 - d. Laboratory Test Reports: Verify that the following products comply with the testing and product requirements of the California Department of Public Health's (CDPH) "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers", or South Coast Air Quality Management District (SCAQMD) Rule 1113:
 - 1) Sealants.
 - 2) Paints and coatings.
 - e. Product Data: For the following, including VOC content:
 - 1) Sealants.
 - 2) Paints and coatings.
 - f. Statement of Volume: for wet-applied products installed in the field.
 - g. Verify that the following products comply with Ultra Low Emitting Formaldehyde and No Added Urea Formaldehyde (ULEF or NAUF) requirements:
 - 1) For composite wood products, verify that product contains no urea formaldehyde, as defined in the California Air Resources Board's (CARB) "Airborne Toxic Control Measure to Reduce Formaldehyde Emissions from Composite Wood Products" or shall be made with no added formaldehyde.
- C. Shop Drawings: Diagram power, signal, and control wiring.
- D. Field quality-control test reports.
- E. Operation and Maintenance Data: For domestic water piping specialties to include in emergency, operation, and maintenance manuals.

1.6 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. NSF Compliance:
 - 1. Comply with NSF 372.
- C. One manufacturer's product is to be provided for each category of products throughout the project, unless specific circumstances do not allow for this approach. Consult with the Architect/Engineer prior to bid to request deviation from this one-product contract requirement. No change order will be considered for failing to comply with this requirement. Installation of non-compliant products will be removed and replaced under this section with compliant products at no additional cost to the owner.

PART 2 - PRODUCTS

2.1 VACUUM BREAKERS

- A. Pipe-Applied, Atmospheric-Type Vacuum Breakers
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following or approved equal:
 - a. Jay R Smith, Inc.
 - b. Watts Industries, Inc.; Water Products Div.

- c. Zurn Plumbing Products Group; Wilkins Div.
 - d. Or equal
 - 2. Standard: ASSE 1001.
 - 3. Size: NPS 1/4 to NPS 3, as required to match connected piping.
 - 4. Body: Bronze.
 - 5. Inlet and Outlet Connections: Threaded.
 - 6. Finish: Chrome plated.
- B. Hose-Connection Vacuum Breakers
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following or approved equal:
 - a. Jay R Smith .
 - b. Watts Industries, Inc.; Water Products Div.
 - c. Zurn Plumbing Products Group; Light Commercial Operation.
 - d. Or equal
 - 2. Standard: ASSE 1011.
 - 3. Body: Bronze, nonremovable, with manual drain.
 - 4. Outlet Connection: Garden-hose threaded complying with ASME B1.20.7.
 - 5. Finish: Rough bronze.

2.2 BACKFLOW PREVENTERS

- A. Reduced-Pressure-Principle Backflow Preventers (Water Service Entrance)
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following or approved equal:
 - a. Watts Industries, Inc.- Watts 994
 - b. Conbraco Industries, Inc.
 - c. Ames Corporation.
 - 2. Standard: ASSE 1013.
 - 3. Reduced pressure backflow preventers shall be lead-free construction and shall be stainless steel construction to provide long term corrosion resistance. The assembly shall consist of pressure differential relief valve located in a zone between two positive seating check valves. The main valve body shall be manufactured from 300 series stainless steel for corrosion resistance. The check valve shall be of thermoplastic construction with stainless steel hinge pins, cam arm, and cam bearing. The check valve shall be modular and shall seal to the main valve body by use of an O-ring. The differential relief valve shall be of stainless steel construction and shall utilize a rolling diaphragm and no sliding seats. The assembly shall include two resilient seated shutoff valves and four-ball type test cock. Gauges shall comply with requirements of ASSE Standard 1013
 - 4. Coordinate the Model with local water department for approval.
 - 5. Operation: Continuous-pressure applications.
 - 6. Size: Refer to drawings
 - 7. Configuration: Designed for horizontal, straight through flow.
 - 8. Accessories:
 - 9. Valves: Ball type with threaded ends on inlet and outlet
 - 10. Air-Gap Fitting: ASME A112.1.2, matching backflow-preventer connection.
 - 11. Schedule: RPBP1 and RPBP2 – 4" in size. Refer to drawing P3.02 for location.
- B. Reduced-Pressure-Principle Backflow Preventers (RPBP2,)
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following or approved equal:
 - a. Watts Industries, Inc.- Watts LF909
 - b. Conbraco Industries, Inc.

- c. Flomatic Corporation.
 - 2. Standard: ASSE 1013.
 - 3. Operation: Continuous-pressure applications.
 - 4. Pressure Loss: 12 psig maximum, through middle 1/3 of flow range.
 - 5. Size: Refer to drawings
 - 6. Body: Bronze for NPS 2 and smaller; cast iron with interior lining complying with AWWA C550 or that is FDA approved for NPS 2-1/2 and larger.
 - 7. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
 - 8. Configuration: Designed for horizontal, straight through flow.
 - 9. Accessories:
 - a. Valves: Ball type with threaded ends on inlet and outlet
 - b. Air-Gap Fitting: ASME A112.1.2, matching backflow-preventer connection.
- C. Double-Check Backflow-Prevention Assemblies
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following or approved equal:
 - a. Conbraco Industries, Inc.
 - b. FEBCO; SPX Valves & Controls.
 - c. Watts Industries, Inc.; Water Products Div.
 - 2. Standard: ASSE 1015.
 - 3. Operation: Continuous-pressure applications, unless otherwise indicated.
 - 4. Pressure Loss: 5 psig maximum, through middle 1/3 of flow range.
 - 5. Size: Refer to drawings
 - 6. Configuration: Designed for horizontal, straight through flow.
 - 7. Accessories: Ball valves with threaded ends on inlet and outlet
- D. Backflow-Preventer Test Kits and spare parts kits for each backflow preventer size are to be provided.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following or approved equal:
 - a. Conbraco Industries, Inc.
 - b. FEBCO; SPX Valves & Controls.
 - c. Watts Industries, Inc.; Water Products Div.
 - 2. Description: Factory calibrated, with gages, fittings, hoses, and carrying case with test-procedure instructions.

2.3 WATER PRESSURE-REDUCING VALVES

- A. Water Regulators
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following or approved equal:
 - a. Watts Industries
 - b. Cash Acme.
 - c. Conbraco Industries, Inc.
 - 2. Standard: ASSE 1003.
 - 3. Pressure Rating: Initial working pressure of 150 psig
 - 4. Size: Refer to drawings
 - 5. Body: Bronze with chrome-plated finish for NPS 2 (DN 50) and smaller; cast iron with interior lining complying with AWWA C550 or that is FDA approved for NPS 2-1/2 and NPS 3
 - 6. Valves for Booster Heater Water Supply: Include integral bypass.
 - 7. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and NPS 3.

8. For 4" reduced port use flanged ANSI 150 automatic control valve with with low flow by-pass.

2.4 BALANCING VALVES

- A. Balancing valves assembly
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following or approved equal:
 - a. Caleffi 1324
 - b. Tacos.
 - c. Bell and Gosset
- B. Install circuit balancing valves in each hot-water circulation return branch.
- C. Lead-free flow calibrated brass balancing valve with built-in flow meter and sight gauge. Furnish with check valve to protect circuit thermos siphoning

2.5 TEMPERATURE-ACTUATED WATER MIXING VALVES

- A. Electronic Master Water Mixing Valves (TM1):
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following or approved equal:
 - a. Leonard Valve –Megatron NV-150-LF
 - b. Armstrong International, Inc.
 - c. Lawler Manufacturing Company, Inc.
 2. Standard: ASSE 1017.
 3. Pressure Rating: 125 psig
 4. Type: Exposed-mounting thermostatically controlled water mixing valve.
 5. Material: Bronze body with corrosion-resistant interior components.
 6. Connections: Threaded inlets and outlet.
 7. Accessories: Manual temperature control, check stops on hot- and cold-water supplies, and adjustable, temperature-control handle.
 8. Valve Pressure Rating: 125 psig minimum, unless otherwise indicated.
 9. Tempered-Water Setting: Varies
 10. Valve Finish: Rough bronze.
 11. Piping Finish: Copper.
 12. Digital Display outlet temperature, Interface with BMS through BACnet IP
 13. Two GFI Recepticle
- B. Thermostatic, Water Mixing Valves (TM2, TM3&TM3 Lab and Kitchen):
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following or approved equal:
 - a. Leonard Valve –TM-520BLF-DT
 - b. Armstrong International, Inc.
 - c. Lawler Manufacturing Company, Inc.
 2. Standard: ASSE 1017.
 3. Pressure Rating: 125 psig
 4. Type: Exposed-mounting thermostatically controlled water mixing valve.
 5. Material: Bronze body with corrosion-resistant interior components.
 6. Connections: Threaded inlets and outlet.
 7. Accessories: Manual temperature control, check stops on hot- and cold-water supplies, and adjustable, temperature-control handle.
 8. Valve Pressure Rating: 125 psig minimum, unless otherwise indicated.
 9. Tempered-Water Setting: Varies

10. Valve Finish: Rough bronze.
 11. Piping Finish: Copper.
- C. Thermostatic mixing valve for individual Emergency Showers (TM-ES). The shower shall ASSE 1071 certified and meet ANSI Z358.1-2009 requirement. The valve shall be equal to Guardian G6044 furnish in recessed stainless steel cabinet (minimum 18x16 size) and lockable latch. The valve shall be directly linked to control the hot and cold water intake and blend to deliver tepid water (75F adjustable). The valve shall be capable of supplying 3 to 34 gpm of tepid water at maximum 20 psi pressure drop. In event of restriction or failure of hot water supply, internal bypass shall allow valve to deliver cold water to emergency unit. In bypass mode, valve shall deliver 20 gpm at 30 psi drop. In event of loss of cold water supply, valve shall close and shall not deliver water
- D. Thermostatic mixing valve for individual Emergency Eye Wash (TM-EE). The mixing valve shall ASSE 1071 certified and meet ANSI Z358.1-2009 requirement. The valve shall be equal to Guardian G6024 furnish in stainless steel cabinet and lockable latch. The valve shall be directly linked to control the hot and cold water intake and blend to deliver tepid water (75F adjustable). The valve shall be capable of supplying 2 to 6 gpm of tepid water at maximum 20 psi pressure drop. In event of restriction or failure of hot water supply, internal bypass shall allow valve to deliver cold water to emergency unit. In bypass mode, valve shall deliver 4 gpm at 30 psi drop. In event of loss of cold water supply, valve shall close and shall not deliver water
- E. Point of use mixing valve for single or multi lavatory faucets: Lead free, Thermostatic Mixing Valves with bronze body, Thermostatic wax element design, locking temperature adjustment knob, integral check valves on inlets and ball shut off valve. Minimum flow 0.35 gpm and maximum flow 4.6 gpm. Mixing valve shall be equal to Chicago Faucets 131 ABNF / 131 CABNF or equal.

2.6 STRAINERS FOR DOMESTIC WATER PIPING

- A. Y-Pattern Strainers
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following or approved equal:
 - a. T&S Brass and Bronze Works, Inc.'s
 - b. NIBCO Inc.
 - c. Watts Industries, Inc.; Water Products Div.
 2. Pressure Rating: 125 psig minimum, unless otherwise indicated.
 3. Body: Bronze for NPS 2 and smaller; cast iron with interior lining complying with AWWA C550 or FDA-approved, epoxy coating and] for NPS 2-1/2 and larger.
 4. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
 5. Screen: Stainless steel with round perforations, unless otherwise indicated.
 6. 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
 7. Drain: Pipe plug

2.7 OUTLET BOXES

- A. Clothes Washer Outlet Boxes
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following or approved equal:
 - a. Acorn Engineering Company.
 - b. Watts Industries, Inc.; Water Products Div.

- c. Zurn Plumbing Products Group; Light Commercial Operation.
 2. Mounting: Recessed.
 3. Material and Finish: Enameled-steel or epoxy-painted-steel box and faceplate.
 4. Faucet: Combination, valved fitting or separate hot- and cold-water, valved fittings complying with ASME A112.18.1. Include garden-hose thread complying with ASME B1.20.7 on outlets.
 5. Supply Shutoff Fittings: NPS 1/2 gate, globe, or ball valves and NPS 1/2 copper, water tubing.
 6. Drain: NPS 2 standpipe and P-trap for direct waste connection to drainage piping.
- B. Ice Maker / Kitchen Valve:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following or approved equal:
 - a. IPS Corp Guy Gray 88436
 - b. Watts Industries, Inc.; Water Products Div.
 - c. Sioux
 - d. Or equal.
 2. Furnish and install 3/8" icemaker outlet Box with CSA listed, 1/2" quarter turn, hammer arrester valve for pipe connection

2.8 HOSE BIBBS

- A. Hose Bibbs (HB1&2)
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following or approved equal:
 - a. Chicago faucets, a Geberit company
 - b. T & S Brass
 - c. Zurn Plumbing Products Group; Light Commercial Operation.
 - d. Or equal
 2. Standard: ASME A112.18.1 for sediment faucets.
 3. Body Material: Bronze.
 4. Seat: Bronze, replaceable.
 5. Supply Connections: NPS 1/2 or NPS 3/4 threaded or solder-joint inlet.
 6. Outlet Connection: Garden-hose thread complying with ASME B1.20.7.
 7. Pressure Rating: 125 psig
 8. Vacuum Breaker: Integral, nonremovable, drainable, hose-connection vacuum breaker complying with ASSE 1011.
 9. Finish for Equipment Rooms: Rough bronze, or chrome or nickel plated.
 10. Finish for Service Areas: Rough bronze.
 11. Finish for Finished Rooms: Chrome or nickel plated.
 12. Include operating key with each operating-key hose bibb.
 13. Include integral wall flange with each chrome- or nickel-plated hose bibb.
 14. Schedule: HB1 (Toilet Rooms) equal to Chicago Model 952-633OLCP.
HB2 (Kitchen area) equal Chicago Model 387-E27CP.

2.9 WALL HYDRANTS (FPHB-1)

- A. Vacuum Breaker Wall Hydrants
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following or approved equal:
 - a. Jay R Smith 5519.
 - b. Zurn Plumbing
 - c. Watts Industries, Inc.; Water Products Div.

2. Standard: ASSE 1019, Type A or Type B.
3. Type: Freeze-resistant, automatic draining with integral air-inlet valve.
4. Classification: Type A, for automatic draining with hose removed or Type B, for automatic draining with hose removed or with hose attached and nozzle closed.
5. Pressure Rating: 125 psig
6. Operation: Loose key
7. Casing and Operating Rod: Of length required to match wall thickness. Include wall clamp.
8. Inlet: NPS 3/4 Outlet: Concealed with garden-hose, thread complying with ASME B1.20.7.

2.10 DRAIN VALVES

A. Stop-and-Waste Drain Valves

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following or approved equal:
 - a. Apollo valves Inc.
 - b. NIBCO Inc.
 - c. Watts Industries, Inc.; Water Products Div.
 - d. Or equal
2. Standard: MSS SP-110 for ball valves or MSS SP-80 for gate valves.
3. Pressure Rating: 200-psig minimum CWP or Class 125.
4. Size: NPS 3/4
5. Body: Copper alloy or ASTM B 62 bronze.
6. Drain: NPS 1/8 side outlet with cap.

2.11 WATER HAMMER ARRESTERS

A. Water Hammer Arresters See Editing Instruction No. 1 in the Evaluations for cautions about naming manufacturers and products.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following or approved equal:
 - a. Josam Company.
 - b. PPP Inc.
 - c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
2. Standard: ASSE 1010 or PDI-WH 201.
3. Type: Metal bellows
4. Size: ASSE 1010, Sizes AA and A through F or PDI-WH 201, Sizes A through F.

2.12 AIR VENTS

A. Bolted-Construction Automatic Air Vents

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following or approved equal:
 - a. Zurn Plumbing Products Group; Wilkins Div.
 - b. NIBCO Inc.
 - c. Watts Industries, Inc.; Water Products Div.
2. Body: Bronze.
3. Pressure Rating: 125-psig minimum pressure rating at 140 deg F
4. Float: Replaceable, corrosion-resistant metal.
5. Mechanism and Seat: Stainless steel.
6. Size: NPS 1/2 minimum inlet.
7. Inlet and Vent Outlet End Connections: Threaded.

2.13 TRAP-SEAL PRIMER SYSTEMS

- A. Electronic Trap Primer (ETP) :
1. Furnish and install trap primer units to serve one or two drains. Provide trap primers to floor drains as required by 248 CMR Plumbing code.
 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following or approved equal:
 - a. Precision Plumbing Product
 - b. MiFAB
 - c. Zurn
 3. Electronic Trap Primer for multiple floor drain shall be equal to Precision Plumbing Products Model PTS. The electronic Time Trap priming manifold (ETP) shall supply 2 oz water at 20 psi at a preset 10 second every 24 hours. The manifold steel cabinet shall include , vacuum breaker, pre-set 24 hour time clock, manual override switch, 120V solenoid valve, 3 wire connection, NPS ¾ inlet connection, manifold, compression outlet fittings, inlet shut off valve
 4. Trap Cabinet: Wall recessed box with stainless steel cover.
 5. For one or two floor drains, the trap shall be Precision Plumbing Products, Inc. Model MP-500, 1/2" connections, Electronic automatic brass trap primer distribution unit which shall be by timer to active cold water line in which attached.
 6. Units shall meet Code and ASSE Standard #1018. Units shall be adjustable to line pressure and desired delivery amount. Units shall deliver a maximum of two ounces of water on a 15 second pressure drop and have corrosion resistant brass fittings with a copper reservoir with clear plastic inspection cover, and mounting brackets, "O" ring seals.
 7. Plumbing Subcontractor shall adjust units and cycle trap primers at least six times to insure proper activity.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Refer to Division 22 Section "Common Work Results for Plumbing" for piping joining materials, joint construction, and basic installation requirements.
- B. Install 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. Locate backflow preventers in same room as connected equipment or system.
 2. Install 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 not acceptable for this application.
 3. Do not install bypass piping around backflow preventers.
- C. Install water pressure reducing valves (PRV) with inlet and outlet shutoff valves and bypass with memory-stop balancing valve. Install pressure gages on inlet and outlet.
- D. Install water control valves with inlet and outlet shutoff valves. Install pressure gages on inlet and outlet.
- E. Install balancing valves in locations where they can easily be accessed and adjusted.

- F. Install temperature-actuated water mixing valves with check stops and shutoff valves on inlets and outlet.
 - 1. Install thermometers and water regulators if specified.
 - 2. Install cabinet-type units recessed in or surface mounted on wall as specified.
- G. Install Y-pattern strainers for water on supply side of each water pressure-reducing valve, and pump.
- H. Install water hammer arresters in water piping according to PDI-WH 201.
- I. Install air vents at high points of water piping.
- J. Install supply-type, trap-seal primer valves with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting. Adjust valve for proper flow.
- K. Install trap-seal primer systems with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting. Adjust system for proper flow.

3.2 CONNECTIONS

- A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping and specialties.
- B. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."
- C. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.3 LABELING AND IDENTIFYING

- A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each of the following:
 - 1. Pressure vacuum breakers.
 - 2. Reduced-pressure-principle backflow preventers.
 - 3. Double-check backflow-prevention assemblies.
 - 4. Carbonated-beverage-machine backflow preventers.
 - 5. Water pressure-reducing valves
 - 6. Calibrated balancing valves.
 - 7. Primary, thermostatic, water mixing valves.
 - 8. Outlet boxes.
 - 9. Trap-seal primer systems.
- B. 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."

3.4 FIELD QUALITY CONTROL

- A. Perform the following tests and prepare test reports:
 - 1. Test each pressure vacuum breaker reduced-pressure-principle backflow preventer according to authorities having jurisdiction and the device's reference standard.

- B. Remove and replace malfunctioning domestic water piping specialties and retest as specified above.

3.5 ADJUSTING

- A. Set field-adjustable pressure set points of water pressure-reducing valves.
- B. Set field-adjustable flow set points of balancing valves.
- C. Set field-adjustable temperature set points of temperature-actuated water mixing valves.

END OF SECTION 22 11 19

SECTION 22 13 16
SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.1 TRADE CONTRACT REQUIREMENTS

- A. Work of this Section is part of the Plumbing Trade Contract. Refer to Section 22 00 01 "Plumbing Trade Contractor Requirements" for additional information about this Trade Contract.

1.2 RELATED DOCUMENTS

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

1.3 SUMMARY

- A. This Section includes the following for soil, waste, and vent piping inside the building:
 - 1. Pipe, tube, and fittings.
 - 2. Special Waste and Vent piping.

1.4 DEFINITIONS

- A. EPDM: Ethylene-propylene-diene terpolymer rubber.
- B. NBR: Acrylonitrile-butadiene rubber.

1.5 PERFORMANCE REQUIREMENTS

- A. Components and installation shall be capable of withstanding the following minimum working pressure, unless otherwise indicated:
 - 1. Soil, Waste, and Vent Piping: 10-foot head of water

1.6 SUBMITTALS

- A. Product Data: For pipe, tube, fittings, and couplings.
- B. LEED Submittals:
 - 1. Complete "Sustainable Materials Attributes Submittal Form" attached to Section 01 81 13 "Sustainable Design Requirements".
 - 2. Provide supporting documentation for Materials and Resources and Low Emitting Materials, as required in Section 01 81 13, from manufacturer for materials attributes data submitted.
 - a. Environmental Product Declaration: For each product.
 - b. Chain-of-Custody Certificates: For FSC certified wood products. Include statement of costs and qualifications of manufacturers and vendors.
 - c. Health Product Declaration: For each product.
 - d. Laboratory Test Reports: Verify that the following products comply with the testing and product requirements of the California Department of Public Health's (CDPH) "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers", or South Coast Air Quality Management District (SCAQMD) Rule 1113:

- 1) Sealants.
- 2) Paints and coatings.
- e. Product Data: For the following, including VOC content:
 - 1) Sealants.
 - 2) Paints and coatings.
- f. Statement of Volume: for wet-applied products installed in the field.
- g. Verify that the following products comply with Ultra Low Emitting Formaldehyde and No Added Urea Formaldehyde (ULEF or NAUF) requirements:
 - 1) For composite wood products, verify that product contains no urea formaldehyde, as defined in the California Air Resources Board's (CARB) "Airborne Toxic Control Measure to Reduce Formaldehyde Emissions from Composite Wood Products" or shall be made with no added formaldehyde.

C. Field quality-control inspection and test reports.

1.7 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- B. One manufacturer's product is to be provided for each category of products throughout the project, unless specific circumstances do not allow for this approach. Consult with the Architect/Engineer prior to bid to request deviation from this one-product contract requirement. No change order will be considered for failing to comply with this requirement. Installation of non-compliant products will be removed and replaced under this section with compliant products at no additional cost to the owner.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

- A. Refer to Part 3 "Piping Applications" Article for applications of pipe, tube, fitting, and joining materials.

2.2 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS

- A. Pipe and Fittings: ASTM A 74, Service Class and Extra Heavy.
- B. Gaskets: ASTM C 564, rubber.
- C. Calking Materials: ASTM B 29, pure lead and oakum or hemp fiber.

2.3 HUBLESS CAST-IRON SOIL PIPE AND FITTINGS

- A. Pipe and Fittings: ASTM A 888 or CISPI 301.
- B. Shielded Couplings: ASTM C 1277 assembly of metal shield or housing, corrosion-resistant fasteners, and rubber sleeve with integral, center pipe stop.
 - 1. Heavy-Duty, Shielded, Stainless-Steel Couplings: With stainless-steel shield, stainless-steel bands and tightening devices, and ASTM C 564, rubber sleeve, similar to husky SD 4000 or Clamp-All Hi-Torq 80.
- C. Manufacturers:
 - 1. Clamp-All Corp.
 - 2. Husky
 - 3. Mission
 - 4. Tyler Pipe; Soil Pipe Div.

2.4 COPPER TUBE AND FITTINGS (can be used for pipe sizes 2 ½" and smaller, shall not be used for urinal waste)

- A. Hard Copper Tube: ASTM B 88, Types M, water tube, drawn temper.
 - 1. Copper Pressure Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint fittings. Furnish wrought-copper DWV fittings if indicated.
 - 2. Copper Flanges: ASME B16.24, Class 150, cast copper with solder-joint end.
 - 3. Copper Unions: MSS SP-123, copper-alloy, hexagonal-stock body with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.

2.5 SPECIAL WASTE PIPE AND FITTINGS

- A. Piping and fittings shall be as manufactured by R.G. Sloane, Enfield, Orion or approved equal.
- B. Polypropylene Plastic (PP) Drainage Pipe and Fittings: ASTM F 1412, pipe extruded and drainage-pattern fittings molded, with Schedule 40 dimensions, from PP resin with fire-retardant additive complying with ASTM D 4101. Include fusion- and mechanical-joint ends.
- C. 3 Joints Connections between polypropylene piping system and between piping and sinks under lab benches shall be made by means of Mechanical Joints. All other connections shall be made by heat fusion joints (FUSEAL II). Connections between polypropylene and other types of piping material shall be made with adapters according to manufacturer's recommendations

2.6 SLEEVES

- A. Cast-Iron Wall Pipes: Fabricated of cast iron, and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.
- B. Galvanized-Steel-Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.
- C. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc-coated, with plain ends.
- D. 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 setscrews.
- E. A. For interior wall, floor and ceiling penetrations, seal annular space between sleeve and pipe or pipe insulation using joint sealants appropriate for fire rating, size, depth, and location of joint shall be under division 078410 for Firestopping and Section 078440 for Fire Resistive Joint Sealants

2.7 SLEEVE SEALS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Advance Products & Systems, Inc.
 - 2. Calpico, Inc.
 - 3. Metraflex, Inc.
 - 4. Pipeline Seal and Insulator, Inc.
- B. Description: Modular sealing element unit, designed for field assembly, used to fill annular space between pipe and sleeve.

1. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
2. Pressure Plates: Carbon steel.
3. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, of length required to secure pressure plates to sealing elements.

PART 3 - EXECUTION

3.1 EXCAVATION

- A. Refer to Division 31 Section "Earth Moving" for excavating, trenching, and backfilling.

3.2 PIPING APPLICATIONS

- A. Flanges and unions may be used on aboveground pressure piping, unless otherwise indicated.
- B. Aboveground, soil and kitchen waste piping shall be the following:
 1. Hubless cast-iron soil pipe and fittings; heavy-duty shielded, stainless-steel couplings; and hubless-coupling joints, collective trademark of the CISPI.
 2. Urinals joint connection shall be service weight hub and spigot with lead and oakum joints
 3. Copper DWV tube, copper drainage fittings, and soldered joints.
- C. Aboveground, vent piping shall be the following:
 1. Hubless cast-iron soil pipe and fittings; heavy-duty shielded, stainless-steel couplings; and hubless-coupling joints.
 2. Copper DWV tube, copper drainage fittings, and soldered joints.
 - a. Option for Vent Piping, NPS 2-1/2 and smaller Hard copper tube, Type M; copper pressure fittings; and soldered joints.
- D. Underground, soil, kitchen waste, and vent piping shall be the following:
 1. Service class, cast-iron soil piping; gaskets; and hub and spigot gasketed joints.
 2. Service weight cast iron soil pipe-coated bearing collective trademark of the Cast Iron Soil Pipe Institute (CISPI). Cleanouts and joints just prior to exiting the building shall be service weight hub and spigot with lead and oakum joints.

3.3 PIPING INSTALLATION

- A. Basic piping installation requirements are specified in Division 22 Section "Common Work Results for Plumbing."
- B. Firestopping is done by Section 078410. Coordinate penetrations with the firestopping contractor.
- C. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers.
- D. Install cast-iron sleeve with water stop and mechanical sleeve seal at each service pipe penetration through foundation wall. Select number of interlocking rubber links required to make installation watertight. Sleeves and mechanical sleeve seals are specified in Division 22 Section "Common Work Results for Plumbing."
- E. Install 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."

1. Install encasement on underground piping according to ASTM A 674 or AWWA C105.
- F. 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. Use long-turn, double Y-branch and 1/8-bend fittings if 2 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. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.
- G. Lay buried building drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install 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.
- H. Install soil and waste drainage and vent piping at the following minimum slopes, unless otherwise indicated:
 1. Building Sanitary Drain: 1/4" per foot downward in direction of flow for piping NPS 3 and smaller; 1/8" per foot downward in direction of flow for piping NPS 4 and larger.
 2. Horizontal Sanitary Drainage Piping: 1/4" per foot downward in direction of flow for piping NPS 3 and smaller; 1/8" per foot downward in direction of flow for piping NPS 4 and larger.
 3. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.
- I. Sleeves are not required for cast-iron soil piping passing through concrete slabs-on-grade if slab is without membrane waterproofing.
- J. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

3.4 JOINT CONSTRUCTION

- A. Basic piping joint construction requirements are specified in Division 22 Section "Common Work Results for Plumbing."
- B. 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.
- C. Join hub-and-spigot, cast-iron soil piping with calked joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for lead and oakum calked joints.
- D. Join hubless cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-coupling joints.
- E. Soldered Joints: Use ASTM B 813, water-flushable, lead-free flux; ASTM B 32, lead-free-alloy solder; and ASTM B 828 procedure, unless otherwise indicated.

3.5 VALVE INSTALLATION

- A. General valve installation requirements are specified in Division 22 Section "General-Duty Valves for Plumbing Piping."

- B. Shutoff Valves: Install shutoff valve on each sewage pump discharge.
 - 1. Install gate or full-port ball valve for piping NPS 2 and smaller.
 - 2. Install gate valve for piping NPS 2-1/2 and larger.
- C. Check Valves: Install swing check valve, between pump and shutoff valve, on each sewage pump discharge.
- D. Backwater Valves: Install backwater valves in piping subject to sewage backflow.
 - 1. Horizontal Piping: Horizontal backwater valves. Use normally closed type, unless otherwise indicated.
 - 2. Floor Drains: Drain outlet backwater valves, unless drain has integral backwater valve.
 - 3. Install backwater valves in accessible locations.
 - 4. Backwater valve are specified in Division 22 Section "Sanitary Waste Piping Specialties."

3.6 HANGER AND SUPPORT INSTALLATION

- A. Seismic-restraint devices are specified in Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment."
- B. Pipe hangers and supports are specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment." Install the following:
 - 1. Vertical Piping: MSS Type 8 or Type 42, clamps.
 - 2. Individual, Straight, Horizontal Piping Runs: According to the following:
 - 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.
 - 4. Base of Vertical Piping: MSS Type 52, spring hangers.
- C. Install supports according to Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."
- D. Rod diameter may be reduced 1 size for double-rod hangers, with 3/8-inch minimum rods.
- E. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 1-1/2 and NPS 2: 60 inches with 3/8-inch rod.
 - 2. NPS 3: 60 inches with 1/2-inch rod.
 - 3. NPS 4 and NPS 5: 60 inches with 5/8-inch rod.
 - 4. NPS 6: 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. Install supports for vertical cast-iron soil piping every 15 feet.
- G. Install supports for vertical steel piping every 15 feet.
- H. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 1-1/4: 72 inches with 3/8-inch rod.
 - 2. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
 - 3. NPS 2-1/2: 108 inches with 1/2-inch rod.
 - 4. NPS 3 to NPS 5: 10 feet with 1/2-inch rod.

5. NPS 6: 10 feet with 5/8-inch rod.
6. NPS 8: 10 feet with 3/4-inch rod.

- I. Install supports for vertical copper tubing every 10 feet.

3.7 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.
- C. Connect drainage and vent piping to the following:
 1. Plumbing Fixtures: Connect drainage piping in sizes indicated, but not smaller than required by plumbing code.
 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. Equipment: Connect drainage piping as indicated. Provide shutoff valve, if indicated, and union for each connection. Use flanges instead of unions for connections NPS 2-1/2 and larger.

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: Prepare 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. Prepare reports for tests and required corrective action.

3.9 CLEANING

- A. Clean interior of piping. 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. Place plugs in ends of uncompleted piping at end of day and when work stops.

END OF SECTION 22 13 16.02

SECTION 22 13 23
SANITARY WASTE INTERCEPTORS

PART 1 - GENERAL

1.1 TRADE CONTRACT REQUIREMENTS

- A. Work of this Section is part of the Plumbing Trade Contract. Refer to Section 22 00 00 "Plumbing Trade Contract Requirements" for additional information about this Trade Contract.

1.2 RELATED DOCUMENTS

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

1.3 SUMMARY

- A. This Section includes the following types of interceptors outside the building:
 - 1. Grease interceptors.

1.4 DEFINITIONS

- A. FRP: Fiberglass-reinforced plastic.
- B. HDPE: High-density polyethylene plastic.
- C. PE: Polyethylene plastic.
- D. PP: Polypropylene plastic.

1.5 SUBMITTALS

- A. Product Data: For each type of metal interceptor indicated. Include materials of fabrication, dimensions, rated capacities, retention capacities, operating characteristics, size and location of each pipe connection, furnished specialties, and accessories.
- B. LEED Submittals:
 - 1. Complete "Sustainable Materials Attributes Submittal Form" attached to Section 01 81 13 "Sustainable Design Requirements".
 - 2. Provide supporting documentation for Materials and Resources and Low Emitting Materials, as required in Section 01 81 13, from manufacturer for materials attributes data submitted.
 - a. Environmental Product Declaration: For each product.
 - b. Chain-of-Custody Certificates: For FSC certified wood products. Include statement of costs and qualifications of manufacturers and vendors.
 - c. Health Product Declaration: For each product.
 - d. Laboratory Test Reports: Verify that the following products comply with the testing and product requirements of the California Department of Public Health's (CDPH) "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers", or South Coast Air Quality Management District (SCAQMD) Rule 1113:
 - 1) Sealants.

- 2) Paints and coatings.
 - e. Product Data: For the following, including VOC content:
 - 1) Sealants.
 - 2) Paints and coatings.
 - f. Statement of Volume: for wet-applied products installed in the field.
 - g. Verify that the following products comply with Ultra Low Emitting Formaldehyde and No Added Urea Formaldehyde (ULEF or NAUF) requirements:
 - 1) For composite wood products, verify that product contains no urea formaldehyde, as defined in the California Air Resources Board's (CARB) "Airborne Toxic Control Measure to Reduce Formaldehyde Emissions from Composite Wood Products" or shall be made with no added formaldehyde.
- C. Shop Drawings: For each type and size of interceptors indicated.
- 1. Include materials of construction, dimensions, rated capacities, retention capacities, location and size of each pipe connection, furnished specialties, and accessories.
- D. Coordination Drawings: Interceptors, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:
- 1. Interceptors.
 - 2. Piping connections. Include size, location, and elevation of each.
 - 3. Interface with underground structures and utility services.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 GREASE INTERCEPTORS

A. Grease Interceptors GI-1:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Jay R Smith 8460.
 - b. Rockford Sanitary Systems, Inc.
 - c. Josam Company; Josam Div
- 2. Standard: ASME A112.14.3, for intercepting and retaining fats, oils, and greases from food-preparation wastewater.
- 3. Plumbing and Drainage Institute Seal: Required.
- 4. Body Material: Cast iron.
- 5. Interior Lining: Corrosion-resistant enamel.
- 6. Exterior Coating: Corrosion-resistant enamel
- 7. Extension Riser: For use below grade; sized to project requirements. Provide with 1 inch markers/ribs on riser and flanged bottom to interlock to frame. Installation components shall be supplied by manufacturer (outlet extension adaptors, seals and mechanical fasteners). Provide Pipe for handle extension.
- 8. The grease Interceptor shall be fully recessed with capacity of 100 GPM flow rate, 200 lbs capacity, 4" inlet & outlet. The steel interceptor shall furnish with integral extension, gray Duco coating (inside and outside) and Flow control fitting.
- 9. The grease trap shall bear the seal of approval from the Plumbing Drainage Institute and Mass approved product.

SANITARY WASTE INTERCEPTORS

2.3 SOLID (PLASTER) INTERCEPTOR

- A. Solid Interceptor (SI-1 and SI-2):
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. MiFAB
 - b. Zurn
 - c. Josam Company; Josam Div.
- B. Solid interceptor (SI-1) for fixtures P-5B and as noted on plan: MIFAB Series MI-SOLID-S sanitary powder epoxy coated inside and outside fabricated 10 gauge steel solids interceptor. Interceptor shall include removable perforated sediment screen with bucket and a gasketed steel lid secured by a single recessed bolt. The interceptor shall be adjacent casework to maintain accessibility clearance
- C. Solid Interceptor (SI-2) for fixture P-4A: MIFAB Model MI-Solid-SA, large capacity side access type 304 14 gauge stainless steel solid interceptor with internal stainless steel perforated sediment bucket connected to removable and gasket side access latched lid. Interceptor shall be complete with 2" female threaded inlet, 2" female threaded outlet on each side right or left-hand installation and internal stainless steel flow control to maximum 35gpm.

2.4 OIL/ SAND INTERCEPTOR

- A. Oil/ Sand Interceptors (OI-1):
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Highland Tank Model 2556.
 - b. Park USA
 - c. Zurn
 - 2. The Oil/ Sand Separator shall be constructed of Mild carbon steel and coated with heavy duty polyurethane.
 - 3. The tank shall be rated for 50 gpm and structurally analyzed in accordance with the requirement of ASCE/ SEI 7 for direct burial.
 - 4. Provide cover with water/ gas tight seal fitting.

PART 3 - EXECUTION

3.1 EARTHWORK

- A. Excavating, trenching, and backfilling are specified in Division 32 Section "Earth Moving."

3.2 INSTALLATION

- A. Install interceptor inlets and outlets at elevations indicated.
- B. Install precast concrete interceptors according to ASTM C 891. Set level and plumb.
- C. Install manhole risers from top of underground concrete interceptors to manholes and gratings at finished grade.

- D. Set tops of manhole frames and covers flush with finished surface in pavements. Set tops 3 inches above finish surface elsewhere, unless otherwise indicated. Provide extensions to floor/grade as required.
- E. Set tops of grating frames and grates flush with finished surface.
- F. Install cleanout immediately downstream from interceptors not having integral cleanout on outlet.
- G. Clean and prepare metal surfaces to be field painted according to SSPC- PA 1. Paint the following metal surfaces according to SSPC-PA 1 and SSPC-Paint 16:
 - 1. Metal Interceptors: surfaces except baskets, screens, and strainers.
 - 2. Metal Manhole Frames and Covers (Including Grates): surfaces.
 - 3. Do not paint metal surfaces with factory-applied, corrosion-resistant coating.
- H. Set metal interceptors level and plumb.
- I. Prepare and paint metal components, to be field painted, according to SSPC-Paint 16.
- J. Repair and restore protective coatings to original condition.

3.3 CONNECTIONS

- A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Make piping connections between interceptors and piping systems.

3.4 IDENTIFICATION

- A. Identification materials and installation are specified in Division 22 Section "Earth Moving." Arrange for installation of green warning tapes directly over piping and at outside edges of underground interceptors.
 - 1. Use warning tapes or detectable warning tape over ferrous piping.
 - 2. Use detectable warning tape over nonferrous piping and over edges of underground structures.

END OF SECTION 22 13 23

SECTION 22 14 13
FACILITY STORM DRAINAGE PIPING

PART 1 - GENERAL

1.1 TRADE CONTRACT REQUIREMENTS

- A. Work of this Section is part of the Plumbing Trade Contract. Refer to Section 22 00 01 "Plumbing Trade Contractor Requirements" for additional information about this Trade Contract.

1.2 RELATED DOCUMENTS

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

1.3 SUMMARY

- A. This Section includes the following storm drainage piping inside the building:
 - 1. Pipe, tube, and fittings.
 - 2. Special pipe fittings.
 - 3. Encasement for underground metal piping.

1.4 DEFINITIONS

1.5 PERFORMANCE REQUIREMENTS

- A. Components and installation shall be capable of withstanding the following minimum working-pressure, unless otherwise indicated:
 - 1. Storm Drainage Piping: 10-foot head of water

1.6 SUBMITTALS

- A. Product Data: For pipe, tube, fittings, and couplings.
- B. LEED Submittals:
 - 1. Complete "Sustainable Materials Attributes Submittal Form" attached to Section 01 81 13 "Sustainable Design Requirements".
 - 2. Provide supporting documentation for Materials and Resources and Low Emitting Materials, as required in Section 01 81 13, from manufacturer for materials attributes data submitted.
 - a. Environmental Product Declaration: For each product.
 - b. Chain-of-Custody Certificates: For FSC certified wood products. Include statement of costs and qualifications of manufacturers and vendors.
 - c. Health Product Declaration: For each product.
 - d. Laboratory Test Reports: Verify that the following products comply with the testing and product requirements of the California Department of Public Health's (CDPH) "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers", or South Coast Air Quality Management District (SCAQMD) Rule 1113:
 - 1) Sealants.
 - 2) Paints and coatings.
 - e. Product Data: For the following, including VOC content:

- 1) Sealants.
- 2) Paints and coatings.
- f. Statement of Volume: for wet-applied products installed in the field.
- g. Verify that the following products comply with Ultra Low Emitting Formaldehyde and No Added Urea Formaldehyde (ULEF or NAUF) requirements:
 - 1) For composite wood products, verify that product contains no urea formaldehyde, as defined in the California Air Resources Board's (CARB) "Airborne Toxic Control Measure to Reduce Formaldehyde Emissions from Composite Wood Products" or shall be made with no added formaldehyde.

C. Field quality-control inspection and test reports.

1.7 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Refer to Part 3 "Piping Applications" Article for applications of pipe, tube, fitting, and joining materials.

2.2 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS

- A. Pipe and Fittings: ASTM A 74, Service class.
- B. Gaskets: ASTM C 564, rubber.
- C. Calking Materials: ASTM B 29, pure lead and oakum or hemp fiber.

2.3 HUBLESS CAST-IRON SOIL PIPE AND FITTINGS

- A. Pipe and Fittings: ASTM A 888 or CISPI 301.
 - 1. Heavy-Duty, Shielded, Stainless-Steel Couplings: With stainless-steel shield, stainless-steel bands and tightening devices, and ASTM C 564, rubber sleeve, similar to husky SD 4000 or Clamp-All Hi-Torq 80.
- B. Manufacturers:
 - 1. Clamp-All Corp.
 - 2. Husky
 - 3. Tyler Pipe; Soil Pipe Div.

2.4 SLEEVES

- A. Cast-Iron Wall Pipes: Fabricated of cast iron, and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.
- B. Galvanized-Steel-Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.
- C. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc-coated, with plain ends.

- D. 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 setscrews.
- E. A. For interior wall, floor and ceiling penetrations, seal annular space between sleeve and pipe or pipe insulation using joint sealants appropriate for fire rating, size, depth, and location of joint shall be under division 078410 for Firestopping and Section 078440 for Fire Resistive Joint Sealants

2.5 SLEEVE SEALS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Advance Products & Systems, Inc.
 - 2. Calpico, Inc.
 - 3. Metraflex, Inc.
 - 4. Pipeline Seal and Insulator, Inc.
- B. Description: Modular sealing element unit, designed for field assembly, used to fill annular space between pipe and sleeve.
 - 1. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
 - 2. Pressure Plates: Carbon steel.
 - 3. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, of length required to secure pressure plates to sealing elements.

PART 3 - EXECUTION

3.1 EXCAVATION

- A. Refer to Division 31 Section "Earth Moving" for excavating, trenching, and backfilling.

3.2 PIPING APPLICATIONS

- A. Flanges and unions may be used on aboveground pressure piping, unless otherwise indicated.
- B. Aboveground storm drainage piping shall be the following:
 - 1. Hubless cast-iron soil pipe and fittings; standard, shielded, stainless-steel couplings; and coupled joints.
- C. Underground, soil, waste, and vent piping shall be the following:
 - 1. Service class, cast-iron soil piping; gaskets; and gasketed joints.

3.3 PIPING INSTALLATION

- A. Basic piping installation requirements are specified in Division 22 Section "Common Work Results for Plumbing."
- B. Install cleanouts at grade and extend to where building storm drains connect to building storm sewers. Cleanouts are specified in Division 22 Section "Storm Drainage Piping Specialties."
- C. Install cast-iron sleeve with water stop and mechanical sleeve seal at each service pipe penetration through foundation wall. Select number of interlocking rubber links required to

make installation watertight. Sleeves and mechanical sleeve seals are specified in Division 22 Section "Common Work Results for Plumbing."

- D. Install 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."
 - 1. Install encasement on underground piping according to ASTM A 674 or AWWA C105.
- E. Make changes in direction for storm drainage piping using appropriate branches, bends, and long-sweep bends. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.
- F. Lay buried building storm drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install 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.
- G. Install storm drainage piping at the following minimum slopes, unless otherwise indicated:
 - 1. Building Storm Drain: 1/4" per foot slope downward in direction of flow for piping NPS 3 and smaller; 1/8" per foot slope downward in direction of flow for piping NPS 4 and larger.
 - 2. Horizontal Storm-Drainage Piping: 1/4" per foot slope downward in direction of flow for piping NPS 3 and smaller; 1/8" per foot slope downward in direction of flow for piping NPS 4 and larger.
- H. Sleeves are not required for cast-iron soil piping passing through concrete slabs-on-grade if slab is without membrane waterproofing.
- I. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

3.4 JOINT CONSTRUCTION

- A. Basic piping joint construction requirements are specified in Division 22 Section "Common Work Results for Plumbing."
- B. Hub-and-Spigot, Cast-Iron Soil Piping Gasketed Joints: Join according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.
- C. Hub-and-Spigot, Cast-Iron Soil Piping Calked Joints: Join according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for lead and oakum calked joints.
- D. Hubless Cast-Iron Soil Piping Coupled Joints: Join according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-coupling joints.

3.5 VALVE INSTALLATION

- A. General valve installation requirements are specified in Division 22 Section "General-Duty Valves for Plumbing Piping."
- B. Shutoff Valves: Install shutoff valve on each sump pump discharge.
 - 1. Install gate or full-port ball valve for piping NPS 2 and smaller.
 - 2. Install gate valve for piping NPS 2-1/2 and larger.

- C. Check Valves: Install swing check valve, between pump and shutoff valve, on each sump pump discharge.
- D. Backwater Valves: Install backwater valves in piping subject to backflow.
 - 1. Horizontal Piping: Horizontal backwater valves. Use normally closed type, unless otherwise indicated.
 - 2. Install backwater valves in accessible locations.
 - 3. Backwater valve are specified in Division 22 Section "Storm Drainage Piping Specialties."

3.6 HANGER AND SUPPORT INSTALLATION

- A. Pipe hangers and supports are specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment." Install the following:
 - 1. Vertical Piping: MSS Type 8 or Type 42, clamps.
 - 2. Individual, Straight, Horizontal Piping Runs: According to the following:
 - 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.
 - 4. Base of Vertical Piping: MSS Type 52, spring hangers.
- B. Install supports according to Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."
- C. Rod diameter may be reduced 1 size for double-rod hangers, with 3/8-inch minimum rods.
- D. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 1-1/2 and NPS 2: 60 inches with 3/8-inch rod.
 - 2. NPS 3: 60 inches with 1/2-inch rod.
 - 3. NPS 4 and NPS 5: 60 inches with 5/8-inch rod.
 - 4. NPS 6: 60 inches with 3/4-inch rod.
 - 5. NPS 8 to NPS 12: 12 feet with 7/8-inch rod.
 - 6. Spacing for 10-foot lengths may be increased to 10 feet. Spacing for fittings is limited to 60 inches.
- E. Install supports for vertical cast-iron soil piping every 15 feet.
- F. Install hangers for steel piping with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 1-1/4: 84 inches with 3/8-inch rod.
 - 2. NPS 1-1/2: 108 inches with 3/8-inch rod.
 - 3. NPS 2: 10 feet with 3/8-inch rod.
- G. Install supports for vertical steel piping every 15 feet.

3.7 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect interior storm drainage piping to exterior storm drainage piping. Use transition fitting to join dissimilar piping materials.

- C. Connect storm drainage piping to roof drains and storm drainage specialties.

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.
 - 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: Prepare inspection reports and have them signed by authorities having jurisdiction.
- D. Test storm drainage 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 storm drainage piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
 - 3. Test Procedure: Test storm drainage 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. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
 - 5. Prepare reports for tests and required corrective action.

3.9 CLEANING

- A. Clean interior of piping. 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. Place plugs in ends of uncompleted piping at end of day and when work stops.

END OF SECTION 22 14 13

SECTION 22 14 23

STORM DRAINAGE PIPING SPECIALTIES

PART 1 - GENERAL

1.1 TRADE CONTRACT REQUIREMENTS

- A. Work of this Section is part of the Plumbing Trade Contract. Refer to Section 22 00 01 "Plumbing Trade Contractor Requirements" for additional information about this Trade Contract.

1.2 RELATED DOCUMENTS

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

1.3 SUMMARY

- A. This Section includes the following storm drainage piping specialties:
 - 1. Backwater valves.
 - 2. Cleanouts.
 - 3. Through-penetration firestop assemblies.
 - 4. Roof drains.
 - 5. Miscellaneous storm drainage piping specialties.
 - 6. Flashing materials.
- B. Related Sections include the following:
 - 1. Division 22 Section "Sanitary Waste Piping Specialties" for backwater valves, floor drains, trench drains and channel drainage systems connected to sanitary sewer, air admittance valves, grease interceptors, oil interceptors and solid interceptors.
 - 2. Division 7 Section "Thermal and Moisture Protection" for flashing.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. LEED Submittals:
 - 1. Complete "Sustainable Materials Attributes Submittal Form" attached to Section 01 81 13 "Sustainable Design Requirements".
 - 2. Provide supporting documentation for Materials and Resources and Low Emitting Materials, as required in Section 01 81 13, from manufacturer for materials attributes data submitted.
 - a. Environmental Product Declaration: For each product.
 - b. Chain-of-Custody Certificates: For FSC certified wood products. Include statement of costs and qualifications of manufacturers and vendors.
 - c. Health Product Declaration: For each product.
 - d. Laboratory Test Reports: Verify that the following products comply with the testing and product requirements of the California Department of Public Health's (CDPH) "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers", or South Coast Air Quality Management District (SCAQMD) Rule 1113:
 - 1) Sealants.

STORM DRAINAGE PIPING SPECIALTIES

- 2) Paints and coatings.
- e. Product Data: For the following, including VOC content:
 - 1) Sealants.
 - 2) Paints and coatings.
- f. Statement of Volume: for wet-applied products installed in the field.
- g. Verify that the following products comply with Ultra Low Emitting Formaldehyde and No Added Urea Formaldehyde (ULEF or NAUF) requirements:
 - 1) For composite wood products, verify that product contains no urea formaldehyde, as defined in the California Air Resources Board's (CARB) "Airborne Toxic Control Measure to Reduce Formaldehyde Emissions from Composite Wood Products" or shall be made with no added formaldehyde.

1.5 QUALITY ASSURANCE

- A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.

1.6 COORDINATION

- A. Coordinate size and location of roof penetrations.

PART 2 - PRODUCTS

2.1 BACKWATER VALVES

- A. Horizontal, Cast-Iron Backwater Valves
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Josam Company; Josam Div.
 - b. Smith, Jay R. Mfr. Co.; Division of Smith Industries, Inc.
 - c. Zurn Plumbing Products Group; Specification Drainage Operation.
 - 2. Standard: ASME A112.14.1.
 - 3. Size: Same as connected piping.
 - 4. Body: Cast iron.
 - 5. Cover: Cast iron with bolted or threaded access check valve.
 - 6. End Connections: Hub and spigot or hubless
 - 7. Type Check Valve: Removable, bronze, swing check, factory assembled or field modified to hang closed
 - 8. Extension: ASTM A 74, Service class; full-size, cast-iron, soil-pipe extension to field-installed cleanout at floor; replaces backwater valve cover.

2.2 CLEANOUTS

- A. Exposed Metal Cleanouts :
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Josam Company; Josam Div.
 - b. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - c. Zurn Plumbing Products Group; Specification Drainage Operation.
 - 2.
 - 3. Standard: ASME A112.36.2M for cast iron for cleanout test tee.
 - 4. Size: Same as connected drainage piping

5. 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.
6. Closure: Countersunk or raised-head, brass plug.
7. Closure Plug Size: Same as or not more than one size smaller than cleanout size.

B. Cast-Iron Wall Cleanouts

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Josam Company; Josam Div.
 - b. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - c. 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: 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.
7. Wall Access: Round, flat, chrome-plated brass or stainless-steel cover plate with screw.
8. Wall Access: Round, nickel-bronze, copper-alloy, or stainless-steel material wall-installation frame and cover.

2.3 THROUGH-PENETRATION FIRESTOP ASSEMBLIES

- A. Through-Penetration Firestop Assemblies: All firestopping is done by Section 078413. Coordinate penetrations with the firestopping contractor.

2.4 ROOF DRAINS

A. Metal Roof Drains with overflow:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Zurn
 - b. Jay R Smith
 - c. Josam Company; Josam Div.
 - d. Watts.
 - e. Or Equal.
2. Standard: ASME A112.21.2M.
3. Pattern: Canopy, Roof or Scupper drain.
4. Body Material: Cast iron

B. Schedules

1. RD-1: Roof drain shall be equal to Zurn Froet 100C_ Bi Functional Roof drain. Refer to roof plan for drain size. The drain shall be bi-functional body, Secured cast-iron dome, adjustable extension, overflow strainer, sump receiver, underdeck clamp, no-hub adaptor.
2. DSN-1 Overflow Corrosion-resistant stainless steel downspout nozzle spout with a perforated hinged strainer. The nozzle to be equal to Z199-DC or equal.
3. RD-2: Roof drain shall be equal to Zurn Z165, 8" Diameter combination main rood and overflow drain with low silhouette domes and double top-set deck plate, static extension, top set plate, sump receiver, underdeck clamp, no-hub adaptor.

2.5 MISCELLANEOUS STORM DRAINAGE PIPING SPECIALTIES

- A. Expansion Joints:
 - 1. Standard: ASME A112.21.2M.
 - 2. Body: Cast iron with bronze sleeve, packing, and gland.
 - 3. End Connections: Matching connected piping.
 - 4. Size: Same as connected piping.

2.6 FLASHING MATERIALS

- A. Copper Sheet: ASTM B 152/B 152M, 12 oz./sq. ft. thickness.
- 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.
- C. Fasteners: Metal compatible with material and substrate being fastened.
- D. Metal Accessories: Sheet metal strips, clamps, anchoring devices, and similar accessory units required for installation; matching or compatible with material being installed.
- E. Solder: ASTM B 32, lead-free alloy.
- F. Bituminous Coating: SSPC-Paint 12, solvent-type, bituminous mastic.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Refer to Division 22 Section "Common Work Results for Plumbing" for piping joining materials, joint construction, and basic installation requirements.
- B. Install 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. Use NPS 4 for larger drainage piping unless larger cleanout is indicated.
 - 2. Locate at each change in direction of piping greater than 45 degrees.
 - 3. Locate at minimum intervals of 50 feet for piping NPS and smaller and 100 feet for larger piping.
 - 4. Locate at base of each vertical soil and waste stack.
- C. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.
- D. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.
- E. Install roof drains at low points of roof areas according to roof membrane manufacturer's written installation instructions. Roofing materials are specified in Division 07.
 - 1. Install roof-drain flashing collar or flange so that there will be no leakage between drain and adjoining roofing. Maintain integrity of waterproof membranes where penetrated.
 - 2. Position roof drains for easy access and maintenance.

- F. Install sleeve flashing device with each riser and stack passing through floors with waterproof membrane.
- G. Install expansion joints on vertical stacks and conductors. Position expansion joints for easy access and maintenance.
- H. Install escutcheons at wall, floor, and ceiling penetrations in exposed finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding pipe fittings.

3.2 BACKWATER VALVES

- A. Install backwater valves in horizontal at low roof drains and in the building drain where outlets are subject to possible reverse flow or backpressure as required by Massachusetts 248 CMR, 10.15 (11), 10.17 and 10.22, Figure 23.

3.3 CONNECTIONS

- A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

3.4 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. Lead Sheets: Burn joints of lead sheets 6.0-lb/sq. ft., 0.0938-inch thickness or thicker. Solder joints of lead sheets 4.0-lb/sq. ft., 0.0625-inch thickness or thinner.
 - 2. Copper Sheets: Solder joints of copper sheets.
- B. Install 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. Fabricate and install flashing and pans, sumps, and other drainage shapes.

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. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION 22 14 23

SECTION 22 33 00
ELECTRIC DOMESTIC WATER HEATERS

PART 1 - GENERAL

1.1 TRADE CONTRACT REQUIREMENTS

- A. Work of this Section is part of the Plumbing Trade Contract. Refer to Section 22 00 00 "Plumbing Trade Contractor Requirements" for additional information about this Trade Contract.

1.2 RELATED DOCUMENTS

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

1.3 SUMMARY

- A. This Section includes the following fuel-fired water heaters:
 - 1. Expansion tanks.
 - 2. Water heater accessories.

1.4 SUBMITTALS

- A. Product Data: For each type and size of water heater indicated. Include rated capacities, operating characteristics, furnished specialties, and accessories.
- B. LEED Submittals:
 - 1. Complete "Sustainable Materials Attributes Submittal Form" attached to Section 01 81 13 "Sustainable Design Requirements".
 - 2. Provide supporting documentation for Materials and Resources and Low Emitting Materials, as required in Section 01 81 13, from manufacturer for materials attributes data submitted.
 - a. Environmental Product Declaration: For each product.
 - b. Chain-of-Custody Certificates: For FSC certified wood products. Include statement of costs and qualifications of manufacturers and vendors.
 - c. Health Product Declaration: For each product.
 - d. Laboratory Test Reports: Verify that the following products comply with the testing and product requirements of the California Department of Public Health's (CDPH) "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers", or South Coast Air Quality Management District (SCAQMD) Rule 1113:
 - 1) Sealants.
 - 2) Paints and coatings.
 - e. Product Data: For the following, including VOC content:
 - 1) Sealants.
 - 2) Paints and coatings.
 - f. Statement of Volume: for wet-applied products installed in the field.
 - g. Verify that the following products comply with Ultra Low Emitting Formaldehyde and No Added Urea Formaldehyde (ULEF or NAUF) requirements:

- 1) For composite wood products, verify that product contains no urea formaldehyde, as defined in the California Air Resources Board's (CARB) "Airborne Toxic Control Measure to Reduce Formaldehyde Emissions from Composite Wood Products" or shall be made with no added formaldehyde.
- C. Shop Drawings: Diagram power, signal, and control wiring.
- D. Product Certificates: For each type of commercial water heater, signed by product manufacturer.
- E. Source quality-control test reports.
- F. Field quality-control test reports.
- G. Operation and Maintenance Data: For water heaters to include in emergency, operation, and maintenance manuals.
- H. Warranty: Warranty specified in this Section.

1.5 QUALITY ASSURANCE

- A. Source Limitations: Obtain same type of water heaters through one source from a single manufacturer.
- B. Product Options: Drawings indicate size, profiles, and dimensional requirements of water heaters and are based on the specific system indicated. Refer to Division 01 Section "Product Requirements."
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- D. ASME Compliance:
 1. Where ASME-code construction is indicated, fabricate and label commercial water heater storage tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
 2. Where ASME-code construction is indicated, fabricate and label commercial, finned-tube water heaters to comply with ASME Boiler and Pressure Vessel Code: Section IV.
- E. Comply with NSF 372, "Drinking Water System Components – Lead Content"; Sections 1 through 9" for components that will be in contact with potable water.
- F. One manufacturer's product is to be provided for each category of products throughout the project, unless specific circumstances do not allow for this approach. Consult with the Architect/Engineer prior to bid to request deviation from this one-product contract requirement. No change order will be considered for failing to comply with this requirement. Installations of non-compliant products will be removed and replaced under this section with compliant products at no additional cost to the owner.

1.6 COORDINATION

- A. Coordinate size and location of concrete bases with Architectural and Structural Drawings.

1.7 WARRANTY

- A. Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of fuel-fired water heaters that fail in materials or workmanship within specified warranty period.
 1. Failures include, but are not limited to, the following:

- a. Structural failures including storage tank and supports.
 - b. Faulty operation of controls.
 - c. Deterioration of metals, metal finishes, and other materials beyond normal use.
2. Warranty Period: Manufacturers standard warranty.

PART 2 – PRODUCTS

2.1 Electrical Water Heaters (EH-#).

- A. Tankless Water Heater
 1. Manufacturers:
 - a. Stiebel Eltron
 - b. Chronomite
 - c. EeMax,
 - d. or approved equal
- B. Unit shall have ABS-UL 94 5VA rated cover. Unit shall have 0.5 GPM turn on. Unit shall allow mounting in vertical or horizontal directions. Element shall be replaceable cartridge insert. Unit shall have replaceable filter in the inlet connector. Element shall be iron free, Nickel Chrome material.
- C. Tankless water heater shall utilize complex algorithm, actively managing power application to real time system demand. Integrated flow meter, along with inlet and outlet temperature sensors provide data which allows the unit to instantly adapt to variations in input parameters
- D. Heater shall be fitted with 3/8" compression fittings to eliminate need for soldering. Maximum operating pressure of 150 PSI. Accessible diagnostic features to include error/fault display. Hot water storage tanks prohibited
- E. Tankless water heater user interface must have the following capabilities:
 1. Selectable display including Celsius /Fahrenheit, setpoint, flow rate, inlet temperature outlet temperature, power factor
 2. Capable of displaying flow rate in gallons per minute & liters per minute
 3. Diagnostic features to include error/fault display
 4. Control board must maintain error/fault history of 5 events
- F. Refer to Water Heater Schedule for water heater capacity required.

2.2 Commercial Electrical Water Heater (EWH-#)

- A. The heater shall be a glass-lined, heavy duty commercial electric water heater and constructed in accordance with ASME Code, shall bear appropriate symbol and be listed with the state plumbing board. Th size and capacity are shown on the drawing schedule.
- B. Manufacturers
 1. A.O Smith
 2. American Standard
 3. Ruud
 4. Or approved equal
- C. Comply with UL 174 for household, storage electric water heaters, Factory-Installed Storage-Tank, Comply insulation with current t ASHRAE/IESNA 90.1.

- D. Heater shall be listed with Underwriters' Laboratories and classified to The National Sanitation Foundation Standard No. 5.
- E. Internal surfaces of the tank shall be glass-lined with an alkaline borosilicate composition that has been fused-to-steel by firing at a temperature of 1600°F. Tank shall be cathodically protected with a combination of sacrificial and powered anodes. The entire vessel is to be enclosed in a round steel enclosure with baked enamel finish.
- F. Water heater shall have an electronic control with large LCD displaying current water heater status; provide real time element status and sensing, low water cutoff and economy mode operation. Shall have 120 volt control circuit transformer, transformer fusing, magnetic contactor(s), element fusing per N.E.C., and commercial grade Incoloy elements.
- G. Temperature controls include limiting switch which will require resetting manually in the event the temperature reaches 202°F.
- H. Foam insulation shall meet the thermal efficiency and/or standby loss requirements of the U. S. Department of Energy and current edition of ASHRAE/IES 90.1.
- I. Heater shall include a CSA Certified and ASME Rated T&P relief valve and a drain valve.
- J. Water heater units(s) shall be compatible with building management systems using Modbus or BACnet with optional ICC interface.

3.1 INSTALLATION

- A. Install water heaters as recommended by manufacturer. Provide final connections as required. Coordinate water heater location with other Contractors.
- B. Warranty on electrical components against defects in workmanship and material for a period of one (1) year from date of start-up, and the heating chamber for a full five (5) years from date of start-up, provided that the unit is started within three (3) months of date of shipment. Fabrication and assembly shall be performed in the U.S.A.
- C. Initial start-up shall be provided by representative of manufacturer.

END OF SECTION

SECTION 22 40 00
PLUMBING FIXTURES

PART 1 - GENERAL

1.1 TRADE CONTRACT REQUIREMENTS

- A. Work of this Section is part of the Plumbing Trade Contract. Refer to Section 22 00 00 "Plumbing Trade Contractor Requirements" for additional information about this Trade Contract.

1.2 RELATED DOCUMENTS

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

1.3 SUMMARY

- A. In general, the work of this section shall include, but not be limited to:
 - 1. Plumbing fixtures and trim.
 - 2. Water Coolers/Bottle Fill Stations
 - 3. Faucets and flushometers.
 - 4. Stops and supplies.
 - 5. Traps and tailpieces.
 - 6. Drain outlets.
 - 7. Mixing valves.
 - 8. Flow controls.
 - 9. Carriers and supports.
 - 10. Lavatory insulators.
- B. Related Sections include the following:
 - 1. Division 10 Section "Toilet, Bath, and Laundry Accessories."
 - 2. Division 22 Section "Domestic Water Piping Specialties" for backflow preventers, floor drains, and specialty fixtures not included in this Section.

1.4 DEFINITIONS

- A. ABS: Acrylonitrile-butadiene-styrene plastic.
- B. Accessible Fixture: Plumbing fixture that can be approached, entered, and used by people with disabilities.
- C. Cast Polymer: Cast-filled-polymer-plastic material. This material includes cultured-marble and solid-surface materials.
- D. Cultured Marble: Cast-filled-polymer-plastic material with surface coating.
- E. 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.
- F. FRP: Fiberglass-reinforced plastic.

- G. PMMA: Polymethyl methacrylate (acrylic) plastic.
- H. PVC: Polyvinyl chloride plastic.
- I. Solid Surface: Nonporous, homogeneous, cast-polymer-plastic material with heat-, impact-, scratch-, and stain-resistance qualities.

1.5 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. LEED Submittals:
 - 1. Complete "Sustainable Materials Attributes Submittal Form" attached to Section 01 81 13 "Sustainable Design Requirements".
 - 2. Provide supporting documentation for Materials and Resources and Low Emitting Materials, as required in Section 01 81 13, from manufacturer for materials attributes data submitted.
 - a. Environmental Product Declaration: For each product.
 - b. Chain-of-Custody Certificates: For FSC certified wood products. Include statement of costs and qualifications of manufacturers and vendors.
 - c. Health Product Declaration: For each product.
 - d. Laboratory Test Reports: Verify that the following products comply with the testing and product requirements of the California Department of Public Health's (CDPH) "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers", or South Coast Air Quality Management District (SCAQMD) Rule 1113:
 - 1) Sealants.
 - 2) Paints and coatings.
 - e. Product Data: For the following, including VOC content:
 - 1) Sealants.
 - 2) Paints and coatings.
 - f. Statement of Volume: for wet-applied products installed in the field.
 - g. Verify that the following products comply with Ultra Low Emitting Formaldehyde and No Added Urea Formaldehyde (ULEF or NAUF) requirements:
 - 1) For composite wood products, verify that product contains no urea formaldehyde, as defined in the California Air Resources Board's (CARB) "Airborne Toxic Control Measure to Reduce Formaldehyde Emissions from Composite Wood Products" or shall be made with no added formaldehyde.
- C. Operation and Maintenance Data: For plumbing fixtures to include in emergency, operation, and maintenance manuals.
- D. Warranty: Standard warranty specified in this Section.

1.6 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. 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.
- C. 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.
- D. Regulatory Requirements: Comply with requirements in Public Law 102-486, "Energy Policy Act," about water flow and consumption rates for plumbing fixtures.
- E. NSF Standard: Comply with NSF 372 for fixture materials that will be in contact with potable water.
- F. Select combinations of fixtures and trim, faucets, fittings, and other components that are compatible.
- G. Comply with the following applicable standards and other requirements specified for plumbing fixtures:
 - 1. Plastic Mop-Service Basins: ANSI Z124.6.
 - 2. Plastic Shower Enclosures: ANSI Z124.2.
 - 3. Solid-Surface-Material Lavatories and Sinks: ANSI/ICPA SS-1.
 - 4. Stainless-Steel Commercial, Handwash Sinks: NSF 2 construction.
 - 5. Vitreous-China Fixtures: ASME A112.19.2M.
 - 6. Water-Closet, Flush Valve, Tank Trim: ASME A112.19.5.
 - 7. Water-Closet, Flushometer Tank Trim: ASSE 1037.
- H. Comply with the following applicable standards and other requirements specified for lavatory and sink faucets:
 - 1. Backflow Protection Devices for Faucets with Side Spray: ASME A112.18.3M.
 - 2. Backflow Protection Devices for Faucets with Hose-Thread Outlet: ASME A112.18.3M.
 - 3. Diverter Valves for Faucets with Hose Spray: ASSE 1025.
 - 4. Faucets: ASME A112.18.1.
 - 5. Hose-Connection Vacuum Breakers: ASSE 1011.
 - 6. Hose-Coupling Threads: ASME B1.20.7.
 - 7. Integral, Atmospheric Vacuum Breakers: ASSE 1001.
 - 8. NSF Potable-Water Materials: NSF 372.
 - 9. Pipe Threads: ASME B1.20.1.
 - 10. Sensor-Actuated Faucets and Electrical Devices: UL 1951.
 - 11. Supply Fittings: ASME A112.18.1.
 - 12. Brass Waste Fittings: ASME A112.18.2.
- I. Comply with the following applicable standards and other requirements specified for shower faucets:
 - 1. Backflow Protection Devices for Hand-Held Showers: ASME A112.18.3M.
 - 2. Combination, Pressure-Equalizing and Thermostatic-Control Antiscald Faucets: ASSE 1016.
 - 3. Faucets: ASME A112.18.1.
 - 4. Hand-Held Showers: ASSE 1014.
 - 5. High-Temperature-Limit Controls for Thermal-Shock-Preventing Devices: ASTM F 445.
 - 6. Hose-Coupling Threads: ASME B1.20.7.
 - 7. Manual-Control Antiscald Faucets: ASTM F 444.
 - 8. Pipe Threads: ASME B1.20.1.
 - 9. Pressure-Equalizing-Control Antiscald Faucets: ASTM F 444 and ASSE 1016.

10. Sensor-Actuated Faucets and Electrical Devices: UL 1951.
 11. Thermostatic-Control Antiscald Faucets: ASTM F 444 and ASSE 1016.
- J. Comply with the following applicable standards and other requirements specified for miscellaneous fittings:
1. Atmospheric Vacuum Breakers: ASSE 1001.
 2. Brass and Copper Supplies: ASME A112.18.1.
 3. Dishwasher Air-Gap Fittings: ASSE 1021.
 4. Brass Waste Fittings: ASME A112.18.2.
 5. Sensor-Operation Flushometers: ASSE 1037 and UL 1951.
- K. Comply with the following applicable standards and other requirements specified for miscellaneous components:
1. Disposers: ASSE 1008 and UL 430.
 2. Dishwasher Air-Gap Fittings: ASSE 1021.
 3. Flexible Water Connectors: ASME A112.18.6.
 4. Floor Drains: ASME A112.6.3.
 5. Hose-Coupling Threads: ASME B1.20.7.
 6. Off-Floor Fixture Supports: ASME A112.6.1M.
 7. Pipe Threads: ASME B1.20.1.
 8. Plastic Toilet Seats: ANSI Z124.5.
 9. Supply and Drain Protective Shielding Guards: ICC A117.1.
 10. Whirlpool Bathtub Equipment: UL 1795.

PART 2 - PRODUCTS

2.1 FIXTURES AND TRIM

- A. Acceptable Manufacturers: Submit manufacturers not listed below for review and approval as specified for substitutions in this Section.
1. Vitreous China: Bradley, American Standard, Crane, Kohler or equal.
 2. Faucets: Chicago Faucet Co., Kohler or T & S Brass or equal.
 3. Self Closing Faucets: Chicago Faucet Co., Sloan, Kohler, Symmons or equal.
 4. Sensor Faucets: Chicago Faucet Co., Hydrotek, Sloan or equal.
 5. Stainless Steel Sinks: Elkay, Just Manufacturing, Metcraft Inc or equal.
 6. Mop Service Basins: Crane, Fiat , Stern Williams or equal.
 7. Carriers and Supports: Jay R. Smith, Wade, or equal.
 8. Thermostatic Mixing Valves: Leonard Valve Co., Powers Process Controls, Symmons, Chicago Faucets or equal.
 9. Pressure Regulating Mixing Valves: Lawler Manufacturing, Leonard Valve Co Symmons or equal.
 10. Emergency Eye Wash: Guardian, Haws, Speakman or equal
 11. Water Cooler: Haws, Halsey Taylor, Filtrine or equal.
 12. Flush Valves: Sloan, American Standards, Hydrotek or equal.
 13. Stops and Supplies: Chicago Faucet Co., Kohler or McGuire.
 14. P-Traps: McGuire, Sanitary-Dash, or Jameco.
 15. Handicap Lavatory Insulation: McGuire, TCI Products or Truebro.
- B. Fixture Trim and Accessories:
1. Provide fixtures complete with floor mounted fixture carrier supports; faucets, flushometers; drain outlets, tailpieces, P-traps and stops and supplies.
 - a. Color and Finish: Trim exposed to view shall be polished chrome plated, and fixtures and toilet seats shall be white unless specified otherwise.

- b. Drain Outlets: Provide drain outlet of the same manufacturer as the fixture or faucet trim with chrome plated 17 gauge minimum weight tailpiece.
 - c. Provide 1-1/4 inch tailpiece on lavatories.
 - d. Provide 1-1/2 inch tailpiece on sinks.
 - e. Provide offset drain outlets on handicapped use lavatories and sinks.
 - f. P-Traps: Cast brass adjustable P-trap with cleanout plug, ground joint and 17 gage minimum weight extension with escutcheon.
 - g. Provide McGuire No. 8090 1-1/4 inch by 1-1/2 inch on lavatories.
 - h. Provide McGuire No. 8089 1-1/2 inch by 1-1/2 inch on sinks.
 - i. Stops and Supplies: Provide stops and supplies of the same manufacturer as the fixture or faucet trim, or provide McGuire Model 170-LK loose key angle stop with 5 inch long 2 inch nominal copper sweat extension, bell escutcheon, and 3/8 inch O.D. by 12 inch flexible riser.
- C. Sinks: Seamlessly drawn, self-rimming minimum 18 gauge, type 302 (18-8) nickel bearing stainless steel with 1-3/4 inch minimum rounded corners, satin finish, and fully undercoated.
- D. Sink Faucets: Chrome plated cast brass with stainless steel seats and monel stems. Gooseneck spouts shall be interchangeable and convertible rigid/swing type. Handles shall be interchangeable with square handle broachings.
- E. Flushometers: Diaphragm operated cast-brass body, brass or copper pipe or tubing inlet with wall flange and tailpiece with spud, screwdriver check stop, vacuum breaker. The flush valve shall be electric sensor operated with true manual override feature.
- F. Water Conservation: Provide water conserving fixtures (Water sense labeled) and trim in compliance with the following maximum water use requirements. Provide Omni or equal variable pressure flow controls on sinks, and lavatory faucets.
 - 1. Public lavatories: 0.35 gpm
 - 2. Sinks: 1.0 gpm
 - 3. Water Closets: 1.28 gallons per flush.
 - 4. Shower : 1.5 gpm
- G. Fixture Supports: Provide floor mounted fixture support carriers for wall mounted fixtures including but not limited to: water closets, lavatories, scrub sinks, urinals, and clinical sinks.
 - 1. Fixture carriers shall support at least 250 pounds on the front rim of the fixture for 5 minutes.
 - a. Water Closets: Jay R. Smith Series 200-Y
 - b. Urinals: Jay R. Smith 637.
 - c. Lavatories: Jay R. Smith 700-M31.
 - d. Wheel Chair Lavatories: Jay R. Smith 700-27-M31.
 - 2. Toilet Seats: Provide extra heavy-duty, commercial/industrial type, elongated, open front, solid white injection molded plastic with integral bumpers; and self-sustaining stainless steel check hinges.
 - a. Acceptable Manufacturers: Bemis, Beneke, or Church.
 - 3. Handicap Lavatory and Sink Insulation: Shall be provided on water supplies and waste piping below handicapped use lavatories and sinks. Acceptable Manufacturers: McGuire, TCI Products or Truebro

2.2 FIXTURE DESCRIPTIONS

- A. **P-1:** HET Water Closet, Equal to American Standard Model Aftwall Millenium 2859.11. Vitreous china wall hung, white, elongated wall outlet water closet, 1.1 GPF, 1-1/2" top spud. Toilet flush valve to be water sense labeled, Manual 1.1 gpf flushometer. Equal to American Standard

6047.111.002. Provide combination drainage fitting and chair carrier to suit. Extra heavy duty solid plastic seat with check hinges (open front). Water closet shall be in compliance to the applicable section of ASME A112.19.2/ CSA B45.1. Refer to architectural drawing for mounting height requirement.

- B. **P-1A:** Water Closet (Barrier Free) Same as P-1, except mounting height to be 17" in accordance with architectural barriers board.
- C. **P-1B:** HET Water Closet (Kindergarten): HET Water Closet, Equal to American Standard Model Afwall Millenium 2859.11. Vitreous china wall hung, white, elongated wall outlet water closet, 1.1 GPF, 1-1/2" top spud. Toilet flush valve to be water sense labeled, Manual 1.1 gpf flushometer. Equal to American Standard 6047.111.002. Provide combination drainage fitting and chair carrier to suit. Extra heavy duty solid plastic seat with check hinges (open front). Water closet shall be in compliance to the applicable section of ASME A112.19.2/ CSA B45.1. Refer to architectural drawing A210 for mounting height requirement.
- D. **P-2:** Wall hung, 0.125 gpf vitreous china, top spud urinal equal to American Standard model Washbrook Universal 6590.001. The Flush valve to be water sense labeled, manual 0.125 gpf equal to American Standard 6045.013.002. Refer to architectural drawing A210 for mounting height requirement. Refer to architectural drawing and ADA mounting requirements.
- E. **P-2A:** Urinal (Barrier Free) Same as P-2, except mounting per architectural drawing.
- F. **P-3:** American Standard Murro Universal Design 0954.00 wall hung lavatory, ASME A112.19.2; vitreous china, wall hung wheel chair lavatory, 22" deep x 21.25" wide with 4" center faucet hole, Bowl size 15.5"x13.5"x 5", concealed arm brackets. Deck Mounted 4" fixed centers metering faucet, (lead free), 0.35 gpm aerator. Faucet to be equal to Chicago Faucets Model 3500-4E39PABCP. Provide Trim Plates, Chrome Plated brass grid strainer w/ 1 ¼ outlet tube. Mounting height in accordance with architectural elevation drawing. Provide knee guard insulation kit for trap and supplies. Coordinate mounting height with architectural elevation drawing.
- G. **P-3A:** (Barrier Free) Same as P-3 except mounting in accordance with architectural drawing and ADA mounting requirements.
- H. **P-3(3):** ADA compliant, wall-mounted, Multi-three station lavatory Equal to Bradley Verge Wash Basin LVGD3, Single piece molded design complete with mounting, access panel, drain and plumbing connections. The basin shall be made from a blend of bio-based resin, natural quartz and made of 20% recycle content, Unit includes waste and supply connections to wall with stop, strainer, and check valves, and heavy-gage stainless steel support brackets, concealed by high impact polymer trap enclosure. Provide hand free, three faucets .35 gpm electronic faucets and soap dispenser. Faucet to be equal to Bradley S53-3100 and soap dispenser 6-3100. AC power adapter, Provide Trim Plates, Chrome Plated brass grid strainer w/ 1 ¼ outlet tube. Mounting height in accordance with architectural elevation drawing. Provide knee guard insulation kit for trap and supplies. Provide point of use thermostatic mixing valve equal to Chicago Faucet model 131-CABNF.
- I. **P-4:** Stainless Steel Sink - Stainless steel counter with backsplash equal to Just Manufacturing Co.NSFB, 160 -12.5, one compartment, 30" high, 14 gauge, type 304 stainless steel, 18 gauge 304 stainless steel, supported on 4-16 stainless steel tubular legs with fully enclosed gussets and adjustable bullet feet.. Conforms to ASME/ANSI A112.3 , IPC. Backsplash mounted faucet equal to Just JS-47_TGSA with gooseneck spout and water-saving aerator (1.5 gpm) flow control fittings. Just J-35-FD chrome plated brass drain, 2" center outlet continuous waste to the suspended solid interceptor. Provide faucet connection supplies.

- J. **P-4A:** Art room stainless steel counter with backsplash equal to Just Manufacturing Co.NSFB, 160 -12.5, one compartment, 30" high, 14 gauge, type 304 stainless steel, 18 gauge 304 stainless steel, supported on 4-16 stainless steel tubular legs with fully enclosed gussets and adjustable bullet feet.. Conforms to ASME/ANSI A112.3 , IPC. Backsplash mounted faucet equal to Just JS-47_TGSA with gooseneck spout and water-saving aerator (1.5 gpm) flow control fittings. Just J-35-FD chrome plated brass drain, 2" center outlet continuous waste to the suspended soild interceptor. Provide faucet connection supplies. Provide solids interceptor SI-2 as specified in section 22 13 23.
- K. **P-5:** Countertop Sinks: Stainless Steel Sink Elkay Manufacturing Co. Model DLSR272210, 27" x 22" x 10" deep ledge type, 18 gauge, two hole, type 304 18-8 stainless steel. Interior and top surfaces polished to polished finish, sound deadened with self-rimming feature. Chicago No. 786-GR2AE35V317AB lead free deck mounted sink faucet, swing gooseneck spout, lever handles, 1.0 gpm E35 aerator, flow control fittings. McGuire mfg. 1151 AWC pre-wrapped 1 1/2 offset tailpiece with 151 stainless steel basket strainer offset rear. McGuire mfg. 165LK loose key stops with supplies McGuire 8089 CP 1 1/2" x 1 1/2" cast brass "P" trap with cleanout. McGuire 2127 CP IPS nipple to cast set screw flange 2127.
- L. **P-5A:** Countertop Sinks: Stainless Steel Sink (Barrier Free) Elkay Manufacturing Co. Model LRAD-25216, 25" x 21" x 6" deep ledge type, 18 gauge, type 304 18-8 stainless steel. Interior and top surfaces polished to polished finish, sound deadened with self-rimming feature. Rear outlet strainer, lead free, 4" center, deck mounted sink faucet equal to Chicago No. 786-GR2AE35V317AB, ADA lever handles, 1 gpm E35 aerator, flow control fittings. McGuire mfg. 1151 AWC pre-wrapped 1 1/2 offset tailpiece with 151 stainless steel basket strainer, rear center drain. McGuire mfg. 165LK loose key stops with supplies McGuire 8089 CP 1 1/2" x 1 1/2" cast brass "P" trap with cleanout. McGuire 2127 CP IPS nipple to cast set screw flange 2127.
- M. **P-5B:** Stainless Steel Sink (Barrier Free) Elkay Manufacturing Co. Model LRAD-221965, 22" x 19.5" x 6" deep ledge type, 18 gauge, type 304 18-8 stainless steel. Interior and top surfaces polished to polished finish, sound deadened with self-rimming feature. Chicago No. 786-GN2VBBCP lead free faucet, Vacuum Breaker, fixed gooseneck spout, 369 handles, 1.0 gpm E35 aerator, flow control fittings. McGuire mfg. 1151 AWC pre-wrapped 1 1/2 offset tailpiece with 151 stainless steel basket strainer offset rear. McGuire mfg. 165LK loose key stops with supplies McGuire 8089 CP 1 1/2" x 1 1/2" cast brass "P" trap with cleanout. McGuire 2127 CP IPS nipple to cast set screw flange 2127. Provide solid interceptor below sink. Refer to specification Section 22 13 23 for below sink solid interceptor.
- N. **P-6:** Hi-Lo Electric Water Cooler Halsey Taylor Barrier-Free Water Cooler, Model HTHB-HAC8BLPV-WF with Bi level ADA cooler and Bottle filling station. The water cooler shall include filter, and certified NDF/ANSI 42 and 53 for lead free chiller unit and Platinum Vinyl finish. Cooler shall provide 8 gph of 50 degree F water at 90 degree F inlet water. Shall have vandal resistant bubbler and front pushbutton activation. Shall comply with ADA standards, U.L listed and be certified to lead free compliance including NSF/ ANSI 61. The Bottle filling Station shall be sensor activated for no touch activation with 20 second shut off timer. The bottle filler shall provide 1.5 gpm of laminar flow and consists of components to prevent mold and mildew. Provide drain with 1 1/2 P-trap and mounting bracket. Refer to architectural drawings for mounting heights. Provide cane touch apron where indicated on drawing. Provide two spare filters. Station shall be provided with a shut-off diverting valve to prevent the bubbler portion of the fountain from operating yet allow the bottle fill portion to operate with full functionality.
- O. **P-7:** Floor Service Sink: Mop Receptor Fiat precast terrazzo mop basin, 24" x 24" x 12" with 6" drop front, stainless steel threshold, flange on wall sides. Fiat Model TSB-3010. Chicago 897 wall mounted service sink faucet w/ vacuum breaker spout. Wall hook, 24" long mop hanger

with 3 spring clips. Provide 6' stainless steel braided water supply hose with pressure bleeder device and dual vented check valve (ASSE1055B approved) for secondary back flow preventer to soap dispenser connection. Installation shall be as per the plumbing code requirement.

- P. **P-8:** Equal to Guardian GBF2372 emergency shower with ADA compliant swing activated eyewash system. 10" stainless steel shower head shall be mounted 96" above finish floor on 1" NPT chrome plated brass nipple. 1" NPTF chrome plated brass stay-open ball valve. Stainless steel triangular pull handle. Pull rod length shall be modified to accommodate varying ceiling heights. The integral eyewash shall be within stainless cabinet and activates automatically as the spray arms are pulled downward. Provide ASSE 1071 certified thermo mixing valve and meet ANSI Z358.1-2009. Refer to specification section 22 11 19 for thermostatic mixing valve TM-ES.
- Q. **P-8A:** Right hand deck mounted, all stainless steel construction, corrosion resistant, AutoFlow™ swivel eyewash less bowl with ½" IPS plug-type valve with PTFE coated O-ring seals. Supplied with in-line strainer to protect valve and spray heads from debris in water line. Unit shall have (2) polypropylene GS-Plus™ spray heads with integral "flip-top" dust covers, filters and 1.6 GPM flow control orifices mounted on stainless steel head assembly. Activate valve by rotating 90° from stored position. Unit shall include ANSI compliant sign. Provide thermostatic mixing valve to provide tepid water. Product shall be equal to Guardian Equipment G1895, Haws 7612, Speakman SE-572-ILS. Refer to specification section 22 11 19 for thermostatic mixing valve TM-ES.
- R. **P-9:** Laundry box shall be PPP Model MM-500 MLB (Fire rated) 1/2" sweat connections, hammer arrester and 2" drain connection. Other acceptable manufacturer LSP Products, Symmons Laundry or approved equal.
- S. **P-10:** Wall Hung Service Sink: Equal to American Standard Model # 7695.018, Enameled cast iron, 24" X 20-½" complete with rim guard, drilled back on 8" centers and #7798.176 P-trap, 3" outlet, floor support with strainer. Faucet shall be equal Chicago Model 956-RCP with #369 lever handle, 8" centers with vacuum breaker

PART 3 - EXECUTION

3.1 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 cabinets, counters, floors, and walls for suitable conditions where fixtures will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Assemble plumbing fixtures, trim, fittings, and other components according to manufacturers' written instructions.
- B. Install off-floor supports, affixed to building substrate, for wall-mounting fixtures.
 - 1. Use carrier supports with waste fitting and seal for back-outlet fixtures.
 - 2. Use carrier supports without waste fitting for fixtures with tubular waste piping.
 - 3. Use chair-type carrier supports with rectangular steel uprights for accessible fixtures.

- C. Install back-outlet, wall-mounting fixtures onto waste fitting seals and attach to supports.
- D. Install floor-mounting fixtures on closet flanges or other attachments to piping or building substrate.
- E. Install wall-mounting fixtures with tubular waste piping attached to supports.
- F. Install floor-mounting, back-outlet water closets attached to building floor substrate and wall bracket and onto waste fitting seals.
- G. Install counter-mounting fixtures in and attached to casework.
- H. Install fixtures level and plumb according to roughing-in drawings.
- I. Install 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: Use ball valves if supply stops are not specified with fixture. Valves are specified in Division 22 Section "General-Duty Valves for Plumbing Piping."
- J. Install trap and tubular waste piping on drain outlet of each fixture to be directly connected to sanitary drainage system.
- K. Install tubular waste piping on drain outlet of each fixture to be indirectly connected to drainage system.
- L. Install flushometer valves for accessible water closets and urinals with handle mounted on wide side of compartment. Install other actuators in locations that are easy for people with disabilities to reach.
- M. Install tanks for accessible, tank-type water closets with lever handle mounted on wide side of compartment.
- N. Install toilet seats on water closets.
- O. Install faucet-spout fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.
- P. Install water-supply flow-control fittings with specified flow rates in fixture supplies at stop valves.
- Q. Install faucet flow-control fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.
- R. Install shower flow-control fittings with specified maximum flow rates in shower arms.
- S. Install traps on fixture outlets.
 - 1. Exception: Omit trap on fixtures with integral traps.
 - 2. Exception: Omit trap on indirect wastes, unless otherwise indicated.
- T. Install disposer in outlet of each sink indicated to have disposer. Install switch where indicated or in wall adjacent to sink if location is not indicated.

- U. Install dishwasher air-gap fitting at each sink indicated to have air-gap fitting. Install in sink deck. Connect inlet hose to dishwasher and outlet hose to disposer.
- V. Install 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 "Common Work Results for Plumbing."
- W. Set shower receptors and service basins in leveling bed of cement grout. Grout is specified in Division 22 Section "Common Work Results for Plumbing."
- X. 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."

3.3 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.
- C. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."
- D. Connect wiring as described in Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.4 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.

3.5 ADJUSTING

- A. Operate and adjust faucets and controls. Replace damaged and malfunctioning fixtures, fittings, and controls.
- B. Operate and adjust disposers and controls. Replace damaged and 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.

- E. Install fresh batteries in sensor-operated mechanisms.

3.6 CLEANING

- A. 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.
- B. After completing installation of exposed, factory-finished fixtures, faucets, and fittings, inspect exposed finishes and repair damaged finishes.

3.7 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 40 00

SECTION 312300

EXCAVATION AND FILL FOR UTILITIES AND PAVEMENT

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials, and equipment necessary to complete the work of this Section (excluding earthwork for building and retaining wall construction), including but not limited to the following:
 - 1. Excavation, backfill, and compaction for pavements, pads, utility trenches and structures, and landscaping.
 - 2. Preparation and protection of subgrades.
 - 3. Removal of underground utilities as applicable.
 - 4. Excavation of all unsuitable materials encountered below indicated subgrade elevations.
 - 5. Placement of subbase course for concrete pavements.
 - 6. Placement of subbase and base course for asphalt paving.
 - 7. Bedding for utility trenches.
 - 8. Dewatering and support of excavation of trenches and excavations.
 - 9. Removal of items covered by Section 012200 - UNIT PRICES as applicable.
 - 10. Disposal of unsuitable or excess excavated material.
 - 11. Coordinate with all trades for complete building and site utility systems.
 - 12. Coordination with maintenance of safe path of travel for the public.
- B. Related Work: The following items are not included in this Section and will be performed under the designated Sections:
 - 1. SECTION 31 20 00 - EARTHWORK for building related soil materials, excavating and backfilling requirements.

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2. SECTION 311000 - SITE CLEARING for site stripping, grubbing, stripping and stockpiling topsoil, and removal of above- and below-grade improvements.
3. SECTION 312316 – ROCK REMOVAL for rock excavation and handling requirements.
4. SECTION 312500 – EROSION AND SEDIMENTATION CONTROLS for temporary erosion and sedimentation control measures.
5. Division 02, 22, 23, and 26 Sections for installing underground mechanical and electrical utilities and buried mechanical and electrical structures.
6. SECTION 333000 – SANITARY SEWERAGE UTILITIES for installing underground sewer pipes and manholes.
7. SECTION 334000 – STORM DRAINAGE UTILITIES for installing underground drain pipes, manholes, area drains, water quality structures, and water storage tanks.

1.3 UNIT PRICES

- A. Unit prices for certain types of earthwork are included in Section 012200 - UNIT PRICES.
- B. Rock Measurement: Volume of rock actually removed as specified in Section 312316, Rock Removal. Unit prices for rock excavation include replacement with approved materials as further defined in Section 312316, Rock Removal.

1.4 DEFINITIONS

- A. Backfill: Soil material or Controlled Density Fill (CDF) used to fill an excavation.
 1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
 2. Final Backfill: Backfill placed over initial backfill to fill a trench.
- B. Base Course: Course placed between the subbase course and hot-mix asphalt paving and concrete paving.
- C. Bedding Course: Course placed over the excavated subgrade in a trench before laying pipe.
- D. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.
- E. Dewatering includes lowering the water table and intercepting seepage which would otherwise emerge from the slopes or bottom of the excavation; increasing the stability of excavated slopes; preventing loss of material from beneath the slopes or bottom of the excavation; reducing lateral loads on sheeting and bracing; improving the excavation and hauling characteristics of sandy soil; preventing rupture of heaving of the bottom of any excavation; and disposing of pumped water.
 1. Normal dewatering is defined as using conventional pumps installed in open excavations, ditches, or sumps.
- F. Drainage Course: Course supporting the pavement that also minimizes upward capillary flow of pore water.

- G. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.
 - 1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by the Owner's Representative or the Designer. Authorized additional excavation and replacement material will be paid for according to Contract provisions for unit prices.
 - 2. Bulk Excavation: Excavation more than 10 feet in width and more than 30 feet in length.
 - 3. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by the Owner's Representative or the Designer. Unauthorized excavation, as well as remedial work directed by Designer, shall be without additional compensation.
- H. Fill: Soil materials used to raise existing grades.
- I. Rock: Rock material in beds, ledges, unstratified masses, conglomerate deposits, and boulders of rock material as defined in Section 312316, Rock Removal, that cannot be removed by normal rock excavating equipment without systematic drilling, ram hammering, ripping, or blasting, when permitted.
- J. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.
- K. Subbase Course: Course placed between the subgrade and base course for hot-mix asphalt pavement, or course placed between the subgrade and a cement concrete pavement or a cement concrete or hot-mix asphalt walk.
- L. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below subbase, drainage fill, or topsoil materials.
- M. Utilities: Onsite underground pipes, conduits, ducts, and cables, as well as underground services within buildings.
- N. Unsuitable Soils: Excavated soils that are determined by the Designer to not be reusable as fill or backfill on-site due to gradation, moisture content, and/or the presence of deleterious materials.

1.5 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.
- B. Product Data: For the following:
 - 1. Each type of plastic warning tape.
 - 2. Geotextile.
 - 3. Controlled Density Fill, including design mixture.

- C. Material Test Reports: From a qualified testing agency indicating and interpreting test results for compliance of the following with requirements indicated:
1. Classification according to ASTM D 2487 of each on-site and borrow soil material proposed for fill and backfill.
 2. Laboratory compaction curve according to ASTM D 1557 for each onsite and borrow soil material proposed for fill and backfill.
- D. Dewatering system: Contractor shall submit, for record, drawings and design data prepared, stamped, and signed by a registered professional engineer in the Commonwealth of Massachusetts who is experienced in groundwater control system design. The submittal shall show arrangement locations, and details of wells and well points and sump pumps; locations of risers, headers, filters, pumps, power units, all treatment components, and discharge lines; and means of discharge, control of sediment, and disposal of water. The submittal of the dewatering system will not relieve the Contractor from the responsibility for the adequacy of the dewatering system to achieve the required results specified in these Specifications and all permit requirements.
1. Include layouts of piezometers and flow-measuring devices for monitoring performance of dewatering system.
 2. Include a written plan for dewatering operations including control procedures to be adapted if dewatering problems arise.
 3. Include design calculations demonstrating adequacy of the proposed dewatering system and equipment.
 4. Provisions and methods of sediment removal and disposal of water.
 5. All permits required for the work.
- E. Support of Excavation: Contractor shall submit, for record, proposed excavation support systems (if required). The proposed lateral support systems shall be designed and stamped by a registered professional engineer licensed in the Commonwealth of Massachusetts. Despite the submittal of the design of excavation support and protection systems, the Contractor shall remain solely responsible for the adequacy and safety of materials and methods used in construction. Include the following as a minimum on the drawings:
1. Details, arrangements, and methods of construction of the proposed system(s).
 2. The method of installation and installation equipment.
 3. The elevation of struts, shores, and tiebacks, as applicable, and permissible depth to which excavation may be carried before such supports are installed.
 4. The excavation depths, the depth below the main excavation to which the support system will be installed, and the maximum design load to be carried by various members of the support system.
 5. Design calculations including references to design methods used, assumptions, design parameters, design soil profile, material properties, allowable stresses, and other

pertinent information stamped by a Professional Engineer registered in the Commonwealth of Massachusetts.

6. The location of existing utilities, facilities and/or structures nearby.
- F. Pre-Excavation Photographs and Videotape: Show existing conditions of adjoining construction and site improvements, including finish surfaces, that might be misconstrued as damage caused by earthwork operations. Submit before earthwork begins. Maintain catalog of up-to-date photographs at the site.
- G. Plan to Maintain Safe Path of Travel: Submit plans for maintaining safe paths of travel for the general public during the entire project, including requirement for police details of necessary.

1.6 PROJECT CONDITIONS

- A. Existing Utilities: Do not interrupt utilities serving facilities occupied by the Owner or others unless permitted in writing by the Owner's Representative and then only after arranging to provide temporary utility services according to requirements indicated.
 1. Notify the Owner's Representative not less than two days in advance of proposed utility interruptions.
 2. Do not proceed with utility interruptions without the Owner's Representative's written permission.
 3. Contact utility-locator service for area where Project is located before excavating.
 - a. The Contractor shall notify "Dig Safe" at 1-888-DIG-SAFE prior to commencing any excavation work.
- B. Demolish and completely remove from site existing underground utilities and structures indicated to be removed. Coordinate with utility companies to shut off services if lines are active.
- C. 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 geotechnical engineer and represent interpretations of subsoil conditions, tests, and results of analyses conducted by geotechnical engineer. Neither the Owner nor the Geotechnical Engineer will be responsible for interpretations or conclusions drawn from the data.
 1. The geotechnical report does not represent, and shall not be construed to represent a guarantee of subsurface conditions.
 2. Interpretation of this data for purposes of construction is the responsibility of the Contractor. It is the Contractor's responsibility to make interpretations and draw conclusions with respect to the character of materials to be encountered and groundwater conditions at the site and their impact upon Contractor's work based on his expert knowledge of the area, construction dewatering methods, and support of excavation methods.
 3. Make additional test borings and conduct other exploratory operations necessary for dewatering and excavation support and protection.
 4. The geotechnical report is referenced elsewhere in the Project Manual.

- D. Survey Work: Contractor shall 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.
 - 1. During earth moving operations, installation of excavation support and protection systems and dewatering, regularly resurvey benchmarks, maintaining an accurate log of surveyed elevations and positions for comparison with original elevations and positions. Promptly notify Owner's Representative if changes in elevations or positions occur or if cracks, sags, or other damage is evident in adjacent construction.
- E. The Contractor shall not close or obstruct any street, sidewalk, or passageway without written permission from authorities having jurisdiction unless otherwise indicated on the Contract Drawings. The Contractor shall conduct the construction operations as to minimize interference with the use of roads, driveways, or other facilities near enough to the project to be affected by the work.
- F. The Contractor shall provide police details when working in roadways as required by local jurisdictional authorities. The Contractor shall pay for any and all police details.

1.7 EXCAVATION SUPPORT AND PROTECTION

- A. The Contractor shall furnish, install, monitor and maintain excavation support and protection systems (sheeting, shoring, and bracing) at locations necessary to support the sides of excavations and resist soil and hydrostatic pressure and superimposed and construction loads; to prevent danger to persons or damage to adjacent pavements, facilities, utilities, or structures; to prevent injurious caving or erosion or the loss of ground; and to maintain pedestrian and vehicular traffic as required by the Contract Documents, the Contractor's sequence of construction, and as directed by the Owner's Representative.
- B. In all sheeting, shoring and bracing operations, care shall be taken to prevent collapse of excavations, injury to persons or damage to adjacent structures, facilities, utilities, and services. Any injuries to persons shall be the responsibility of the Contractor; and any damage to the work occurring as a result of settlement, water or earth pressure, or other causes due to inadequate bracing or other construction operations of the Contractor shall be satisfactorily repaired and made good by the Contractor, at no additional cost to the Owner.
- C. The excavation support system shall be of sufficient strength and be provided with adequate bracing to support all loads to which it will be subjected. The excavation support system shall be designed to prevent any movement of earth that would diminish the width of the excavation or damage or endanger adjacent structures.
- D. Where sheeting is to be used, it shall be driven ahead of excavation operations to the extent practicable so as to avoid the loss of material from behind the sheeting; where voids occur outside of the sheeting, they shall be filled immediately with ordinary fill, thoroughly compacted.
- E. The Contractor shall leave in place all sheeting and bracing at the locations and within the limits ordered by the Owner's Representative in writing. The Contractor shall cut off the sheeting at elevations as indicated on the Contract Drawings or to be determined with the approval of the Owner's Representative.

- F. The Contractor shall comply with all federal, state, and local safety regulations, and requirements.

1.8 DEWATERING

- A. The Contractor shall provide, at his own expense, adequate pumping and drainage facilities to maintain the excavated area sufficiently dry from groundwater and/or surface runoff so as not to adversely affect construction procedures nor cause excessive disturbance of underlying natural ground. The flows of all water resulting from pumping shall be managed so as not to cause erosion, siltation of drainage systems, or damage to adjacent property.
- B. Any damage resulting from the failure of the dewatering operations of the Contractor, and any damage resulting from the failure of the Contractor to maintain all the areas of work in a suitable dry condition, shall be repaired by the Contractor, as directed by the Owner's Representative and/or the Designer, at no additional cost to the Owner. The Contractor's pumping and dewatering operations shall be carried out in such a manner as to prevent damage to the Contract work and so that no loss of ground will result from these operations. Precautions shall be taken to protect new work from flooding during storms or from other causes. Pumping shall be continuous to protect the work and/or to maintain satisfactory progress.
- C. All pipelines or structures not stable against uplift during construction or prior to completion shall be thoroughly braced or otherwise protected. Water from the trenches, excavations, and stormwater management operations shall be disposed of in such a manner as to avoid public nuisance, injury to public health or the environment, damage to public or private property, or damage to the work completed or in progress.
- D. The Contractor shall control the grading in the areas surrounding all excavations so that the surface of the ground will be properly sloped to prevent water from running into the excavated area. Where required, temporary ditches shall be provided to control drainage. Upon completion of the work and when directed, all areas shall be restored by the Contractor in a satisfactory manner and as directed.
- E. Remove dewatering system when no longer required for construction.
- F. The Contractor shall obtain and maintain all required local, state, and federal permits necessary for construction dewatering for the duration of dewatering activities including all chemical testing required for disposal and discharge of dewatering effluent. The Contractor shall be responsible for treatment of water, if necessary, to meet minimum discharge criteria specified in the permits.

1.9 QUALITY CONTROL

- A. Inspection and testing will be performed by the Contractor to ensure that the materials placed meet the requirements in this section. Fill materials imported from off-site sources shall be chemically and geotechnically tested once for every 2,000 tons of material.
- B. If fill soils are not obtained from a commercial gravel pit, the Contractor shall provide certified analytical testing of offsite backfill to demonstrate that the soil does not exceed the limitations for MCP reference/reportable concentrations. Analyses shall include RCRA-8 metals, Extractable and Volatile Petroleum Hydrocarbons (EPH/VPH), and Volatile Organic Compounds (by EPA Method 8260B/5035). No testing will be required of imported fill soils obtained from a commercial gravel pit, provided the soils are free of odors, discoloration,

staining or other conditions indicative of contamination, in the opinion of the Geotechnical Engineer and/or the Designer.

- C. Tests and analysis of soil material will be performed in accordance with ASTM D422, ASTM D1557, ASTM D2922, ASTM D3017 and ASTM D4318.
- D. If tests indicate materials do not meet specified requirements, the Contractor shall identify an alternative borrow source, test the new material, and submit results to the Designer at no cost to Owner.

1.10 LAYOUT AND GRADES

- A. The Contractor is responsible for establishing vertical and horizontal control for the work and shall establish permanent bench marks and replace as directed any that are destroyed or disturbed. The Contractor shall maintain sufficient reference points at all times during construction to properly perform site grading. The existing survey benchmark shall be protected throughout the construction project.
- B. Finished grades, contours, and elevations indicated on the Drawings describe final surface elevation for completed construction. The words "finished grade" as used herein shall mean final grade elevations indicated on the Drawings. Spot elevations shall govern over proposed contours. Where not otherwise indicated, project site areas shall be given uniform slope between points and existing established grades.

1.11 QUALITY ASSURANCE

- A. Field inspection and testing may be performed by a Geotechnical Engineer at the Owner's expense to supplement the Contractor's Quality Control testing. Classification of all materials will be made by the Geotechnical Engineer whose decision shall be final and binding on the Contractor.
- B. The Contractor shall be responsible for managing and tracking all materials excavated and placed in stockpiles for testing.
- C. Comply with governing EPA notification regulations before beginning dewatering. Comply with hauling and disposal regulations of authorities having jurisdiction.
- D. The Contractor is responsible for the adequacy of the dewatering systems.
 - 1. The dewatering systems shall be capable of effectively reducing the hydrostatic pressure and lowering the groundwater levels to a minimum of 2 feet below excavation bottom, unless otherwise directed by the Designer, so that all excavation bottoms are firm and dry.
 - 2. The dewatering system shall be capable of maintaining a dry and stable subgrade until the structures, pipes, and appurtenance to be built therein have been completed to the extent that they will not be floated or otherwise damaged.
 - 3. The dewatering system and excavation support shall be designed so that the lowering of the groundwater level outside the excavation does not adversely affect adjacent structures, utilities or other improvements.

- E. The Owner will perform in place density tests in accordance with ASTM D2922 or D3017 as the Work progresses, to determine the degree of compaction. Any corrective work required as a result of such tests, such as additional compaction, or a decrease in the thickness of layers, shall be performed by the Contractor at no additional expense to Owner. In place density testing shall be made at the Contractor's expense by a qualified geotechnical testing laboratory.
- F. The Designer's duties do not include the supervision or direction of the actual work by the Contractor, his employees or agents. Neither the presence of the Designer nor any observation and testing by the Geotechnical Engineer shall excuse the Contractor from defects discovered in his Work at that time or subsequent to the testing.
- G. Contractor shall assist the Owner's Testing Laboratory in performing in-place density testing at a minimum frequency of one test per lift but no less than one test per 200 cubic yards of material placed in any one lift. Compaction testing will be performed in accordance with ASTM D1557, D2922, and D3017.
- H. Subgrades shall be approved for compactness and material composition prior to placing subsequent lifts. If inspections indicate Work does not meet specified requirements, the work shall be removed, replaced, and compacted at no additional cost to Owner.

1.12 REGULATORY REQUIREMENTS

- A. Comply with the Safety and Health regulations of the U.S. Department of Labor set forth in 29 CFR, Part 1926, and to the Massachusetts Department of Labor and Industries, Division of Industrial Safety "Rules and Regulations for the Prevention of Accidents in Construction Operations (454 CMR 10.0 et seq.). Contractors shall be familiar with the requirements of these regulations.
 - 1. All excavations shall comply with the requirements of OSHA excavation safety standards (29 CFR Part 1926.650 Subpart P), State, and local requirements. Where conflict between OSHA, State, and local regulations exists, the most stringent requirements shall apply.
- B. Comply with governing EPA notification regulations before, during, and upon completion of dewatering. Comply with hauling and disposal regulations of authorities having jurisdiction.
- C. Comply with all rules, regulations, laws, and ordinances of the municipality, the Commonwealth of Massachusetts, and other authorities having jurisdiction over the project site or work. All labor, materials, equipment, and services necessary to make the work comply with requirements shall be provided by the Contractor without additional cost to the Owner.
- D. The Contractor shall obtain and pay for all permits and licenses required to complete the work specified herein and indicated on the Contract Drawings.

1.13 EXAMINATION OF SITE AND DOCUMENTS

- A. It is hereby understood that the Contractor has carefully examined the site and all conditions affecting work under this Section. No claim for additional costs will be allowed because of a lack of knowledge of existing conditions as indicated in the Contract Documents, or obvious from observation of the site.

- B. Plans, surveys, measurements, and dimensions under which the work is to be performed are believed to be correct, but the Contractor shall have examined them for himself during the bidding period and formed his own conclusions as to the full requirements of the work involved.

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: ASTM D 2487 Soil Classification Groups GW, GP, GM, SW, SP, and SM 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.
- D. Ordinary Borrow: Ordinary borrow shall meet the requirements of MassDOT M1.01.0. It shall be well-graded, natural inorganic soil containing no stone greater than 6 inches maximum dimension. The materials shall be free of trash, ice, snow, tree stumps, roots, and other organic and deleterious materials. It shall be free of highly plastic clays, of all materials subject to decay, or other materials that will corrode piping or metals. Ordinary borrow shall have a maximum dry density of not less than 110 pounds per cubic foot. It shall be of such a nature and character that it can be compacted to the specified densities. Topsoil shall not be considered ordinary borrow. Existing available fill materials from onsite excavations may be reused as ordinary borrow if it meets the above requirements. It shall be graded within the following limits:

<u>U.S. Standard Sieve Size</u>	<u>Percent Finer by Weight</u>
6 inch	100
No. 10	30-90
No. 40	10-70
No. 200	0-15

- E. Gravel Borrow: Gravel borrow shall meet the requirements of MassDOT M1.03.0, Type B. It shall be an inert, hard, durable sand and gravel or stone soil obtained from an offsite commercial source. It shall be free of ice, snow, roots, sod, rubbish, oil, hazardous material, and other deleterious or organic matter. It shall be graded within the following limits:

<u>U.S. Standard Sieve Size</u>	<u>Percent Finer by Weight</u>
3 inch	100
½ inch	50-85
No. 4	40-75
No. 50	8-28
No. 200	0-10

- F. $\frac{3}{4}$ " Crushed Stone: $\frac{3}{4}$ " crushed stone shall meet the requirements of MassDOT M2.01.4. It shall consist of durable crushed rock or crushed gravel stone, free of ice, snow, sand, silt, clay, loam, shale, or other deleterious or organic matter. It shall be graded within the following limits:

<u>U.S. Standard Sieve Size</u>	<u>Percent Finer by Weight</u>
1 inch	100
$\frac{3}{4}$ inch	90-100
$\frac{1}{2}$ inch	10-50
$\frac{3}{8}$ inch	0-20
No. 4	0-5

- G. 1-1/2" Crushed Stone: 1-1/2" crushed stone shall meet the requirements of MassDOT M2.01.1. It shall consist of durable crushed rock or crushed gravel stone, free of ice, snow, sand, silt, clay, loam, shale, or other deleterious or organic matter. It shall be graded within the following limits:

<u>U.S. Standard Sieve Size</u>	<u>Percent Finer by Weight</u>
2 inch	100
1-1/2 inch	95-100
1 inch	35-70
$\frac{3}{4}$ inch	0-25

- H. Dense Graded Crushed Stone: Dense graded crushed stone shall meet the requirements of MassDOT M2.01.7. It shall consist of a mixture of crusher-run aggregate of crushed stone mixed with natural sand and gravel soil obtained from an offsite commercial source. It shall be free of ice, snow, roots, sod, rubbish, soil, hazardous material, and other deleterious or organic matter. It shall be graded within the following limits:

<u>U.S. Standard Sieve Size</u>	<u>Percent Finer by Weight</u>
2 inch	100
1-1/2 inch	70-100
$\frac{3}{4}$ inch	50-85
No. 4	30-55
No. 40	8-24
No. 200	3-10

- I. Sand: Sand shall meet the requirements of MassDOT M1.04.1. It shall consist of clean inert, hard, durable grains of quartz or other hard durable rock, free from clay, organics, surface coatings, or other deleterious or organic matter. It shall be graded within the following limits:

<u>U.S. Standard Sieve Size</u>	<u>Percent Finer by Weight</u>
$\frac{1}{2}$ inch	100
$\frac{3}{8}$ inch	85-100
No. 4	60-100
No. 16	35-80
No. 50	10-55

No. 100

2-10

- J. Dumped Riprap: Stone used for dumped riprap shall be hard, durable, angular in shape stones, resistant to weathering and shall meet the gradation requirement specified. Neither breadth nor thickness of a single stone should be less than one-third its length. Rounded stone or boulders will not be accepted unless authorized by the Engineer. Each load of riprap shall be reasonably well graded from the smallest to the maximum size specified. Stone shall be free from overburden, spoil, shale, and organic material and shall conform to the following gradation with no more than 5% by weight passing a 2-inch sieve:

<u>Weight of Stone (lbs.)</u>	<u>Percent Finer by Weight</u>
400	100
300	50
200	30
25	10

- K. Stone for Pipe Ends: Stone for pipe ends shall be sound, curable rock which is angular in shape. Rounded stones, boulders, sandstone or similar stone or relatively thin slabs will not be acceptable. Each stone shall weigh not less than 50 pounds not more than 125 pounds and at least 75% of the volume shall consist of stones weighing not less than 75 pounds each. The remainder of the stones shall be so graded that when placed with the larger stones the entire mass will be compact.
- L. Controlled Density Fill (CDF) shall be a cement concrete backfill material that flows like a liquid, supports like a solid when cured, and levels without tamping or vibrating to reach 100 percent compaction. CDF shall meet the requirements of MassDOT Specifications M4.08.00 for Type 1E (Very Flowable, Excavatable) or type 2E (Flowable, Excavatable) CDF. The mix formulation will be submitted to the Designer for review prior to placement of the material in the project.
- M. Reuse of Excavated Rock: Excavated on-site rock materials processed by the Contractor meeting the gradation limits for ¾" Crushed Stone, 1-1/2" Crushed Stone, Dense Graded Crushed Stone, and Stone for Pipe Ends contained herein may be segregated and reused as approved by the Owner.

2.2 GEOTEXTILES

- A. Subsurface Drainage Geotextile: Nonwoven needle-punched geotextile, manufactured for subsurface drainage applications, made from polyolefins or polyesters; complying with AASHTO M 288 and the following, measured per test methods referenced:
1. Survivability: Class 2; AASHTO M 288.
 2. Elongation: 50% minimum; ASTM D 4632
 3. Grab Tensile Strength: 160 lbs.; ASTM D 4632.
 4. Trapezoid Tear Strength: 60 lbs.; ASTM D 4533.
 5. CBR Puncture Strength: 410 lbs.; ASTM D 6241
 6. Apparent Opening Size: No. 70 sieve maximum; ASTM D 4751.

7. Permittivity: 1.50 sec-1 minimum; ASTM D 4491
 8. UV Stability: 70% after 500 hours' exposure; ASTM D 4355.
- B. Separation Geotextile: Woven geotextile fabric, manufactured for separation applications, made from polyolefins or polyesters; complying with AASHTO M 288 and the following, measured per test methods referenced:
1. Survivability: Class 1; AASHTO M 288.
 2. Elongation: 15% maximum; ASTM D 4632
 3. Grab Tensile Strength: 315 lbs.; ASTM D 4632.
 4. Trapezoidal Tear Strength: 120 lbs.; ASTM D 4533.
 5. Puncture Strength: 1,000 lbs.; ASTM D 6241.
 6. Apparent Opening Size: No. 40 sieve, maximum; ASTM D 4751.
 7. Permittivity: 0.05 sec-1 minimum; ASTM D 4491.
 8. UV Stability: 70% after 500 hours' exposure; ASTM D 4355.

2.3 ACCESSORIES

- A. Detectable Underground Warning Tapes: Acid and alkali-resistant polyethylene plastic film warning tape, 6-inches wide by 4-mils minimum thickness, with continuously printed caption in black letters "CAUTION - xxxxx LINE BURIED BELOW." The text and color of the tape shall be as shown in the table below. The tape shall have a metallic core encased in a protective jacket for corrosion protection and be detectable by a metal detector when the tape is buried up to 2.5-feet deep.

Color	Utility
Safety Red	Electric
High Visibility Safety Yellow	Gas, Oil, Steam
Safety Alert Orange	Telephone, Communications, Cable Television
Safety Precaution Blue	Water System, Irrigation
Safety Green	Sanitary Sewer, Storm Sewer
White	Proposed Excavation

2.4 USES OF MATERIALS

- A. Fill materials listed in Paragraph 2.1 above shall be utilized as follows and as otherwise indicated on the Drawings, specified or directed.
- B. Gravel Borrow:
1. As fill and base coarse soils below cement concrete and hot-mix asphalt pavements as shown on the Contract Drawings.

2. Trench backfill within paved areas.
 3. Bedding for ductile iron drain, water, and sewer piping.
- C. Dense Graded Crushed Stone:
1. As base course soils below cement concrete and hot-mix asphalt pavement as shown on the Contract Drawings.
- D. $\frac{3}{4}$ -inch and 1-1/2-inch Crushed Stone:
1. Base for drain manholes, catch basins, sewer manholes, and utility structures.
 2. Bedding for drain pipe and sewer pipe.
 3. Around perforated drain lines.
 4. To stabilize wet subgrade conditions.
 5. Elsewhere as shown on the Drawings or specified herein.
 6. To aid in dewatering.
- E. Sand:
1. Bedding for drain, water, sewer, and other utility piping.
 2. Elsewhere as shown on the Drawings or specified herein.
- F. Ordinary Borrow:
1. For general site fill outside of the proposed building footprint, concrete, and bituminous concrete areas.
 2. Trench backfill material outside of paved areas.
 3. Elsewhere as shown on the Drawings or specified herein.
- G. Geotextiles:
1. Subsurface non-woven Drainage Geotextile shall fully wrap 3-4-inch Crushed Stone.
 2. Use to prevent soil intrusion into drains and/or to assist in stabilizing soil subgrades prior to placement of fill materials.
 3. Subsurface woven separation geotextile as separation material between crushed stone and gravel borrow base materials below cement concrete and hot-mix asphalt pavement as shown on the Contract Drawings.
 4. Where indicated or shown in the Contract Drawings.
- H. Controlled Density Fill (CDF):

1. CDF shall be used as shown on the Contract Drawings.
2. CDF shall be used if directed by the DESIGNER as fill at the limits of the excavation areas.

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

- A. The Contract Drawings indicate the proposed finish alignment, elevation, and grade of the work. Establish the line and grade in close conformity with the Contract Drawings.
- B. The Contractor is responsible for establishing construction phasing, means, and methods and interim grading and temporary conditions required to attain the finish product required by the Contract Documents. The Contractor is responsible for all construction, protection, movement, and maintenance of stockpiles. Establish and maintain suitable benchmarks and grade control to accurately perform the work.
- C. No excavation shall be deposited or stockpiled at any time to endanger portions of new or existing structures, either by direct pressure or indirectly by overloading banks contiguous to the operation. Material, if stockpiled, shall be stored so as not to interfere with the established sequence of the construction. If there is not sufficient area available for stockpiling within the limits of the project, the Contractor will be required to furnish his own area for stockpiling.
- D. When the plans require excavation in areas in close proximity to existing buildings, roads, structures and utilities it shall be the responsibility of the Contractor at his expense to use satisfactory means and methods to protect and maintain the stability of such roads, and structures located immediately adjacent to but outside the limits of excavations.

3.2 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.
- B. Preparation of subgrade for earthwork operations including removal of vegetation, topsoil, debris, obstructions, and deleterious materials from ground surface is specified in Section 311000 - SITE CLEARING.
- C. Protect and maintain erosion and sedimentation controls, which are specified in Section 312500 – EROSION AND SEDIMENTATION CONTROLS, during earthwork operations.
- D. Provide protective insulating materials to protect subgrades and foundation soils against freezing temperatures or frost.

3.3 DEWATERING

- A. Provide Dewatering as required to maintain dry excavations.
- B. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.

- C. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.
 - 1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.
 - 2. Install a dewatering system to keep subgrades dry and convey ground water away from excavations. Maintain until dewatering is no longer required.
 - 3. Where soil has been softened or eroded by flooding, equipment, traffic or placement of fill or concrete during unfavorable weather or such other conditions, it shall be removed and replaced by the Contractor with suitable material and at the Contractor's expense. The necessity and extent of such removals shall be determined by the Designer.
- D. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by dewatering operations.
- E. Monitor dewatering systems continuously.
- F. 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.
- G. Before excavating below ground-water level, place system into operation to lower water to specified levels. Operate system continuously until drains, sewers, and structures have been constructed and fill materials have been placed or until dewatering is no longer required.
- H. Provide an adequate system to lower and control ground water to permit excavation, construction of structures, and placement of fill materials on dry subgrades. Install sufficient dewatering equipment to 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.
- I. Reduce hydrostatic head in water-bearing strata below subgrade elevations of foundations, drains, sewers, and other excavations.
 - 1. Maintain piezometric water level a minimum of 24 inches below surface of excavation.
- J. 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. Provide sumps, sedimentation tanks, and other flow-control devices as required by authorities having jurisdiction.
- K. 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. If

dewatering requirements are not satisfied due to inadequacy or failure of dewatering system, restore damaged structures and foundation soils at no additional expense to the Owner.

1. 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.

L. Damages: Promptly repair damages to adjacent facilities caused by dewatering operations.

3.4 EXCAVATION SUPPORT AND PROTECTION

- A. Work shall not be started until all materials and equipment necessary for the construction are either on the site of the work or satisfactorily available for immediate use as required.
- B. 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.
- C. 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 the Owner's Representative and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.
- D. Locate excavation support and protection systems clear of permanent construction so that forming and finishing of concrete surfaces or installation of improvements is not impeded.
- E. The excavation support and protection systems shall be securely and satisfactorily braced to withstand all pressures to which it may be subjected and be sufficiently tight to minimize lowering of the groundwater level outside the excavation.
- F. Monitor excavation support and protection systems daily during excavation progress and for as long as excavation remains open. Promptly correct bulges, breakage, or other evidence of movement to ensure that excavation support and protection systems remain stable.
- G. Promptly repair damages to adjacent facilities caused by installing excavation support and protection systems.
- H. Responsibility for the satisfactory construction and maintenance of the excavation support system, complete in place, shall rest with the Contractor. Any work done, including incidental construction, which is not acceptable for the intended purpose shall be either repaired or removed and reconstructed by the Contractor at his expense.
- I. Remove excavation support and protection systems when construction has progressed sufficiently to support excavation and bear soil and hydrostatic pressures. Remove in stages to avoid disturbing underlying soils 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 herein.
3. Repair or replace, as approved by Owner's Representative, adjacent work damaged or displaced by the installation, performance, and removal of the excavation support and protection systems.

3.5 ROCK EXCAVATION

- A. See Section 312316, Rock Removal for rock excavation and handling requirements.

3.6 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.
 1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.
 2. Remove rock to lines and grades indicated to permit installation of permanent construction without exceeding the following dimensions:
 - a. 24 inches outside of concrete forms.
 - b. 6 inches outside of minimum required dimensions of concrete cast against grade.
 - c. 6 inches beneath pipe in trenches, and the greater of 24 inches wider than pipe or 42 inches wide.
- B. Provide sheeting, shoring and bracing to complete and protect all excavated areas, are required for safety and compliance with OSHA. Cost for sheeting, shoring and bracing shall be included as a part of the contract price for completing the work and Owner shall make no separate payment for this work.
- C. Perform excavation work in accordance with all applicable Federal, State, and Local regulations regarding safe excavation work.
- D. Excavation in the area of existing utilities. Expose utilities by hand or other excavation methods that will prevent damage. Required excavation near electric, gas, water lines, and fiber-optic telecommunication lines shall be hand dug within 3 feet of the lines.
- E. Do not excavate to full depths when freezing temperatures may be expected unless subgrades are protected from freezing.

3.7 EXCAVATION FOR STRUCTURES

- A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch. If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.
 1. Excavation for Underground Tanks, Manholes, Basins, Mechanical and/or Electrical Utility Structures, Drainage and Sewer Systems, Infiltration Systems, and Utility

Structures: Excavate to elevations and dimensions indicated within a tolerance of plus or minus 1 inch. Do not disturb bottom of excavations intended as bearing surfaces.

3.8 EXCAVATION FOR WALKS AND PAVEMENTS

- A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades.

3.9 EXCAVATION FOR UTILITY TRENCHES

- A. Excavate trenches to indicated gradients, lines, depths, and elevations.
 - 1. Beyond building perimeter, excavate trenches to allow installation of top of pipe below frost line.
- B. Excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches higher than top of pipe or conduit, unless otherwise indicated.
 - 1. Clearance: 12 inches each side of pipe or conduit.
- C. Trench Bottoms: Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Shape subgrade to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. Remove projecting stones and sharp objects along trench subgrade.
 - 1. For pipes and conduit less than 6 inches in nominal diameter and flat-bottomed, multiple-duct conduit units, hand-excavate trench bottoms and support pipe and conduit on an undisturbed subgrade.
 - 2. For pipes and conduit 6 inches or larger in nominal diameter, shape bottom of trench to support bottom 90 degrees of pipe circumference. Fill depressions with tamped sand backfill.
 - 3. Excavate trenches 6 inches deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

3.10 SUBGRADE INSPECTION

- A. Notify the Owner's Representative when excavations have reached required subgrade.
- B. If the Owner's Representative, Geotechnical Engineer and/or the Designer determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.
- C. Proof-roll granular subgrade below structures and pavements with heavy vibrating drum roller 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 approved equipment weighing not less than 15 tons.

3. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Designer, and replace with compacted backfill or fill as directed.
- D. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by the Geotechnical Engineer and/or the Designer, without additional compensation.
- E. Protect all subgrades from disturbance.
 1. Place Gravel Borrow or Crushed Stone wrapped in non-woven geotextile over clayey, silty or wet footing subgrades. Fill shall not be placed in standing water.
 2. Grade around prepared subgrade areas to direct stormwater runoff away from the work area.
 3. Protect subgrades from frost at all times during construction. Fill should not be placed over frozen soil.

3.11 UNAUTHORIZED EXCAVATION

- A. Fill unauthorized excavations under site improvement construction or utility pipe as directed by Designer. Lean concrete fill, with 28-day compressive strength of 2500 psi may be used when approved by Designer.

3.12 STORAGE OF SOIL MATERIALS

- A. Stockpile borrow soil materials (from off-site sources) 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.
 2. Stockpile soil materials in a location, acceptable to the Owner's Representative, that will preclude having to relocate stockpiled soil materials that would otherwise delay or impact the Work.

3.13 BACKFILL

- A. Place and compact backfill in excavations promptly, but not before completing the following:
 1. Construction below finish grade including, where applicable, subdrainage, dampproofing, waterproofing, and perimeter insulation.
 2. Surveying locations of underground utilities for Record Documents.
 3. Testing and inspecting underground utilities.
 4. Removing concrete formwork.
 5. Removing trash and debris.
 6. Removing temporary shoring and bracing, and sheeting.

7. Installing permanent or temporary horizontal bracing on horizontally supported walls.
- B. Place backfill on previously placed and compacted fill and/or subgrades free of mud, frost, snow, or ice.
- C. Excavated on-site natural soils may be used as Ordinary Fill, provided the material can be placed and compacted as required herein and at the approval of the Designer.
- D. The Contractor shall not commence backfilling operations without approval of the Owner's Representative and/or the Designer.
- E. The Contractor shall maintain a dry and firm subgrade throughout construction. Dewatering shall be performed as needed at the Contractor's expense.
- F. The Contractor shall strip the existing subgrade of any vegetation, topsoil, organics, debris, or other unsuitable materials. The subgrade shall be proof compacted using a vibratory roller to treat any loose or disturbed areas and to provide a dense uniform surface.
- G. After the subgrade has been prepared, fill material shall be placed and built-up in successive layers until the required elevations are reached. No fill shall be placed on a frozen surface, nor shall snow, ice, or other frozen materials be included in fill. Wet materials containing moisture in excess of the amount necessary for satisfactory placement or compaction shall not be used.
- H. All fill shall be brought up in essentially level lifts and shall be placed in levels by standard methods. Layers of fill outside of utility trenches shall not exceed nine (9) inches in uncompacted thickness before compaction, unless otherwise specified, or as required for proper subgrade stabilization.
- I. Filling operations shall continue until the fill has been brought up to the finished slopes, lines, and grades making proper allowances for thickness of the overlying topsoil.
- J. The entire surface of the work shall be maintained free from ruts and in the condition that will permit construction equipment to travel over any section readily. The top surface of each layer shall be made level or slightly sloped toward the center of the filled area.
- K. Backfilling shall not be performed when weather conditions or the conditions of the materials are such that, in the opinion of the Geotechnical Engineer or the Designer, work cannot be performed satisfactorily.

3.14 BACKFILLING AGAINST STRUCTURES

- A. Place backfill on subgrades free of mud, frost, snow, or ice.
- B. Backfilling against masonry or concrete shall not be done until permitted by the Owner's Representative. The Contractor shall not place backfill against or on structures until they have attained sufficient strength to support the loads (including construction loads) to which they will be subjected, without distortion, cracking or other damage.
- C. As soon as practicable after the structures are structurally adequate and other necessary work has been satisfactorily completed and approved, special leakage tests of the structures shall be made by the Contractor, as required by the Owner's Representative. After the satisfactory completion of leakage tests and the satisfactory completion of any other required

work in connection with the structures, the backfilling around the structures shall proceed using suitable and approved excavation material.

- D. The best of the backfill material shall be used for backfilling within 2-feet of the structure. Just prior to placing backfill, the areas shall be cleaned of all excess construction material and debris and the bottom of excavations shall be in a thoroughly compacted condition.
- E. Symmetrical backfill loading shall be maintained. Special care shall be taken to prevent any wedging action or eccentric loading upon or against the structures. During backfilling operations, care shall be exercised that the equipment used will not overload the structures in passing over and compacting these fills. Except as otherwise specified or directed, backfill shall be placed in layers not more than 12 inches in loose depth and each layer of backfill shall be compacted thoroughly and evenly using approved types of mechanical equipment. Each pass of the equipment shall cover the entire area of each layer of backfill.
- F. In compacting and other operations, the Contractor shall conduct his operations in a manner to prevent damage to structures due to passage of heavy equipment over, or adjacent to, structures, and any damage thereto shall be made good by the Contractor at no additional expense to the Owner.

3.15 UTILITY TRENCH BACKFILL

- A. Place backfill on subgrades free of mud, frost, snow, or ice.
- B. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.
- C. Backfill trenches excavated under footings and within 18 inches of bottom of footings with satisfactory soil; fill with concrete to elevation of bottom of footings. Concrete is specified in Section 033000 - CAST-IN-PLACE CONCRETE.
- D. Provide 4-inch- thick, concrete-base slab support for piping or conduit less than 30 inches below surface of roadways. After installing and testing, completely encase piping or conduit in a minimum of 4 inches of concrete before backfilling or placing roadway subbase.
- E. Place and compact initial backfill of subbase material free of particles larger than 1 inch in any dimension, to a height of 12 inches over the utility pipe or conduit.
 - 1. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of utility piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.
- F. Backfill voids with satisfactory soil while installing and removing shoring and bracing.
- G. Backfill material shall be placed in maximum 6-inch lifts and mechanically compacted as specified herein.
- H. Place and compact final backfill of satisfactory soil to final subgrade elevation.
- I. Install warning tape directly above utilities, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

- J. Any trenches or excavations improperly backfilled or where settlement occurs shall be reopened, to the depth required for proper compaction, then refilled and compacted with the surface restored to the required grade and condition, at no additional expense to the Owner.
- K. During filling and backfilling operations, pipelines will be checked by the Owner's Representative to determine whether any displacement of the pipe has occurred. If the observation of the pipelines shows poor alignment, displaced pipe or any other defects they shall be remedied in a manner satisfactory to the Owner's Representative at no additional cost to the Owner.

3.16 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.
- C. Place soil fills on subgrades free of mud, frost, snow, or ice.

3.17 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. Fill material shall not be placed, spread or rolled during unfavorable weather conditions. When work is interrupted by heavy rains, fill operations shall not be resumed until the moisture content and the density of the previously placed fill are as specified.

3.18 COMPACTION OF SOIL BACKFILLS AND FILLS

- A. Place backfill and fill soil materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.
- B. Place backfill and fill soil materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.
- C. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D 1557:

Area	ASTM Density Degree of Compaction
Pavement and walkway base course	95%
Pavement and walkway subgrade	95%
General fill below pavement and walkway subbase	95%
Trench backfill - below pavements - below landscaped areas - below structures	95% 92% 95%
All other areas	90%

1. Under structures and pavement, proof-compact existing subgrade. Compact each layer of backfill soil material at 95 percent of the soils' maximum dry density (per ASTM D 1557). Fill areas within the 1H:1V influence zone of foundations and retaining wall footings shall also be compacted to 95 percent of the soils' maximum dry density (per ASTM D 1557).
 2. Under walkways, scarify and re-compact top 6 inches below subgrade to 95 percent of the soils' maximum dry density (per ASTM D 1557). Fill and base course material within 2 feet of the finished asphalt or concrete pavement grade shall be compacted to 95 percent of the soils' maximum dry density (per ASTM D 1557).
 3. For utility trenches in paved areas, compact each layer of initial and final backfill soil material to at least 95 percent of the soils' maximum dry density (per ASTM D 1557).
 4. For utility trenches in lawn or unpaved areas, compact each layer of backfill soil material to at least 92 percent of the soils' maximum dry density (per ASTM D 1557).
 5. Under lawn or unpaved areas, scarify and re-compact top 6 inches below subgrade and compact each layer of backfill or fill soil material to at least 90 percent of the soils' maximum dry density (per ASTM D 1557).
- D. In confined areas, place Crushed Stone in maximum 6-inch lifts and compact each lift with at least 4 passes of a vibratory plate compactor to a firm and unyielding surface. In open areas, place Crushed Stone in maximum 12-inch lifts and compact each lift with at least four passes of a vibratory drum roller with a minimum static weight of 10,000 pounds. Crushed stone fill shall be wrapped on all sides with non-woven filter fabric.

3.19 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 Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:
1. Lawn or Unpaved Areas: Plus or minus 1 inch.
 2. Walks: Plus or minus 1 inch.
 3. Pavements: Plus or minus 1/2 inch.

3.20 SUBSURFACE DRAINAGE

- A. Subdrainage Pipe: Specified in Division 2 Section "Subdrainage."
- B. Subsurface Drain: Place subsurface drainage geotextile around perimeter of subdrainage trench. Place a 6-inch course of filter material on subsurface drainage geotextile to support subdrainage pipe. Encase subdrainage pipe in a minimum of 12 inches of filter material, placed in compacted layers 6 inches thick, and wrap in subsurface drainage geotextile, overlapping sides and ends at least 6 inches.
1. Compact each filter material layer to 85 percent of maximum dry unit weight according to ASTM D 1557.
- C. Drainage Backfill: Place and compact filter material over subsurface drain, in width indicated, to within 12 inches of final subgrade, in compacted layers 6 inches thick. Overlay drainage backfill with 1 layer of subsurface drainage geotextile, overlapping sides and ends at least 6 inches.
1. Compact each filter material layer to 85 percent of maximum dry unit weight according to ASTM D 1557.
 2. Place and compact impervious fill over drainage backfill in 6-inch-thick compacted layers to final subgrade.

3.21 SUBBASE AND BASE COURSES

- A. Place subbase and base course on subgrades free of mud, frost, snow, or ice.
- B. On prepared subgrade, place subbase and base course under pavements and walks as follows:
1. Install separation geotextile fabric on prepared subgrade, where indicated on the Contract Drawings, according to manufacturer's written instructions, overlapping sides and ends.
 2. Place base course material over subbase course under hot-mix asphalt pavement.
 3. Shape subbase and base course to required crown elevations and cross-slope grades.
 4. Place subbase and base course 6 inches or less in compacted thickness in a single layer.

5. Place subbase and base course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.
 6. Compact subbase and base course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D 1557.
- C. Pavement Shoulders: Place shoulders along edges of subbase and base course to prevent lateral movement. Construct shoulders, at least 12 inches wide, of satisfactory soil materials and compact simultaneously with each subbase and base layer to not less than 95 percent of maximum dry unit weight according to ASTM D 1557.

3.22 DRAINAGE COURSE

- A. Place drainage course on subgrades free of mud, frost, snow, or ice.
- B. On prepared subgrade, place and compact drainage course under pavements, walkways and cast-in-place concrete slabs-on-grade as follows:
1. Install subdrainage geotextile on prepared subgrade according to manufacturer's written instructions, overlapping sides and ends.
 2. Compact each layer of drainage course to required cross sections and thicknesses to not less than 95 percent of maximum dry unit weight according to ASTM D 1557.

3.23 FIELD QUALITY CONTROL

- A. Independent Testing Agency: Cooperate with the Independent Testing Agency engaged by the Owner for field quality control activities for the Work of this Section. Refer also to Section 014325 - TESTING AGENCY SERVICES.
- B. Cooperate with field quality control personnel.
- C. Additional inspections and retesting of materials which fail to comply with specified material and installation requirements shall be performed at Contractor's expense.
- D. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earthwork only after test results for previously completed work comply with requirements.
- E. Testing agency will test compaction of soils in place according to ASTM D 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 Areas: At subgrade and at each compacted fill and backfill layer, at least 1 test for every 2000 sq. ft. or less of paved area or building slab, but in no case fewer than 3 tests.
 2. Trench Backfill: At each compacted initial and final backfill layer, at least 1 test for each 150 feet or less of trench length, but no fewer than 2 tests.

- F. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil to depth required; recompact and retest until specified compaction is obtained. Costs related to re-testing due to unacceptable quality of work and failures discovered by the testing shall be borne by the Contractor.
- G. Notify the Independent Testing Agency a minimum of 72 hours prior to start of earthwork operations, to comply with Code requirement that a registered design professional be present at all times during backfill to assure adequate compaction with no bridging effects. The services of the Testing Agency, Geotechnical Engineer, and the Designer shall include but not be limited to the following:
 - 1. Observation during excavation, backfilling, and compaction.
 - 2. Laboratory testing and analysis of fill materials specified or proposed for use as required.
 - 3. Observation of construction and performance of water content, gradation, and compactions tests at a frequency and at locations that he/she shall select. The results of these test will be submitted to the Owner's Representative so that the Contractor can take such action as is required to remedy any indicated deficiencies.
 - 4. Observation of proof-compaction of exposed subgrades. Proof-compaction may be waived if, in the opinion of the Geotechnical Engineer, disturbance will occur and cause loss of strength of underlying soil.
- H. The Contractor shall make provisions for allowing observations and testing of Contractor's Work by the Testing Agency and the Geotechnical Engineer, and the Designer. The presence of the Testing Agency, Geotechnical Engineering, and/or the Designer does not include supervision or direction of the actual work by the Contractor, his/her employees, or agents. Neither the presence of the Testing Agency, Geotechnical Engineer, and/or the Designer nor any observations and testing performed by those entities or any notice or failure to give notice, shall excuse the Contractor from defect discovered in his/her work.

3.24 PROTECTION

- A. No excavation will be permitted below a line drawn downwards at 2 horizontal to 1 vertical from the underside of the closest edge of any proposed in-place footing or utility at a higher elevation without providing adequate sheeting and bracing or underpinning to prevent loss of support of the footing or utility.
- B. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.
- C. 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 Designer; reshape and recompact.
- D. 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.

3.25 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Disposal: Contractor shall remove surplus satisfactory soil and waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off the Owner's property.

END OF SECTION

SECTION 312500

EROSION AND SEDIMENTATION CONTROLS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials, and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Control measures to prevent all erosion, siltation, and sedimentation of wetlands, waterways, construction areas, adjacent areas and off-site areas.
 - 2. Control measures shall be accomplished adjacent to or in the following work areas:
 - a. Soil stockpiles and on-site storage and staging areas.
 - b. Cut and fill slopes and other stripped and graded areas.
 - c. Constructed and existing swales and ditches.
 - d. Retention ponds.
 - e. At edge of wetlands areas, if applicable, as shown on Drawings.
 - 3. The Contract Drawings indicate the minimum requirements for sedimentation and erosion control. The Contractor shall install all measures needed to control sediment and erosion as required by the Contractor and Sub-contractor's construction methods and operations, the weather conditions, and as directed by the Engineer.
 - 4. Additional means of protection shall be provided by the Contractor as required for continued or unforeseen erosion problems, at no additional cost to the Owner.
 - 5. Periodic maintenance of all sediment control structures shall be provided to ensure intended purpose is accomplished. Sediment control measures shall be in working condition at the end of each day.
 - 6. After any significant rainfall, sediment control structures shall be inspected for integrity. Any damaged device shall be corrected immediately.
- B. Alternates: Not Applicable.
- C. Items to Be Installed Only: Not Applicable.
- D. Items to Be Furnished Only: Not Applicable.

- E. Related Work: The following items are not included in this Section and will be performed under the designated Sections:
 - 1. Section 311000 – SITE CLEARING for protection of existing trees and other vegetation to remain.
 - 2. Section 312000 – EARTH MOVING for soil materials, excavating, backfilling, and site grading and removal of site utilities.

1.3 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.
 - 1. At least 20 days prior to the start of the project, the Contractor shall submit an Appendix by a qualified person to the Draft Stormwater Pollution Prevention Plan (SWPPP) indicating project phasing, Contractor operation areas, work areas, stockpile locations, construction staging/sequencing, and sedimentation and erosion control measures to be used. This Appendix shall become part of the SWPPP that is to be updated and maintained by the Contractor.
 - 2. As part of the Contract Closeout procedures, the Contractor is responsible for filing a Notice of Termination with the EPA once the project has been completed and is permanently stabilized. Stabilization is complete when all temporary storm water and erosion controls have been removed, all permanent storm water and erosion controls are in place and functional and all vegetated areas are at least 70% viable.
 - 3. The Contractor shall provide the manufacturer's literature, material specification, and installation instructions for sedimentation and erosion control materials and devices for approval. Do not order materials until approval of certifications or test results has been obtained. Delivered materials shall match the approved submittals.
 - 4. LEED Supporting Documentation (if required): Submit LEED supporting documentation as outlined in Section 018110 SUSTAINABLE DESIGN REQUIREMENTS for materials and products that have been extracted, harvested, or recovered, as well as manufactured within 500 miles of the project site.

1.4 QUALITY ASSURANCE

- A. When applicable, comply with the requirements of Stormwater Pollution Prevention Plan prepared for the NPDES permit, which are incorporated herein by reference, and all other applicable requirements of governing authorities having jurisdiction. The specifications and drawings are not represented as being comprehensive, but rather convey the intent to provide complete slope protection and erosion control for both the project site and adjacent property.
 - 1. 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 a sediment and erosion control plan specific to the site, that complies with EPA 832/R-92-005 or requirements of authorities having jurisdiction, whichever is more stringent.
- B. Erosion control measures shall be established at the beginning of construction and maintained during the entire period of construction. On-site areas which are subject to severe erosion, and off-site areas which are especially vulnerable to damage from erosion and/or sedimentation, are to be identified and receive special attention.

- C. The Contractor shall install and maintain sedimentation control devices during construction to prevent the movement of sediment from the construction site to off site areas, into adjacent water bodies via surface runoff or into underground drainage systems. Measures to prevent the movement of sediment off site shall be installed, maintained, removed, and cleaned up at no additional cost to the Owner.
- D. All land-disturbing activities are to be planned and conducted to minimize the size of the area to be exposed at any one time, and the length of time of exposure.
- E. Surface water runoff originating upgrade of exposed areas should be controlled to reduce erosion and sediment loss during the period of exposure.
- F. When the increase in the peak rates and velocity of storm water runoff resulting from a land-disturbing activity is sufficient to cause accelerated erosion of the receiving stream bed, provide measures to control both the velocity and rate of release so as to minimize accelerated erosion and increased sedimentation of the stream.
- G. All land-disturbing activities are to be planned and conducted so as to minimize off-site sedimentation damage.
- H. The Contractor is responsible for cleaning out and disposing of all sediment once the storage capacity of the sediment facility is reduced by one-half.
- I. Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.
- J. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

1.5 REFERENCE STANDARDS

- A. The following standards are applicable to the work of this Section to the extent referenced herein:
 - 1. "Massachusetts Erosion and Sedimentation Control Guidelines for Urban and Suburban Areas, A Guide for Planners, Designers and Municipal Officials", prepared by the Massachusetts Department of Environmental Protection, Bureau of Resource Protection, dated March 1997, reprinted May 2003.

1.6 EXAMINATION OF SITE AND DOCUMENTS

- A. It is hereby understood that the Contractor has carefully examined the site and all conditions affecting work under this Section. No claim for additional costs will be allowed because of a lack of knowledge of existing conditions as indicated in the Contract Documents, or obvious from observation of the site.
- B. Plans, surveys, measurements, and dimensions under which the work is to be performed are believed to be correct, but the Contractor shall have examined them for himself during the bidding period and formed his own conclusions as to the full requirements of the work involved.

1.7 PERMITS, CODES, AND REGULATIONS

- A. Comply with all rules, regulations, laws, and ordinances of the City and State, and all other authorities having jurisdiction over the project site. All labor, materials, equipment, and services necessary to make the work comply with such requirements shall be provided by the Contractor without additional cost to the Owner.

- B. Comply with all applicable regulations of the Commonwealth of Massachusetts Department of Environmental Protection (DEP) and the EPA.
- C. The Contractor shall comply with the requirements of the NPDES CGP for this project.

1.8 STORM WATER POLLUTION PREVENTION PLAN

- A. A professional engineer has prepared a Draft Storm Water Pollution Prevention Plan (SWPPP). The Contractor shall locate the SWPPP and review its contents thoroughly. Upon the award of the Contract, the Contractor becomes responsible for implementing the SWPPP and meeting the requirements and standards detailed within the SWPPP. The Contractor is also responsible for all record keeping associated with maintaining the SWPPP and for maintaining in good operating condition all SWPPP controls. The Contractor shall modify the SWPPP as necessary to reflect changes in project scope, schedule, or approach. All labor, materials, equipment, and services necessary to make the work comply with such requirements shall be provided by the Contractor without additional cost to the Owner.
- B. The Contractor shall fill out all pertinent information within the SWPPP.
- C. The Contractor shall locate the EPA "Notice of Intent for Storm Water Discharges Associated with CONSTRUCTION ACTIVITY Under a NPDES General Permit" (NOI) form in the SWPPP. The Contractor is responsible for signing and filing his copy of the NOI at least 14 calendar days prior to the start of any construction activity and placing a signed copy along with proof of mailing in the SWPPP.
- D. The Contractor is responsible for obtaining a copy of the Owner's filed copy of the NOI form and proof of mailing and placing it in the SWPPP.
- E. The Contractor is responsible for filling in the Contractor and Sub-Contractor information in the areas indicated within the SWPPP and for completing the Contractor's Certification portion of the SWPPP.
- F. The Contractor is responsible for maintaining the following records on site:
 - 1. Completed SWPPP as indicated in sections B, C, D, and E.
 - 2. Completed Inspection Reports
 - 3. Completed Maintenance Reports
 - 4. Construction Activity Reports
 - 5. Spill Records
 - 6. Other Materials relevant to the NOI Permit and SWPPP
 - 7. A copy of the Notice of Termination
- G. The Contractor is responsible for filing a Notice of Termination once the project has been completed and is permanently stabilized. Stabilization is complete when all temporary storm water and erosion controls have been removed, all permanent storm water and erosion controls are in place and functional and all vegetated areas are at least 70% viable.
- H. All labor, materials, equipment, and services necessary to make the work comply with the above requirements shall be provided by the Contractor without additional cost to the Owner.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Straw Bales: Wire or nylon bound bales of straw, oriented around sides, rather than over and under.
- B. Stakes: Stakes for bales shall be one of the following materials: Wood stakes of sound hardwood 2 by 2 inches in size or steel reinforcing bars of at least No. 4 size. Lengths shall be approximately three feet.
- C. Straw Wattles
 - 1. Straw wattles shall consist of weed free rice straw inside biodegradable netting. Straw wattles shall measure at least nine (9) inches in diameter.
 - 2. Stakes for wattles shall be one of the following materials. Lengths shall be approximately two feet (2').
 - a. Wood stakes of sound hardwood, one inch by one inch (1" x 1") in size.
 - b. Steel reinforcing bars of at least No. 4 size.
- D. Siltation Fence
 - 1. Fabricated or prefabricated unit consisting of the following filter fabric properties:

a. Grab Tensile Strength (lbs)	124	ASTM D4632
b. Elongation at Failure (%)	15	ASTM D4632
c. Mullen Burst Strength (PSI)	280-300	ASTM D3786
d. Puncture Strength (lbs)	60-65	ASTM D4833
e. Water Flow Rate (gal/min/sf)	8-10	ASTM D4491
f. Apparent Opening Size (Sieve)	30	ASTM D4751
g. Ultraviolet Radiation Stability (%)	70-80	ASTM D4355
 - 2. Use only commercially available fabric that is certified in writing by the manufacturer for the purpose intended.
 - 3. Acceptable fabric materials include "Mirafi Envirofence" by Mirafi Construction Products, "Style 2130" by Amoco Fabrics Co., and "IVI 3617C Silt Fence" by Indian Valley Industries, Inc., or approved equal by the Engineer.
 - 4. Silt fence posts: Posts may be wood or metal. Wood post shall be a minimum 1¼ inch by 1¼ inch by 5 feet long hardwood stakes commonly used to support siltation fabric. Metal posts shall be a minimum of 1 inch wide and 5 feet long. Posts shall be spaced at a maximum distance of 8 feet on center.
 - 5. Provide suitable heavy nylon cord for securing abutting silt fence posts.

- E. Fencing: Steel posts shall be standard 6-foot long metal stamped drive stakes commonly used to support snow fences. Fencing shall be new four-foot height wood lath snow fencing. Provide suitable steel staples or heavy nylon cord for securing filter cloth to support system.
- F. Crushed Stone: Crushed stone shall consist of durable crushed rock or durable crushed gravel stone, free from ice and snow, sand, clay, loam, or other deleterious or organic material. The crushed stone shall be uniformly blended and shall conform to the following requirements.

Percent Passing by Weight		
Sieve Size	1 1/2-inch Stone	3/4-inch Stone
2-inch	100	---
1 1/2-inch	95-100	---
1 1/4-inch	---	---
1-inch	35-70	100
3/4-inch	0-25	90-100
1/2-inch	---	10-50
3/8-inch	---	0-20
No. 4	---	0-5

- G. Protective Measures: As temporary coverings on ground areas subject to erosion, provide one of the following protective measures, and as directed by the Designer with concurrence of the Owner's Representative:
1. Hay or straw temporary mulch, 100 pounds per 1,000 square feet.
 2. Wood fiber cellulose temporary mulch, 35 pounds per 1,000 square feet.
 3. Tackifier for anchoring mulch or straw shall be a non-petroleum based liquid bonding agent specifically made for anchoring hay or straw.
 4. Provide natural (jute, wood excelsior) or man-made (glass fiber) covering with suitable staples or anchors to secure to ground surface. Note that wire staples and non-biodegradable coverings shall not be used for any area that will be mown turf.
 5. Temporary vegetative cover for graded areas shall be undamaged, air dry threshed straw or hay free of undesirable weed seed.
- H. Temporary Covers for Drainage Structures
1. Filter fabric for use as temporary covers for drainage structures shall be the same as noted above for siltation fence.
 2. Wire mesh for use at temporary drainage structure covers shall be 6" x 6", W2.9 welded wire mesh.
 3. Crushed stone shall be as specified herein before.
 4. Silt-Sac, Hydro-FloGard + Plus Catch Basin Insert, Ultra-DrainGuard Insert, or approved equal, may be used in lieu of hay bales and filter fabric at catch basins.

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

- A. The Contractor shall provide suitable and adequate means of sedimentation and erosion control during construction. Control measures shall prevent all erosion, siltation, and sedimentation of waterways, drainage systems, construction areas, adjacent areas and off-site areas. Work shall be accomplished on and/or adjacent to the following work areas:
 - 1. Earthwork stockpiles and on-site storage and staging areas.
 - 2. Cut and fill slopes and other stripped and exposed graded areas.
 - 3. Constructed and existing swales and ditches.
 - 4. Unestablished lawns and seeded embankments.
- B. Means of protection as noted on the Contract Drawings indicate the minimum provisions necessary. Additional means of protection shall be provided by the Contractor as required for continued or unforeseen erosion problems, at no additional expense to the Owner.
- C. Periodic maintenance of all sediment control installations shall be provided to ensure intended purposes are accomplished. Sediment control measures shall be in working condition at the end of each day.
- D. After any significant rainfall, sediment control devices shall be inspected for integrity. Any damaged device shall be corrected immediately.
- E. The Contractor shall provide adequate means of control of runoff, as to not detrimentally impact downstream conditions during construction. The Contractor shall plan his operations so that permanent drainage mitigation systems such as detention/retention/infiltration basins and chambers are in place and properly functioning prior to connecting upland drainage flows to these systems. The Contractor shall plan his operations such that downstream drainage mitigation measures are in place and functioning before attempting to tie in upgradient drainage systems.
- F. In the event that the Contractor is unable to sequence the work so that construction of the permanent drainage mitigation systems precedes the upland work, then the Contractor shall submit a plan indicating his proposed methods of otherwise controlling runoff from the site.
- G. The "Massachusetts Erosion and Sedimentation Control Guidelines for Urban and Suburban Areas" should be consulted as a guide for the selection and installation of Best Management Practices to suit the conditions encountered.

3.2 STRAW BALE BARRIERS

- A. Excavation shall be to the width of the bale and the length of the proposed barrier to a minimum depth of 4 inches.
- B. Bales shall be placed in a single row, lengthwise on proposed line, with ends of adjacent bales tightly abutting one another. In swales and ditches, the barrier shall extend to such a length that the bottoms of the end bales are higher in elevation than the top of the lowest middle bale.
- C. Staking shall be accomplished to securely anchor bales by driving at least two stakes or rebars through each bale to a minimum depth of 18 inches.

- D. The gaps between bales shall be filled by wedging straw in the gaps to prevent water from escaping between the bales.
- E. The excavated soil shall be backfilled against the barrier. Backfill shall conform to ground level on the downhill side and shall be built up to 4 inches on the uphill side. Loose straw shall then be scattered over the area immediately uphill from a straw barrier.
- F. Inspection shall be frequent and repair or replacement shall be made promptly as needed.
- G. Bales shall be removed when they have served their usefulness so as not to block or impede stormwater flows or drainage.

3.3 STRAW WATTLE BARRIERS

- A. Install straw wattles in locations as shown on Contract Drawings and as directed.
 - 1. Wattles shall be placed in a row with ends overlapping a minimum of two (2) feet.
 - 2. Each wattle shall be embedded in the soil a minimum of two (2) and a maximum of six (6) inches.
 - 3. Wattles shall be securely anchored in place by stakes or rebars driven through the wattles and a minimum twelve (12) inches into the soil. Stakes shall be placed four (4) feet on center.
- B. Inspection shall be frequent and repair or replacement shall be made as needed.
- C. Wattles shall be removed when they have served their usefulness so as not to block or impede stormwater flows or drainage.

3.4 STABILIZED CONSTRUCTION ENTRANCE AND STONE BERMS

- A. Stone size: Use ASTM designation C-33, size No. 2 (1-1/2" to 2-1/2"). Use crushed stone.
- B. Length: As effective, but not less than 50 feet.
- C. Thickness: Not less than eight inches.
- D. Width: Not less than full width of all points of ingress or egress, but not less than 25 feet.
- E. Washing: When necessary, wheels shall be cleaned to remove sediment prior to entrance onto public right-of-way. When washing is required, it shall be done on an area stabilized with crushed stone which drains into an approved sediment trap or sediment basin. All sediment shall be prevented from entering any storm drain, ditch, or watercourse through the use of sand bags, gravel boards or other approved methods.
- F. Maintenance: The entrance shall be maintained in a condition which will prevent tracking or flowing of sediment onto public rights-of-way. This may require periodic top dressing with additional stone as conditions demand and repair and/or cleanout of any measures used to trap sediment. All sediment spoiled, dropped, washed or tracked onto public rights-of-way must be removed immediately.
- G. Place crushed stone berms in locations required and as directed. Berms shall have side slopes of 1:3 or less.

- H. Inspect stone berms periodically and replace and/or regrade crushed stone as required.

3.5 SILT FENCING

- A. Excavate a 6-inch trench along the upstream side of the desired fence location.
- B. Drive fence posts a minimum of 1'-6" into the ground. Install fence, well-staked at maximum eight-foot intervals in locations as shown on Drawings. Secure fabric to fence and bury fabric end within the six-inch deep trench cut.
- C. Lay lower 12 inches of silt fence into the trench, 6 inches deep and 6 inches wide. Backfill trench and compact.
- D. Overlap joints in fabric at post to prevent leakage of silt at seam.
- E. Inspect siltation fence after major storm events and periodically and remove accumulated sediment and debris. If a breach or failure of the siltation fence occurs, the fence shall immediately be restored.

3.6 EROSION CONTROL GRASSING

- A. Grassing shall be applied according to the Massachusetts Erosion and Sedimentation Control Guidelines for Urban and Suburban Areas, A Guide for Planners, Designers and Municipal Officials.

3.7 INLET PROTECTION

- A. Install silt fence or straw bales around inlet as specified herein.
- B. Install temporary covers at drainage structure locations that may be subject to erosion infiltration and as directed by the Engineer.
- C. Inspect drainage structures periodically. Remove sediment accumulation and regrade or replace materials as required.

3.8 DUST CONTROL

- A. Throughout the construction period the Contractor shall carry on an active program for the control of fugitive dust within all site construction zones, or areas disturbed as a result of construction. Control methods shall include the following: Apply calcium chloride at a uniform rate of one and one-half (1 ½) pounds per square yard in areas subject to blowing. For emergency control of dust apply water to affected areas. The source of supply and the method of application for water are the responsibility of the contractor.
- B. The frequency and methods of application for fugitive dust control shall be as directed by the Designer with concurrence by the Owner's Representative.

3.9 TEMPORARY PROTECTIVE COVERINGS

- A. Place temporary soil coverings to control erosion and sedimentation on all disturbed or graded areas as required by the construction methods employed and as directed by the Engineer. Erosion control matting shall be installed in all areas seeded or hydroseeded with slopes of one vertical foot to three-foot horizontal, or steeper, immediately after such areas have been seeded and a hay mulch applied as follows:

1. The area to receive matting shall have been recently seeded and shall have a smooth surface free from stones, clods or depressions.
 2. Roll out of the matting perpendicular to the slope, do not stretch the fabric. In drainage swales, center the fabric along the flow line. Install the matting in a check slot at the top and bottom of the slope and at the edges of the area to be covered. Check slots shall be six inches deep and six inches wide. Fabric shall extend down one wall of the check slot and across the full width of the base. Overlap edges of matting rolls four (4) inches minimum and overlap the ends eighteen (18) inches minimum.
 3. Install staples in check slots, edges, center, and ends of rolls by driving specified steel staples two feet on center over the entire area to be covered except at check slots and ends of rolls, where staples shall be placed six inches on center. All staples shall be driven below finished grade.
 4. Fill check slots with loam and tamp firmly.
 5. Reseed check slots and all disturbed areas per Specifications.
 6. Following matting installation, roll the entire area with a smooth drum roller weighing between fifty and seventy-five (50-75) pounds per linear foot of roller. The finished installation of matting shall be firmly in contact with the seeded area and provide a smooth, finished appearance free from lumps or depressions.
- B. Install erosion control matting as a temporary ground cover in all disturbed or graded areas subject to erosion and as directed by the Engineer. The temporary ground cover shall protect the site from erosion until a full permanent lawn can be installed. Install and anchor in place temporary erosion control matting in accordance with manufacturer's printed instructions or as directed by the Engineer and remove all temporary erosion control matting prior to installation of a permanent lawn.
- C. Inspect protective coverings periodically and reset or replace materials as required.
- 3.10 TEMPORARY PROTECTIVE COVERINGS (AFTER GROWING SEASON)
- A. Place temporary covering for erosion and sedimentation control on all areas that have been graded and left exposed after October 30. Contractor shall have the choice to use either or both of the methods described herein.
- B. Hay or straw shall be anchored in-place by one of the following methods and as approved by the Designer with concurrence by the Owner's Representative: Mechanical "crimping" with a tractor drawn device specifically devised to cut mulch into top two inches of soil surface or application of non-petroleum based liquid tackifier, applied at a rate and in accordance with manufacturer's instructions for specific mulch material utilized.
- C. Placement of mesh or blanket matting and anchoring in place shall be in accordance with manufacturer's printed instructions.
- D. Inspect protective coverings periodically and reset or replace materials as required.
- 3.11 REMOVAL AND FINAL CLEANUP
- A. Once the site has been fully stabilized against erosion, and with the approval of the Owner's Representative remove sediment control devices and all accumulated silt. Dispose of silt and

waste materials offsite. Regrade all areas disturbed during this process and stabilize against erosion with surfacing materials as indicated.

END OF SECTION

SECTION 321216.13

ASPHALT | BITUMINOUS CONCRETE PAVING (SITE)

1.1 SUMMARY

- A. Section Includes:
 - 1. Hot-mix asphalt | bituminous concrete paving.

1.2 QUALITY ASSURANCE

- A. Regulatory Requirements: Massachusetts Highway Department (MHD) Standard Specification (for Highways and Bridges), 1988 ed. including all addenda.

1.3 MATERIALS

- A. Bituminous concrete Materials:
 - 1. Asphalt | Bituminous Concrete Binder: AASHTO M 320, performance graded.
 - 2. Asphalt | Bituminous Concrete Cement: ASTM D 3381/D 3381M, viscosity graded.
 - 3. Prime Coat: Cutback bituminous concrete.
 - 4. Tack Coat: Emulsified bituminous concrete.
- B. Auxiliary Materials:
 - 1. Recycled Materials: Reclaimed bituminous concrete pavement; reclaimed, unbound-aggregate base material; and recycled tires, asphalt shingles, and glass.
 - 2. Herbicide.
 - 3. Paving Geotextile: Nonwoven polypropylene.
- C. Mixes:
 - 1. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 10 percent or more than 50 percent by weight.
 - a. Surface Course Limit: No more than 10 percent by weight.
- D. Bituminous Concrete Mixes: Approved by authorities having jurisdiction and designed according to procedures in AI MS-2.
 - 1. Base Course: 2 inch (50mm).
 - 2. Surface Course: 1 inch (25mm).

1.4 INSTALLATION

- A. Hot-Mix Bituminous Concrete Paving:
 - 1. Subgrade proof rolled.
 - 2. Herbicide applied.
 - 3. [Prime coat over unbound-aggregate base course] [tack coat over existing asphalt | bituminous concrete pavement].
 - 4. Base Course: 2 inch (50mm).
 - 5. Surface Course: 1 inch (25mm).

1.5 FIELD QUALITY CONTROL

- A. Testing Agency: Contractor engaged.

END OF SECTION

SECTION 321216

ASPHALT PAVING

PART 1-GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials, and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Hot-mix asphalt paving, including walkways, ramps, and curbs.
 - 2. Hot-mix asphalt patching.
 - 3. Pavement-marking paint.
 - 4. Setting of Curb.
- B. Alternates: Not Applicable.
- C. Items To Be Installed Only: Not Applicable.
- D. Items To Be Furnished Only: Not Applicable.
- E. Related Work: The following items are not included in this Section and will be performed under the designated Sections:
 - 1. Section 312000 - EARTH MOVING for aggregate subbase and base courses and for aggregate pavement shoulders.

1.3 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.
- B. Product Data: For each type of product indicated. Include technical data and tested physical and performance properties.
 - 1. Job-Mix Designs: Certification, by authorities having jurisdiction, of approval of each job mix proposed for the Work.
- C. Shop Drawings: Indicate pavement markings, lane separations, and defined parking spaces. Indicate, with international symbol of accessibility, spaces allocated for people with disabilities. Submit shop drawings for curbing items.
- D. Material Certificates: For each paving material, from manufacturer.

1.4 REFERENCE STANDARDS

- A. The following standards are applicable to the work of this Section to the extent referenced herein:
 - 1. Commonwealth of Massachusetts, Massachusetts Highway Department (MHD), Standard Specifications for Highways and Bridges, latest English Edition with amendments. All references to method of measurement, basis of payment and payment items in the Standard Specifications are hereby deleted. References made to particular sections or paragraphs in the Standard Specifications shall include all related articles mentioned herein.
 - 2. ASTM: American Society for Testing and Materials
 - 3. AASHTO: American Association of State Highway and Transportation Officials
 - 4. ACI: American Concrete Institute
 - 5. MUTCD: Manual on Uniform Traffic Control Devices

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A paving-mix manufacturer registered with and approved by the Massachusetts Highway Department (MHD).
- B. Regulatory Requirements: Comply with materials, workmanship, and other applicable requirements of the Massachusetts Highway Department (MHD) for hot mix asphalt paving work.
 - 1. Comply with requirements of the Massachusetts Highway Department (MHD) Standard Specifications for Highways and Bridges, including supplemental specifications and special provisions.
 - 2. Comply with requirements of the Americans with Disabilities Act (ADA) and the Massachusetts Architectural Access Board (MAAB). If these requirements cannot be met with the grades and slopes indicated on the plans, notify the Designer immediately.
 - 3. Comply with requirements of the local authority having jurisdiction concerning the location and construction of accessible curb cuts.
- C. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01.
 - 1. Review methods and procedures related to hot-mix asphalt paving including, but not limited to, the following:
 - a. Review proposed sources of paving materials, including capabilities and location of plant that will manufacture hot-mix asphalt.
 - b. Review condition of subgrade and preparatory work.
 - c. Review requirements for protecting paving work, including restriction of traffic during installation period and for remainder of construction period.

- d. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver pavement-marking materials to Project site in original packages with seals unbroken and bearing manufacturer's labels containing brand name and type of material, date of manufacture, and directions for storage.
- B. Store pavement-marking materials in a clean, dry, protected location within temperature range required by manufacturer. Protect stored materials from direct sunlight.

1.7 PROJECT CONDITIONS

- A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.
- B. 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. Tack Coat: Minimum surface temperature of 60 deg F.
 - 2. Asphalt Base Course: Minimum surface temperature of 40 deg F and rising at time of placement.
 - 3. Asphalt Surface Course: Minimum surface temperature of 60 deg F at time of placement.
- C. Pavement-Marking Paint: Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 55 deg F for water-based materials, and not exceeding 95 deg F.

1.8 EXAMINATION OF SITE AND DOCUMENTS

- A. It is hereby understood that the Contractor has carefully examined the site and all conditions affecting work under this Section. No claim for additional costs will be allowed because of a lack of knowledge of existing conditions as indicated in the Construction Documents, or obvious from observation of the site.
- B. Plans, surveys, measurements, and dimensions under which the work is to be performed are believed to be correct, but the Contractor shall have examined them for himself during the bidding period and formed his own conclusions as to the full requirements of the work involved.

1.9 ADA AND MAAB COMPLIANCE

- A. Comply with American with Disabilities Act (ADA) and the requirements of the Massachusetts Architectural Access Board (MAAB).
 - 1. Slopes: Walkways as defined by Section 22.1 of 521 CMR, shall be graded to a maximum of 4.5%. The cross-pitch (perpendicular to travel) for walkways and paths shall be constructed at 1.5%. The slopes of ramps and side slopes on handicap curb cuts as defined by Section 21.1 of 521 CMR shall be constructed at 7% maximum.

Ramps as defined in Section 24.1 of 521 CMR, shall be constructed to a maximum slope of 7%.

2. The Contractor is to assume that sidewalk grades will be verified and checked with a 2-foot long electronic 'smart level'.
3. A 5'-0" minimum level, 1.5% pitch, area shall be provided at entrances to buildings. Puddling or ponding of water at the entrances will not be accepted.
4. Handicap parking spaces and access aisles shall be graded level with the slope not to exceed 1.8% in any direction.
5. The requirements specified hereinabove shall supersede the grades indicated on the Drawings. If these requirements cannot be met with the grades indicated on the Drawings, the Designer shall be notified immediately for direction.

PART 2 - PRODUCTS

2.1 AGGREGATES

- A. Coarse Aggregate: ASTM D 692, sound; angular crushed stone, crushed gravel, or cured, crushed blast-furnace slag.
- B. Fine Aggregate: ASTM D 1073 or AASHTO M 29, sharp-edged natural sand or sand prepared from stone, gravel, cured blast-furnace slag, or combinations thereof.
- C. Mineral Filler: ASTM D 242 or AASHTO M 17, rock or slag dust, hydraulic cement, or other inert material.
- D. Reclaimed Asphalt Pavement (RAP): Provide material obtained from the highways or streets by crushing, milling, or planing existing hot mix asphalt pavements.
 1. The proportion of RAP to virgin aggregate for base course mixtures and intermediate course mixtures shall be limited to a maximum of 40% for drum mix plants and 20% for modified batch plants. The maximum amount of RAP for surface course mixtures shall be 10%.

E. RECLAIMED BASE COURSE

1. The work under this item shall consist of scarifying and pulverizing in place the existing asphalt pavement and underlying material, mixing and blending the material, and spreading and compacting the mixture to the lines and grades shown on the Contract Drawings.
2. Equipment such as rear-mounted ripper crushers and cold planing/milling equipment will not be permitted to perform the work under this item.
3. Prior to scarifying and pulverizing the pavement, the Contractor shall locate, protect, or remove all drainage and utility structure castings. All lowered structures shall be protected and covered by a steel plate and all watergates shall be covered as well to prevent any materials from falling into the bottom sections. All materials that fall into any structures as a result of the Contractor's operations shall be removed by the Contractor at no additional cost.

4. The existing full bituminous pavement structure and underlying base materials shall be simultaneously crushed, pulverized, and blended into a homogenous material to create the following gradation:

<u>Sieve Designation</u>	<u>Percent Passing</u>
2-inch	100
1½-inch	70-100
½-inch	50-85
No. 4	30-60
No. 50	8-28
No. 200	0-10

5. The construction operation shall be performed in such a manner as to allow for continuous vehicular access as required by the project schedule. Emergency vehicular access shall be maintained at all times.

2.2 ASPHALT MATERIALS

- A. Asphalt Binder, Performance Graded: AASHTO M320 or AASHTO MP 1a, performance grade as required by MHD Specifications.
- B. Tack Coat: AASHTO M 140 emulsified asphalt, or AASHTO M 208 cationic emulsified asphalt, slow setting, diluted in water, of suitable grade and consistency for application.

2.3 AUXILIARY MATERIALS

- A. Herbicide: Commercial chemical for weed control, registered by the EPA. Provide in granular, liquid, or wettable powder form.
- B. Pavement-Marking Paint: Fast Drying White Water-borne Traffic Paint and Fast Drying Yellow Water-borne Traffic Paint as specified in the "Standard Specifications" under Sections M7.01.23 and M7.01.24, respectively.
1. Color: As indicated
- C. Detectable Warning Panels shall have dome geometry in accordance with ADA Regulations for Detectable Warning on Curb Ramps. They shall be raised truncated domes with a nominal diameter of 0.9-inches, a nominal height of 0.2-inches, and a center-to-center spacing of 1.6 inches to 2.4-inches. Panels shall be 24-inches deep in the direction of travel and the full width of the proposed ramp. The panel shall be a homogeneous glass and carbon reinforced composite, which is colorfast, and UV stable. The panel is to be colored throughout and not a painted coating. The color is to be contrasting to the background sidewalk color. The panels shall have a compressive strength in excess of 10,000 psi, flexural strength in excess of 3,000 psi and a slip resistance in excess of 0.8 wet or dry.
- D. Wheel Stops: Precast, air-entrained concrete, 2500-psi minimum compressive strength, 4-1/2 inches high by 9 inches wide by 72 inches long. Provide chamfered corners, drainage slots on underside, and holes for anchoring to substrate.
1. Dowels: Galvanized steel, 3/4-inch diameter, 10-inch minimum length.

2.4 ASPHALT MIXES

- A. Hot-Mix Asphalt: Dense, hot-laid, hot-mix asphalt plant mixes approved by MHD Specifications and designed according to procedures in AI MS-2, "Mix Design Methods for Asphalt Concrete and Other Hot-Mix Types".

2.5 ASPHALT CURB

- A. Bituminous concrete curb shall conform to Section 501.64 of the Standard Specifications for Class 1 Bituminous Concrete Curb, Type-2 and Type-3 and shall meet the dimensions as shown on the Contract Drawings.
- B. Bituminous concrete shall meet the requirements of Dense Mix as specified in the Standard Specifications under Section M3.12.00.

2.6 GRANITE CURB AND EDGING

- A. Granite curb and edging shall be light gray in color, free of seams and other imperfections, which would affect its structural integrity. The front face of the stone shall be at right angles to the plane of the top and the ends and shall have a smooth surface. The ends of the stones shall be square with the planes of the top and front face to provide flush joints. Top surface shall be sawn cut with a split front face.
- B. Granite curb shall have a top width of 6 inches and a depth of 17 to 19 inches and a minimum length of 6 feet. Granite edging shall have a thickness of 5 to 6 inches and a depth of 11 to 13 inches with a minimum length of 4 feet.
- C. Granite curb to be set on a radius of 100 feet or less shall be cut to the required radius and shall have a minimum length of 6 feet or the length of the curb section, whichever is less. Granite edging set on a radius of 160 feet or less shall be supplied in lengths shorter than 6 feet but no less than 1 foot to provide a smooth appearance.
- D. The ends of all transition curb shall be cut with a power-driven saw to provide a flush vertical joint with adjacent curbing

2.7 PRECAST CONCRETE CURB

- A. Precast concrete curb units shall consist of castings conforming to a 6-inch by 18-inch nominal profile size with a 7-inch base dimension. Straight curb shall be cast in minimum lengths of 6 feet. Straight and curved curb may be cast in lengths of not less than 3 feet for closure sections only. Curb on a radius of 100 feet or less shall be cast in radius forms to the correct radius. The Contractor shall supply special cast corner sections for all corners where curb runs change direction. All curbs shall have a ½ inch chamfered edge on both ends and front sides as detailed. The front top edge shall have a ¾ inch radius and the back top edge shall have a ¼-inch radius.
- B. Curb shall be made of Portland cement types I or III, conforming to ASTM C150. Admixtures shall meet ASTM C233. Forms shall be made of metal to tight, rigid construction with true surfaces. Wood forms are not acceptable except for cast-in-place closure sections.
- C. Concrete mix for curb shall be made of a maximum ¾-inch aggregate with a design strength of 5,000 psi at 28 days. An air-entraining agent shall be added to the mixer in accurately proportioned amounts to give air content to the concrete of not less than 5 percent and not more than 7 percent by volume. A high range water-reducing agent (super plasticizer) shall

be added to the mixer in accurately proportioned amounts to meet design strength requirements and maintain a smooth, dense surface on the curb.

- D. Surface Treatment: Upon removal from the forms, the surfaces of the curb shall have all surfaces rubbed with a carborundum stone to fully remove any rough or imperfections in the cast finish. All curbing sections shall have a uniform color and finish appearance and shall be approved by the Architect. An approved sample shall be standard for the entire job.
- E. Curb shall be reinforced with bars conforming to ASTM A615.

2.8 SEALCOAT

- A. Asphalt emulsion sealcoat shall conform to the requirements of the Asphalt Institute for seal coating. Non-volatile solids shall be 40-70%. No additional water shall be added. The emulsion shall be produced using a colloid mill to ensure homogeneity and appropriate size of the particles in suspension.
- B. Sand shall be washed and graded silica sand, or crushed, washed, and graded slag, free of all contaminants, and conforming within a 40-70 mesh gradation range. The addition of sand shall target 3 lbs.-4 lbs. per gallon.
- C. Sand shall be slowly added into the emulsion with the mixer engaged during the addition of the sand to ensure uniform dispersion and to prevent overloading of the mixing device. No additional water shall be added.
- D. Slow mixing shall be continuous from the time all materials are placed into the mixer until the pavement sealer mix is applied to the pavement by the application equipment. During the entire mixing process, no breaking, segregating, or hardening of the emulsion, and no balling or lumping of the aggregate shall be permitted.
- E. The Contractor shall submit a certified analysis of the proposed asphalt bulk emulsion, non-volatiles content, and ash content.

2.9 SEALANT FOR CRACK FILLING/SEALING

- A. The sealant material shall be a hot pour elastomeric type conforming to the requirements of ASTM D 6690 Type II, together with the following modifications:

Cone Penetration at 77°F (25°C), 150 g, 5 sec.	50 – 90
Flow at 140°F (60°C), 75 degree angle, 5 hrs.	5 mm
Bond at 0°F (-18°C), 100 percent extension, ½" (12.7mm) thick specimen	Pass 5 cycles
Resilience at 77°F (25°C)	25 - 60

- B. Storage, heating instructions, and cautions shall be printed on each box of sealant. The sealant must be able to be reheated to application temperature at least once after the initial heat up without degradation of sealant specifications. Sealant shall have an application life at application temperature of approximately 12 to 15 hours.
- C. Prior to the use of the sealant material, the contractor shall submit to the Engineer, the appropriate material certification or laboratory test indicating that the material meets specification requirements.

PART 3 - EXECUTION

3.1 GENERAL

- A. Subbase under paving shall be compacted as described in Section 312000, EARTH MOVING. Add material meeting the requirements of ordinary borrow to bring the subgrade to the required grade as necessary before placing base course.
- B. The gravel base course shall be spread in layers upon the prepared subgrade conforming to the required line and grade. Gravel shall be placed in compacted layers not more than 4 inches thick compacted to not less than 95 percent of the maximum dry density of the material. Any stone greater than 3 inches in size shall be removed. Compaction shall continue until the surface is even and true to line and grade.
- C. Gravel base course shall be placed on backfilled and compacted trenches to proper grade before placement of pavement.
- D. The edges of existing pavement that is to remain shall be saw cut to an even, straight edge using a power-driver rotary saw; use of a jackhammer is unacceptable. This includes road, parking lot, sidewalk, and utility trench edges.
- E. Asphalt courses shall be spread and compacted to the finished thicknesses as shown on the Contract Drawings. A smooth even surface shall be produced.
- F. Any joints at junctions of old and new pavements shall be sealed with tack coat and covered with sand.

3.2 EXAMINATION

- A. Examine exposed subgrades and subbase surfaces for compliance with requirements for dimensional, grading, and elevation tolerances.
- 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.
- C. Proceed with paving only after unsatisfactory conditions have been corrected.

3.3 COLD MILLING

- A. This work consists of removing bituminous or cement concrete pavements by use of a cold planer in areas designed on the Contract Drawings. The cold planer must be equipped with an elevating device capable of loading planed material directly into dump trucks while operative. It shall have all the necessary safety devices, such as reflectors, headlights, taillights, flashing lights, and backup signals so as to operate safely in traffic both day and/or night.
- B. The cold planer shall be designed and built for planing flexible pavements and possess the ability to plane cement concrete patches when encountered in bituminous pavement. It shall be self-propelled and have the means for planing without tearing or gouging the underlying surface. Variable lacing patterns shall be provided to permit a rough grooved or smooth surface as directed.
- C. The cold planer shall be able to make up to a 3 inch cut or any specified lesser depth may be required in one pass. The minimum width of pavement planed in each pass shall be 6

feet, except in areas to be trimmed and edged. The machine shall be adjustable as to crown and depth and meet the standards set by the Air Quality Act for noise and air pollution.

- D. The planed surface shall conform to the grade and cross-slope required. The surface shall not be torn, gouged, shoved, broken, or excessively grooved. It shall be free of imperfections in workmanship that prevent resurfacing after this operation. Surface texture shall be as specified by the Engineer and excess material shall be removed so the surface is acceptable to traffic if required.
- E. 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.

3.4 PATCHING

- A. Existing Hot-Mix Asphalt Pavement: Saw-cut perimeter of patch and excavate existing pavement section to sound base. Excavate rectangular or trapezoidal patches, extending 12 inches into adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically. Remove excavated material. Recompact existing unbound-aggregate base course to form new subgrade.
- B. Existing Portland Cement Concrete Pavement: Break cracked slabs and roll as required to reseat concrete pieces firmly.
 - 1. Remove disintegrated or badly cracked pavement. Excavate rectangular or trapezoidal patches, extending into adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically. Recompact existing unbound-aggregate base course to form new subgrade.
- C. Tack Coat: Apply uniformly to vertical surfaces abutting or projecting into new, hot-mix asphalt paving at a minimum 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. Patching: Fill excavated pavements with hot-mix asphalt base mix for full thickness of patch and, while still hot, compact flush with adjacent surface.

3.5 SURFACE PREPARATION

- A. General: Immediately before placing asphalt materials, remove loose and deleterious material from substrate surfaces. Ensure that prepared subgrade is ready to receive paving.
- B. Herbicide Treatment: Apply herbicide according to manufacturer's recommended rates and written application instructions. Apply to dry, prepared subgrade or surface of compacted-aggregate base before applying paving materials.
- C. 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.

3.6 HOT-MIX ASPHALT PLACING

- A. Machine place hot-mix asphalt on prepared surface, spread uniformly, and strike off. Place asphalt mix by hand to 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. Spread mix at minimum temperature of 250 deg F.
 2. 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.
- 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.

3.7 JOINTS

- A. Construct joints to ensure a continuous bond between adjoining paving sections. Construct joints free of depressions, with same texture and smoothness as other sections of hot-mix asphalt course.
 1. Clean contact surfaces and apply tack coat to joints.
 2. Offset longitudinal joints, in successive courses, a minimum of 6 inches.
 3. Offset transverse joints, in successive courses, a minimum of 24 inches.
 4. Construct transverse joints at each point where paver ends a day's work and resumes work at a subsequent time. Construct these joints using either "bulkhead" or "papered" method according to AI MS-22, for both "Ending a Lane" and "Resumption of Paving Operations."

3.8 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: ASTM D 2041, per MHD Specifications.
- 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. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.
- G. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

3.9 ASPHALT CURBS

- 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 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.

3.10 CURBING AND EDGING

- A. Construct curbing and edging of the type and at the locations shown on the Contract Drawings.
- B. Construct curbing and edging in accordance with the details shown on the Contract Drawings.
 1. The foundation for curb and edging shall consist of gravel spread upon the subgrade and after being thoroughly compacted shall be 6 inches in depth. The bottom of the curbstones shall be fully seated and supported on the compacted subgrade.
 2. The joints between curbstones shall be carefully filled with cement mortar and neatly pointed on all exposed surfaces.
 3. After pointing, the curbstones shall be cleaned of all excess mortar.
- C. After curbing and edging is in place at the line and grade shown on the Contract Drawings, backfill and compact equally on both sides with subbase course material, as specified in Section 312000 – EARTH MOVING. Compaction shall be by vibratory, hand-operated equipment, and shall achieve the same density as specified for subbase course in Section 312000 – EARTH MOVING.

3.11 INSTALLATION TOLERANCES

- A. Accessibility: Comply with requirements of Massachusetts Architectural Access Board and ADAAG requirements. Remove and replace paving that does not meet required tolerances when measured with a 2 foot straight edge.

- B. 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.
- C. Pavement Surface Smoothness: Compact each course to produce a surface smoothness within MHD Specification tolerances as determined by using a 10-foot straightedge applied transversely or longitudinally to paved areas.

3.12 SEALCOATING

- A. Contractor shall provide all tools and equipment necessary to perform the work, including but not limited to brushes, hand squeegees, pumps and hose equipment, storage tanks, mixing tanks, water distributors, power sweepers, blowers, barricades, and applicator equipment.
 - 1. Spray equipment used on the job shall have full sweep mechanical agitators incorporated in their construction to assure homogeneous mixing of the asphalt emulsion sealer, sand, and water (if required). The pumping system must be adequate to apply a uniform coating at the specified rates of application. Equipment requiring pressurization of the mixing tank for distribution will not be used.
 - 2. Motorized squeegee application equipment used on the job will have two or more devices such as squeegees and/or drag broom assemblies to assure even distribution of the asphalt emulsion sealer. A full sweep mechanical agitator will be incorporated into the construction of the applicator to assure homogeneous mixing of the emulsion.
 - 3. Mixing or agitating equipment may be either portable powered or a tank-type power mixer. In any case, mixers shall be of sufficient capacity to assure homogeneous mixing of the emulsion and to maintain complete suspension of mineral aggregate until the emulsion is applied to the pavement. All storage tanks shall be equipped with mechanical agitators sufficient to keep the asphalt emulsion homogeneous during storage.
- B. The contractor shall coordinate their activities with each other to ensure the availability of the work area to avoid delaying the execution of the project, to maintain traffic flow, and to minimize activities that might be detrimental to the work in progress, other customer or construction traffic.
- C. Surface to receive sealcoat must be free of all foreign material and dry immediately prior to application of sealer.
- D. Remove oil and grease spots that have not permanently damaged or softened the pavement by scrubbing with a detergent and flushing with water until a water-break-free surface is obtained. Oil and grease spots with deeper penetration will be treated by burning with hand held propane torch, and then coating the spot with an approved oil spot primer compatible with the sealer. If the oil spot is so severe as to cause permanent deterioration of the pavement, or if the pavement has failed due to other causes, the pavement shall be removed to the full depth of the damage and replaced with new asphalt pavement.
- E. Existing pavement markings shall be blackened with black epoxy or black acrylic coatings. Excessive buildup of old lines should be abraded before any prime coats of emulsion are applied.

- F. Cracks in excess of 1/4", but less than one inch in width must be crack filled prior to application.
- G. Pavement shall be cleaned by air blowing, vacuum, or mechanical sweeper.
- H. Asphalt sealcoat shall not be placed on new asphalt concrete until a 30 day cure time has occurred.
- I. Application of asphalt sealcoat shall be by mechanical means using rubber faced squeegees, brooms, distributor bar/wand in combination. Two (2) coat application.
 - 1. The coating shall be applied uniformly over the entire pavement surface and free of voids and pinholes. Subsequent coats shall be applied only after the previous coat is dried, preferably after 24 hours of cure time, but after no less than 4 hours under ideal conditions. Ideal conditions are temperatures in excess of 70° F, sunshine, and less than 60% relative humidity. Marginal conditions can require curing times greater than 24 hours. Subsequent coats shall be applied at right angles to the previous coat, if possible.
 - 2. First coat mechanical squeegee self-propelled is recommended, but wand application is allowed. Second coat by spray wand to lock down exposed aggregate and to return the parking lot to a proper aesthetic appearance free of streaks and marks.
 - 3. Application rate for each coat shall be 13 to 17 gallons per 1,000 SF as recommended by the Asphalt Sealcoat Manufacturers Association. Alternative application rates may be allowed if approved by Engineer.
 - 4. Sealer shall not be applied unless the temperature is a minimum 50° F and rising and pavement temperature is 60° F and rising. Work shall be completed so that there is a minimum of three hours of sunlight remaining after completing the day's work. Sealer shall not be applied under rainy or wet conditions such as an overcast sky with high humidity. UNDER NO CIRCUMSTANCES shall work, be performed under cold and/or wet conditions, nor shall emulsion be used that has been subjected to freezing weather.
 - 5. In hot weather application 80° F or higher (pavement temperatures are in excess of 120° F) fog spraying of pavement with potable water shall be used to achieve better bond and even spreading of material. Properly applied fog spray shall dampen pavement without leaving puddles. Seal coat application shall not commence until it is determined there is no standing water to prevent even application and drying of the asphalt sealer.
 - 6. Striping for parking and traffic flow should be done only after the sealcoat has dried completely to accept approved traffic paint
- J. PAVEMENT CLEANING AND PROTECTION
 - 1. The pavement surface and all work areas shall be left in a clean condition.
 - 2. Vehicular traffic shall not be permitted on the pavement that has been sealed during the dry period. The contractor shall supply all temporary traffic control devices (barricades, cones, signing, etc.) to protect the sealant. Any damage to uncured sealant shall be repaired at the contractor's expense.

3.13 CRACK FILLING/SEALING

- A. Contractor shall provide all tools and equipment necessary to perform the work, including but not limited to Routers (Vertical-Spindle and/or Rotary-Impact), Hot Compressed Air Heat Lance, Hot-applied Sealant Applicators, Wire-brushes, and compressed air equipment.
1. Router: The routing machine shall be an impact router equipped with carbide-tipped vertical-sided bits. It shall be portable and capable of routing existing asphalt surfaces along and adjacent to the crack and joint. The unit shall be capable of following random cracks and be designed to adjust the cutting widths. The unit shall be equipped with a cutter head clutch and shall have an adjustable depth control.
 2. Hot Compressed-Air Lance (HCA): The HCA shall be capable of producing air temperature up to 2500°F and constructed of suitable hardware. It shall be provided with separate valves to control propane, burner air, and lance air. The fuel and burner air shall be mixed only at the point of combustion before leaving the burner tube. A separate air lance tube shall pass inside the burner chamber and be orificed to a maximum 1/4". At the fuel source, a high-pressure regulator to control fuel pressure from 5 PSI to 30 PSI and to prevent flashback shall be used. Burner BTU should range from 20,000 to 500,000 BTU. A wheel kit constructed to keep the unit at the proper height and angle from the pavement should be used. No external flame shall be allowed to touch the pavement.
 3. Hot-Applied Sealant Applicator (melter): The melter applicator unit shall be a self-contained double boiler device with the transmittal of heat through a heat transfer oil. It must be equipped with an onboard automatic heat-controlling device to permit the attainment of a predetermined temperature, then maintain that temperature as long as required. The unit shall have a means to vigorously and continuously agitate the sealant. The sealant shall be transferred from the unit to the crack by means of a direct-connected feed hose and wand. The equipment should be designed to allow the sealant to be circulated back into the unit when sealing is not being performed or equipped with a temperature controlled heated hose and wand that does not require circulation. The sealant should not be heated to a temperature in excess of that specified by the manufacturer.
- B. CRACK PREPARATION PROCEDURES
1. Hairline cracks (less than 1/4") require no preparation
 2. Small to Medium Cracks (1/4" to 1-1/4"): All open cracks and joints from 1/4" to 1-1/4" shall be routed to remove at least 1/8" from each sidewall. This will result in a minimum reservoir width of 1/2" to a maximum reservoir width of 1-1/2". Widening the cracks 1/8" from each sidewall will reduce the potential for raveling of the pavement along the edges of cracks and will provide a sealant reservoir that has vertical faces. The depth of the routing shall be approximately a one to one ratio (width to depth), with a minimum depth of approximately 3/4". Backer rods can be used for deeper cracks (over 1-1/4" deep) to minimize material loss and still provide an acceptable seal.
 3. Large Cracks (Greater than 1-1/4"). Cracks wider than 1-1/4" shall be prepared in the same manner as potholes. A saw shall be used to cut away damaged pavement to provide a vertical face. The area should then be cleaned and filled with hot mix asphalt instead of sealed.
 4. No sealant shall be installed until all cracks and joints have to be cleaned free of all deleterious materials, including any dust, old sealant, incompressible material, and

organic material, and are sufficiently dry. Following the initial routing and cleaning operation, all cracks and joints shall be HCA lanced within 10 minutes of application of the sealant. Equipment for the two operations should be kept in a compact configuration such that not more than 50 feet separates equipment required by the two operations. Extreme care shall be used to ensure the crack sidewalls do not become overheated and burned.

5. When vegetation exists in the cracks and joints, it shall be removed and those cracks and joints shall be treated with a herbicide that sterilizes the soil.

C. APPLICATION OF CRACK AND JOINT SEALANT

1. The sealant shall be applied in the crack or joint reservoir uniformly from the bottom to the top and shall be filled without formation of entrapped air or voids.
2. Pouring pots or gravity-fed sealant applicators shall not be used for sealing cracks and joints.
3. Joints and cracks shall be filled flush with the surface and any overfill shall be squeegeed so that the overband cap does not exceed 1/16" above the surface and the width does not exceed 2" beyond the crack edges.
4. All overbanding shall be kept to a minimum. After the sealant has cooled, settling shall not exceed 3/8" below the surface.

D. PAVEMENT CLEANING AND PROTECTION

1. The pavement surface and all work areas shall be left in a clean condition.
2. Vehicular traffic shall not be permitted on the pavement in the areas of the treated cracks and joints during the curing period. The contractor shall supply all temporary traffic control devices (barricades, cones, signing, etc.) to protect the sealant. Any damage to uncured sealant shall be repaired at the contractor's expense.

3.14 PAVEMENT MARKING

- A. Do not apply pavement-marking paint until layout, colors, and placement have been verified with Designer.
- B. Allow paving to age for a minimum of 30 days before starting pavement marking.
- C. Sweep and clean surface to eliminate loose material and dust.
- D. Apply paint with mechanical equipment to produce pavement markings, of dimensions indicated, with uniform, straight edges. Apply at manufacturer's recommended rates to provide a minimum wet film thickness of 15 mils.

3.15 WHEEL STOPS

- A. Securely attach wheel stops to pavement with not less than two galvanized-steel dowels embedded at one-quarter to one-third points. Securely install dowels into pavement and bond to wheel stop. Recess head of dowel beneath top of wheel stop.

3.16 FIELD QUALITY CONTROL

- A. Independent Testing Agency: Cooperate with the Independent Testing Agency engaged by Owner for field quality control activities for the Work of this Section. Refer also to Section 014325 - TESTING AGENCY SERVICES.
- B. Test the plane of the finished surfaces of base, binder, and surface courses with a 16-foot straightedge, except use a 10-foot straightedge on vertical courses and on the top course of resurfaced streets which contain manhole covers, valve boxes, and the like.
- C. Carefully apply the straight edge immediately after the first compaction by rolling, and from then on as may be necessary until and after the final compaction of the material in place. Hold the straightedge in successive positions parallel to the road centerline and in contact with the road surface; check the entire area from one side of the pavement to the other.
- D. Correct irregularities which vary $\frac{3}{8}$ inch from a true finished surface in base and binder courses, and $\frac{1}{4}$ inch in top courses.
- E. Irregularities which may develop before the completion of rolling and while the material is still workable may be remedied by loosening the surface mixture and removing or adding material as necessary. Should any unsatisfactory irregularities or defects remain after final compaction, the defective work shall be corrected by removing and replacing with new material to form a true and even surface.

3.17 OPENING TO TRAFFIC

- A. No vehicular traffic or loads shall be permitted on the newly completed pavement until all of the following conditions are met:
 - 1. Adequate stability has been attained.
 - 2. The material has cooled sufficiently to prevent distortion or loss of fines.
 - 3. The pavement has achieved a maximum temperature of 140 degrees F.
- B. If the climatic or other conditions warrant it, the period of time before opening to traffic may be extended at the discretion of the Designer.

3.18 DISPOSAL

- A. Except for material indicated to be recycled, remove excavated materials from the Project site, and legally dispose of them in an EPA-approved landfill.

END OF SECTION

SECTION 321313.13
CONCRETE PAVING (SITE)

1.1 SUMMARY

- A. Section Includes:
 - 1. Concrete sidewalk and plazas.

1.2 QUALITY ASSURANCE

- A. Installer Qualifications: Engage and experienced installer who has completed pavement work similar in material, design, and extent to that indicated for this project and with a record of successful in-service performances.
- B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.
- C. Source Limitations: Obtain each type of class of cementitious material of the same brand from the same manufacturer's plant and each aggregate from one source.

1.3 PRODUCTS FORM MATERIALS

- A. Form Materials: Plywood, metal, metal-framed plywood, or other approved panel-type materials to provide full-depth, continuous, straight, and smooth exposed surfaces.
- B. Plain-Steel Welded Wire Reinforcement: ASTM A 185/A 185M, fabricated from steel wire into flat sheets.
- C. Epoxy-Coated, Joint Dowel Bars: ASTM A 775/A 775M; with ASTM A 615/A 615M, Grade 60 (Grade 420), plain-steel bars.

1.4 CONCRETE MATERIALS

- A. Cement: Shall be American-made Portland Cement; and conform to chemical and physical requirements of ASTM C150/C 150M for Type I for exposed concrete and Type II, low alkali, standard gray color for all other work.
- B. Proportion mixtures to provide normal-weight concrete with the following properties:
 - 1. Compressive Strength (28-days): 4,000 psi (27.6 MPa).
 - 2. Water/Cement Ratio (maximum): 0.45-percent by weight (mass).
 - 3. Slump Limit: Maximum 3-inches (16.2 mm) to 5-inches (125 mm) a time of placement.
- C. Add air-entraining admixture at manufacturer's prescribed rate to result in normal-weight concrete at point of placement having an air content as follows:
 - 1. Air Content: 6 percent, plus or minus 1 percent at point of delivery for ¾ inch nominal maximum aggregates size (applies to footings and foundation walls and all other concrete exposed to freeze/thaw action).

- D. Limit water-soluble, chloride ion content in hardened concrete to 0.15-percent by weight of cement.

1.5 INSTALLATION

- A. Form construction, isolation, and contraction joints and tool edges true to line, with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline unless otherwise indicated.
- B. Construction Joints.
- C. Expansion Joints.
- D. Contraction Joints.
- E. Float Finish.
 - 1. Medium-to-Coarse-Textured Broom Finish: Provide a coarse finish by striating float-finished concrete surface 1/16 to 1/8 inch (1.6 to 3 mm) deep with a stiff-bristled broom, perpendicular to line of traffic.
- F. Detectable Warnings.

1.6 FIELD QUALITY CONTROL

- A. Testing and Inspecting: Engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.
- B. Field Inspection and testing will be performed in accordance with ACI 301.

END OF SECTION

SECTION 321373

CONCRETE PAVING JOINT SEALANTS

1.1 SUMMARY

- A. Section includes:
 - 1. Cold-applied joint sealants.
 - 2. Hot-applied joint sealants.

1.2 PRECONSTRUCTION TESTING

- A. Preconstruction compatibility and adhesion testing.

1.3 MATERIALS

- A. Colors of Exposed Joint Sealants: shall be shall match as closely as possible the color of the surrounding materials and shall be approved by Owner's Representative from sealant manufacturer's full range.
- B. Joint-Sealant Backer Materials: use round backer rods for expansion (isolation) joints, per detail. Use backer strips to protect concrete as it cures.

1.4 SCHEDULE

- A. Joint-Sealant Application: Joints within cement concrete pavement
 - 1. Location: Expansion (isolation) and contraction joints in cast-in-place concrete pavement shall be per plan.
 - 2. Material: Multicomponent, non-staining, self-leveling, non-sag, silicone, or pourable, traffic-grade, Class 25, urethane as detailed and appropriate for each application for joint sealant for concrete.
- B. Joint-Sealant Application: Joints between cement concrete and asphalt pavement.
 - 1. Location: Joints between pedestrian concrete and asphalt pavement; Joints between concrete curbs and pedestrian asphalt pavement.
 - 2. Material: Hot-applied, single-component joint sealant for concrete and asphalt.

END OF SECTION

SECTION 321700

LANDSCAPE PAVING SPECIALTIES

1.1 SUMMARY

- A. Section Includes:
 - 1. Stone drip strip.
 - 2. Aluminum edge restraints.

1.2 QUALITY ASSURANCE

- A. Mockups: Construct a sample panel of each paving surfacing on the corresponding specified base and setting bed before start of any surfacing.

1.3 MATERIALS

- A. Graded aggregate for subbase.
- B. Graded aggregate for base.
- C. Aluminum edge restraints.
- D. Filter fabric for stone drip strip.
- E. Stone drip strip.

1.4 STONE DRIP STRIP SURFACING

- A. Drip strip surfacing shall be placed only after planting, excavation and construction work that might injure the surfacing have been completed.
- B. Drip strip stone shall be spread in layers not more than 4" thick compacted measure and all layers shall be compacted to not less than 95% of the maximum dry density of the material.
- C. Compaction shall continue until the surface is even and true to the proposed lines and grades within a tolerance of 1/8".

END OF SECTION

SECTION 321723.13

PAVEMENT MARKINGS - PLAY

1.1 SUMMARY

- A. Section includes:
 - 1. Painted markings applied to asphalt multiuse sport court, four-square, and hopscotch pavement.

1.2 QUALITY ASSURANCE

- A. Regulatory Requirements: Comply with materials, workmanship, and other applicable requirements for pavement-marking work.

1.3 SPORT COURT, FOUR SQUARE, HOPSCOTCH-MARKING PAINT

- A. Sport Court- Marking Paint: Acrylic Latex line-marking paint.

1.4 SPORT COURT, FOUR SQUARE, HOPSCOTCH- MARKING

- A. Allow paving to age for a minimum of 30 days before starting pavement marking.
- B. Apply paint with mechanical equipment to produce pavement markings, of dimensions indicated, with uniform, straight edges. Apply at manufacturer's recommended rates to provide a minimum wet film thickness of 15 mils (0.4 mm).

END OF SECTION

SECTION 321726

TACTILE WARNING SURFACING

1.1 SUMMARY

- A. This Section includes:
 - 1. This Section includes Specifications for furnishing and installing embedded Cast Iron Detectable Warning Surface Plates with an in-line truncated dome pattern embedded in concrete at pedestrian crossings, boarding platforms, and rail crossing locations to the dimensions shown on the Drawings.

1.2 QUALITY ASSURANCE

- A. Provide Cast Iron Detectable Warning Surface Plates and accessories as produced by a single manufacturer with a minimum of five years of experience in manufacturing Cast-In-Place Detectable Warning Surface Products.

1.3 INSTALLATION WARRANTY

- A. Cast Iron Detectable Warning Surface Plates installation shall be warranted in writing for two (2) years by the installer. Products must be guaranteed from defective work and loosening of plates.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Cast Iron Detectable Warning Surface Plates
- B. Domes: Raised truncated domes of 0.2" (5.0 mm) nominal height, base diameter of 0.9" (22.8 mm) and top diameter of 0.45" (11.4 mm). ADA Standards and Public Rights-of-Way Accessibility Guidelines require truncated dome spacing range of 1.6"-2.4" (40.6-60.9 mm).
- C. Dome Spacing:
 - 1. Standard Rectangular Plates: 2.4" (60.9 mm) dome spacing in square grid pattern
 - 2. Radius Wedge Plates: 1.67" to 2.4" (40.6-60.9 mm) dome spacing in radial pattern

END OF SECTION

SECTION 321810
COURT SURFACING

1.1 SUMMARY

- A. Section includes:
 - 1. Multiuse sport court sealcoat.

1.2 QUALITY ASSURANCE

- A. Regulatory Requirements: Comply with materials, workmanship, and other applicable requirements for pavement-marking work.

1.3 COLOR SEALCOAT

- A. Filler Coat.
- B. Color Emulsion.
- C. Finish Coat.

1.4 COLOR SEALCOAT SYSTEM

- A. Allow paving to age for a minimum of 14 days before starting color sealcoat marking.
- B. The two filler coats shall be applied so that both coats are of a total quantity and with a uniform spread at the rate of 1 gallon/ 100 square feet of surface area.
- C. After the filler coat applications have been completed and approved by the Owner's Representative, apply one acrylic color emulsion coating to the properly prepared surfaces with a uniform spread at the rate of 1 gallon/ 200 square feet of surface area.

END OF SECTION

SECTION 321816.13

PLAYGROUND PROTECTIVE SURFACING

1.1 SUMMARY

- A. Section includes:
 - 1. Unitary synthetic Poured-in-Place Resilient Rubber Surfacing; bonded rubber seamless surface.

1.2 WARRANTY

- A. Warranty Period: All safety surfacing shall be free of defects due to workmanship or material for a minimum of two (2) years from the date of installation. A minimum of 15 years performance warranty is required for Poured-in-Place safety surfacing.

1.3 PRODUCTS

- A. Unitary Synthetic Seamless Surface: Poured-in-place, two-layer system.
 - 1. Recycled content.
 - 2. Provide manufacturer's standard thickness for each layer as required for overall thickness indicated, tested for impact attenuation according to ASTM F 1292 and for accessibility according to ASTM F 1951.

1.4 FIELD QUALITY CONTROL

- A. Testing: By Contractor-engaged agency.

END OF SECTION

SECTION 323113
CHAIN LINK FENCES

1.1 SUMMARY

- A. Section Includes:
 - 1. Chain-link fences.

1.2 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design chain-link fences and gates, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. Structural Performance: Chain-link fence and gate framework shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions.
- C. Lightning Protection System: Maximum grounding-resistance value of 25 ohms under normal dry conditions.

1.3 QUALITY ASSURANCE

- A. Testing Agency Qualifications: For testing fence grounding. Member company of NETA or an NRTL.
- B. Emergency Access Requirements.

1.4 WARRANTY

- A. Warranty Period: Five years from date of Substantial Completion.

1.5 CHAIN-LINK FENCE

- A. Fabric Fabric: Steel Wire Mesh; sized 2 inches (50 mm).
- B. Posts and Rails: Light Industrial strength; round shape.
- C. Horizontal Framework Members: top and bottom rails.
- D. Tension Wire: Steel.
- E. Steel Finish: Polymer coated.
- F. Fittings: Steel.
- G. Privacy Slats: PVC.
- H. Fence Grounding: Copper.

1.6 INSTALLATION

- A. Chain-Link Fencing: ASTM F 567.
- B. Post Setting: Set posts in concrete.
- C. Grounding and Bonding: NFPA 780.

1.7 FIELD QUALITY CONTROL

- A. Grounding-Resistance Testing: Engage a qualified testing agency to perform tests and inspections.

END OF SECTION

SECTION 323119

DECORATIVE METAL FENCES AND GATES (AMERISTAR)

1.1 SUMMARY

- A. Section Includes:
 - 1. Decorative steel guard fence.

1.2 PERFORMANCE REQUIREMENTS

- A. Lightning-Protection System: Maximum grounding-resistance value of 25 ohms under normal dry conditions.

1.3 DECORATIVE METALLIC-COATED-STEEL PICKET FENCES & GATES

- A. Decorative Metallic-Coated-Steel Picket Fences: Comply with ASTM F 2408 for light industrial (commercial) application unless otherwise indicated.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. "Montage Commercial Steel Fence" manufactured by Ameristar Fence Products, Inc., 1555 N. Mingo Road, Tulsa, OK 74116; Tel: 888.333.3422; Web: www.ameristarfence.com.
- B. Fasteners.
- C. Fence posts and gate posts shall meet the minimum size requirements per manufacturer.
- D. Hardware.

1.4 FABRICATION

- A. Pickets, rails and posts shall be pre-cut to specified lengths. Rails shall be pre-punched to accept pickets.
- B. Coated panels and posts shall be capable of meeting the performance requirements.

1.5 INSTALLATION

- A. Fence post shall be spaced according to manufacturer's recommendation, plus or minus 1/4".

END OF SECTION

SECTION 323300

SITE FURNISHINGS

1.1 SUMMARY

- A. Section includes:
 - 1. Benches; backless.
 - 2. Litter and recycling receptacle.
 - 3. Bicycle rack.

1.2 BENCHES; BACKLESS

- A. Products: Subject to compliance with requirements, provide the following:
 - 1. Backless Benches shall be Knight Bench, FSC recycled, reclaimed teak hardwood slats, 4-foot length, aluminum frame, backless as shown on the drawings and as manufactured by Forms+Surfaces.

1.3 LITTER AND RECYCLING RECEPTACLES

- A. Products: Subject to compliance with requirements, provide the following:
 - 1. Litter and Recycling Receptacle shall be "Universal Litter and Recycling Receptacle" 36 gallon, split- stream, with standard side-opening and lid surface mount (on concrete base) as manufactured by Forms+Surfaces.

1.4 BICYCLE RACKS

- A. Products: Subject to compliance with requirements, provide the following:
 - 1. Bicycle Rack shall be Trio Hoop; Finish: TGIC Polyester Powder Coating, color silver, mounted: embedded, as manufactured by Forms+Surfaces.

1.5 MATERIALS

- A. Aluminum: Alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated; free of surface blemishes.
- B. Stainless Steel: Free of surface blemishes.
- C. Wood: Surfaced smooth on four sides with eased edges; kiln dried, free of knots.
- D. Fiberglass: Multiple laminations of glass-fiber-reinforced polyester resin with UV-light stable, colorfast, nonfading, weather- and stain-resistant, colored polyester gel coat, and with manufacturer's standard finish.
- E. Plastic: Color impregnated, color and UV-light stabilized, and mold resistant.

END OF SECTION

SECTION 329200

TURF AND GRASSES

1.1 SUMMARY

- A. Section includes:
 - 1. Fine grading and loaming.
 - 2. Seeding.
 - 3. Hydroseeding.
 - 4. Turf renovation for damaged areas.
 - 5. Erosion-control material(s).
 - 6. Maintenance and protection.

1.2 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified landscape Installer whose work has resulted in successful turf and meadow establishment.
 - 1. Professional Membership: Installer shall be a member in good standing of either the Professional Landcare Network or the American Nursery and Landscape Association.
 - 2. Experience: Three years' experience in turf installation of similar quality, schedule requirement and construction detailing.
 - 3. Installer's Field Supervision: Require Installer to maintain an experienced full-time foreman or crew leader on Project site when work is in progress.
 - 4. Personnel Certifications: Installer's foreman or crew leader shall be either a certified landscape professional or a certified horticulturalist.
 - 5. Pesticide Applicator: State of Massachusetts licensed, commercial.
- B. Soil-Testing Laboratory Qualifications: An independent laboratory or university laboratory.
- C. Soil Analysis: For each unamended soil type.

1.3 MAINTENANCE SERVICE

- A. Initial Turf Maintenance Service:
 - 1. Seeded Turf: 60 days from date of final acceptance of lawn areas.

1.4 MATERIALS

- A. Grass Seed Mixes:
 - 1. General Lawn Seed Mixture Composition; shall be "**Tall Fescue Blue Mix**" composed by the following species as supplied by: Summit Seed.
 - 2. Slope | Sustainable Lawn Seed Mixture Composition; shall be "**Logro Fescue Mix**" composed by the following species as supplied by: Summit Seed.
 - 3. Multi-use Lawn Seed Mixture Composition; shall be "**Tall Fescue Blue Athletic Seed Mix**" composed by the following species as supplied by: Summit Seed.
- B. Limestone is used to raise pH and neutralize acidic soils. In first paragraph below, insert percentages of carbonates, calcium, and magnesium if required. Revise to a pelleted form of limestone with a water-soluble binder that speeds breakdown if required.

- C. Lime: ASTM C 602, agricultural liming material containing a minimum of 80 percent calcium carbonate equivalent.
- D. Compost: Well-composted, stable, and weed-free organic matter.
- E. Sphagnum Peat: Partially decomposed sphagnum peat moss.
- F. Manure: Well-rotted, unleached, stable or cattle manure containing not more than 25 percent by volume of straw, sawdust, or other bedding materials.
- G. Bonemeal: Commercial, raw or steamed, finely ground.
- H. Superphosphate: Commercial, phosphate mixture, soluble.
- I. Commercial Fertilizer: Commercial-grade complete fertilizer of neutral character.
- J. Slow-Release Fertilizer: Granular or pelleted.
- K. Planting Soil for Seeded and Sodded Lawn.
- L. Planting Soil for Naturalized Meadow.
- M. Straw Mulch.
- N. Fiber Mulch for hydro-seeding.
- O. Nonasphaltic Tackifier for hydro-seeding.
- P. Asphalt Emulsion for straw mulching.
- Q. Water: Suitable for irrigation and free of substance harmful to plant growth.
- R. Pre-Emergent Herbicide (Selective and Non-Selective).
- S. Post-Emergent Herbicide (Selective and Non-Selective).
- T. Erosion-Control Blankets: Biodegradable wood excelsior, straw, or coconut-fiber mat enclosed in a photodegradable plastic mesh.
- U. Erosion-Control Fiber Mesh: Biodegradable burlap or spun-coir mesh, a minimum of 0.92 pounds / square yard, with 50 to 65 percent open area.

END OF SECTION

SECTION 329300

PLANTS

1.1 SUMMARY

- A. Section includes:
 - 1. Planting trees, shrubs, rain gardens, vines, groundcover, bulbs and perennials.
 - 2. Planting soils.
 - 3. Tree stabilization.
 - 4. Landscape edgings.
 - 5. Mulching.
 - 6. Maintenance.

1.2 MAINTENANCE SERVICE

- A. Initial Maintenance Service for Trees, Shrubs, Rain Gardens, and Vines:
 - 1. Maintenance Period: 60 days from date of final acceptance of trees, shrubs, rain gardens, and vines.
- B. Initial Maintenance Service for Perennials, Ground Cover and Other Plants:
 - 1. Maintenance Period: 60 days from date of final acceptance of perennials, ground covers and other plants.

1.3 MATERIALS

- A. Plants: Furnish nursery-grown plants true to genus, species, variety, cultivar, stem form, shearing, and other features indicated in Plant Schedule or Plant Legend shown on Drawings and complying with ANSI Z60.1 "Standardized Plant Names" by the American Joint Committee on Horticultural Nomenclature.
- B. Lime.
- C. Compost.
- D. Manure.
- E. Bonemeal.
- F. Superphosphate.
- G. Commercial Fertilizer.
- H. Slow-Release Fertilizer: Granular or pelleted.
- I. Chelated Iron.
- J. Planting Soil for Trees, Shrubs, Ground Covers, Vines and Perennials.
- K. Organic Mulch.

- L. Pre-Emergent Herbicide (Selective and Non-Selective).
- M. Post-Emergent Herbicide (Selective and Non-Selective).
- N. Stakes and Web Guys.
- O. Steel Edging.
- P. Aluminum Edging.
- Q. Mycorrhizal Fungi.
- R. Slow-release Watering Bags.

END OF SECTION

SECTION 331000

WATER UTILITIES

PART 1-GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all SECTIONS within DIVISION 1 – GENERAL REQUIREMENTS, which are hereby made a part of this Section of Specifications.

1.2 DESCRIPTION OF WORK

- A. Provide labor, materials, and equipment necessary to construct the exterior water system complete, including connections to existing pipelines and testing, all as indicated on the Drawings and as specified, including but not limited to the following:
 - 1. Installation of ductile iron pipe, fittings, accessories, and appurtenant work, at the locations and to the lines and grades indicated on the Contract Drawings.
 - 2. The installation of hydrants, gate valves and boxes and concrete thrust blocks.
 - 3. Furnishing and installation of all materials required to connect to existing water mains, replace existing services, install new gate valves, remove existing gate valves, install corporation cocks, saddles, curb stops, service boxes, and abandoning of the existing water system (if applicable), all as shown on the Contract Drawings. All valves, 24 inches and larger shall be butterfly valves. All abandoned pipes shall be cut and capped at the main.
 - 4. In accordance with 528 CMR 11.00, work on the fire protection system, including hydrants and exterior underground piping, shall be performed by a Licensed Fire Protection Sprinkler Systems Contractor. The fire protection exterior underground piping will terminate at the valved tee connection to the water distribution system. The tee and valve will not be considered part of the fire protection system work.
- B. Unless otherwise indicated on the Drawings, exterior water lines shall be installed from a point 10 feet outside the building foundation walls to the potable water source
- C. Related Work: The following items are not included in this Section and will be performed under the designated Sections.
 - 1. Section 312300 - EXCAVATION & FILL FOR UTILITIES AND PAVEMENT for aggregate subbase and base courses and for aggregate pavement shoulders
 - 2. Section 211000 – FIRE PROTECTION for fire protection service piping.
 - 3. Section 221000 – PLUMBING for potable water service piping.

1.3 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.
 - 1. Descriptive literature showing pipe dimensions, pipe and joint materials and dimensions, and other details for each class or type of pipe or product to be furnished for this contract. All pipe furnished under the contract shall be manufactured in accordance with these Specifications.
 - 2. Product Data: Submit manufacturer's technical product data and installation instructions for potable water system materials and products.

3. Shop Drawings: The Contractor shall submit for review shop drawings or descriptive literature for potable water system, showing piping, fittings, couplings, valves, hydrants, materials, dimensions, restrained joint calculations, joints and other details, blocks, and anchors. All hydrants and valves furnished under the Contract shall be manufactured only in accordance with the Specifications and the approved Shop Drawings.
4. At project closeout, submit record drawings of installed potable water system piping and products, in accordance with requirements of Division 1. As-Built Drawings shall be complete and shall indicate the true measurement and location, horizontal and vertical, of all new construction. As-Built drawings shall be stamped and signed by a Massachusetts Licensed Land Surveyor or Licensed Professional Engineer. The as-built plans shall also be submitted electronically as an AutoCAD drawing file (release 2010 or higher).
5. Maintenance Data: Submit maintenance data and parts lists for water system materials and products. Include this data, product data, shop drawings, and record drawings in maintenance manual in accordance with requirements of Division 1.

1.4 REFERENCE STANDARDS

- A. The following standards are applicable to the work of this Section to the extent referenced herein:
 1. ASTM: American Society for Testing and Materials.
 2. ANSI: American National Standards Institute.
 3. AWWA: American Water Works Association.
 4. AASHTO: American Association of State Highway and Transportation Officials.
 5. Reference is made herein to the Commonwealth of Massachusetts, Department of Transportation (MassDOT), Formerly Massachusetts Highway Department (MHD) Standard Specifications for Highways and Bridges, latest edition, hereinafter referred to as the "Standard Specifications". All references to method of measurement, basis of payment, and payment items in the "Standard Specifications" are hereby deleted. References made to particular sections or paragraphs in the "Standard Specifications" shall include all related articles mentioned therein.
 6. MassDOT, Construction Standards, latest Edition with amendments, hereinafter referred to as the "Construction Standards."
 7. Commonwealth of Massachusetts State Plumbing Code, latest edition.
 8. Commonwealth of Massachusetts Regulations 528 CMR 12.00 Sprinkler Contractor Licensing Regulations.
 9. Town/City Water Department Regulations.

1.5 EXAMINATION OF SITE AND DOCUMENTS

- A. It is hereby understood that the Contractor has carefully examined the site and all conditions affecting work under this Section. No claim for additional costs will be allowed because of a lack of knowledge of existing conditions as indicated in the Contract Documents, or obvious from observation of the site.
- B. Plans, surveys, measurements, and dimensions under which the work is to be performed are believed to be correct, but the Contractor shall have examined them for himself during the bidding period and formed his own conclusions as to the full requirements of the work involved.

1.6 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of potable water systems materials and products, of types and sizes required, whose products have been in satisfactory use in similar service for not less than five years.
- B. Installer's Qualifications: Firm with at least three years of successful installation experience on projects with potable water piping work similar to that required for this project.
- C. Water Purveyor Compliance: Comply with requirements of Purveyor supplying water to project, obtain required permits and inspections.

1.7 PROJECT CONDITIONS

- A. Site Information: Perform site inspection and survey, research utility records, and verify existing utility locations and elevations. Verify that water system piping may be installed in compliance with Contract Drawings and referenced standards.
- B. Interruption of Existing Water Distribution System: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to the requirements indicated:
 - 1. Notify Architect no fewer than two days in advance of proposed interruption of service.
 - 2. Do not proceed with interruption of service without Architect's written permission.

1.8 SEQUENCING AND SCHEDULING

- A. Coordinate with interior building domestic water and fire protection system piping.
- B. Coordinate with other utility work.
- C. The Contractor is responsible for developing a sequence of work to maintain existing services in operation until the new services are operational.
- D. The Contractor is responsible for coordinating and scheduling the inspection of the work by the jurisdictional authority. All permits and inspection costs and fees shall be included in the bid prices and no additional costs will be paid to the Contractor.

PART 2-PRODUCTS

2.1 DUCTILE IRON PIPE AND FITTINGS

- A. General: Provide piping materials and factory fabricated piping products of sizes, types, pressure ratings, and capacities as indicated. Where not indicated, provide proper selection as determined by Engineer to comply with installation requirements. Provide pipe fittings and accessories of same materials and class as pipes with joining method, as indicated. The piping shall be manufactured by an established manufacturer of good reputation in the industry and in a permanent plant adapted to meet all the design requirements of the pipe.
 - 1. Ductile iron pipe shall be that of a manufacturer who can demonstrate at least five years of successful experience in manufacturing ductile iron pipe. The pipe shall be equipped with push on type, restrained joint, or mechanical joints, as required.
 - 2. All ductile iron water pipe shall conform to American Water Works Association (AWWA) C150 and AWWA C151.
 - 3. The ductile iron pipe shall be Class 52 and furnished in minimum nominal 18-foot lengths, with Push-on or Mechanical Joints as manufactured by U.S. Pipe and Foundry Company, Atlantic States Cast Iron Pipe Co., Clow Corporation, or approved equal with

gaskets conforming to AWWA C111 "Rubber Gasket Joints". A minimum of two bronze wedges per joint shall be used to maintain conductivity and facilitate lock-on.

4. All ductile iron pipes shall be rated for a minimum operating pressure of 350 psi.
5. The ductile iron water pipe shall be double cement lined inside and then asphalt seal coated in accordance with AWWA C104 and AWWA C151. The pipe shall be furnished along with necessary materials and equipment recommended by the manufacturer for use in joining pipe lengths and fittings.
6. All water pipe shall be encased in polyethylene film when the trench is backfilled with control density fill.
7. Fittings shall be ASTM A-536 ductile iron with mechanical joint fittings. All fittings 3 inches through 48 inches in diameter shall meet or exceed the requirements of AWWA C110. Compact fittings shall be ductile iron meeting or exceeding the requirements of AWWA C153. Fittings shall have the same lining and coating as the pipe specified above. All fittings shall be marked with the weight and shall have distinctly cast upon them the pressure rating, the manufacturer's identification, nominal diameter of openings and the number of degrees or fraction of the circle on all bends. All fittings 4 through 24 inches shall be Class 350. All fittings greater than 24 inches shall be as specified above except they shall be Class 250. Compact fittings shall only be used in sizes 4 through 24 inches. Fittings shall conform to the weights, excluding accessories, and dimension shown in the latest edition of the Handbook of Ductile Iron Pipe and come complete with all joint accessories as required. All accessories (gland, gaskets, T-bolts, and nuts) shall be in accordance with AWWA C111. All mechanical joint bolts (T-bolts) shall be Cor-Ten or equal.
8. In order to provide positive joint restraint, valve anchor tees/valves and restrained joints shall be used on fire services and on the 6-inch branch connections for hydrants.
9. Caps and plugs installed in all new work as indicated on the Contract Drawings shall be provided with a threaded corporation or bleeder valve so that air and water pressure can be relieved prior to future connection.
10. Contractor shall provide all adapters and fittings such as transition couplings, as determined in the field, necessary to complete all cross connections, whether or not specifically stated in the Contract Drawings and Specifications.
11. All pipe shall be marked with the class, thickness designation, and initials of the manufacturer.
12. If required the manufacturer shall supply the Engineer with certificates of compliance with these Specifications and certification that each piece of ductile iron pipe has been tested at the foundry with the Ball Impression Test, Ring Bending, or equal.
13. Thrust blocks shall be used at all bends and fittings as shown on the details. In addition, all bends and fittings shall be restrained with Megalug Series 1100 mechanical joint restraint. In the event that the use of thrust blocks is not practical or allowed, the Contractor shall provide an alternate method of joint restraint, at no additional cost to the owner, as approved and/or as directed by the Engineer. Restraint length calculations and restrained joint locations shall be provided by the contractor and submitted to the engineer for review. Restraint length values shall be calculated per the manufacturer's standards.
 - a. Restraint for standardized mechanical joints shall be incorporated in the design of the follower gland and shall impart multiple wedging action against the pipe, increasing its resistance as the pressure increases. The assembled joint shall maintain its flexibility after burial and shall maintain its integrity by a controlled and limited expansion of each joint during the wedging action. Restraining glands shall be manufactured of high strength ductile iron conforming to the requirements of ASTM A536, Grade 65-45-12. Wedging mechanisms shall be manufactured of ductile iron, heat treated to a hardness of 370 BHN minimum. Dimensions of the

gland shall be such that it can be used with the standardized mechanical joint bell and tee head bolts conforming to the requirements of ANSI/AWWA A21.11/C111 and ANSI/AWWA A21.53/C153 of latest revision. Twist-off nuts shall be incorporated in the design of the wedge activation screws to ensure proper torque. The mechanical joint restraining device shall have a water working pressure rating of 350 psi minimum (in sizes 4" thru 16") with a safety factor of at least 2:1 against separation when tested in a dead-end situation.

- b. Restraint for push-on ductile iron pipe shall consist of a wedge action restraint ring on the spigot joined to a split ductile iron ring behind the bell. The restraint ring shall have individually actuated wedges that increase their resistance to pull-out as pressure or external forces increase. The restraint ring and its wedging components shall be made of minimum grade 65-45-12 ductile iron conforming to ASTM A536. The wedges shall be heat treated to a minimum hardness of 370 BHN. Torque limiting twist off nuts shall be used to ensure proper actuation of the restraining wedges. The split ring shall be made of a minimum grade of 65-45-12 ductile iron conforming to ASTM A536. The connecting tie rods that join the two rings shall be made of low alloy steel that conforms to ANSI/AWWA C111/A21.11. The assembly shall have a rated pressure with a minimum two to one safety factor of 350 PSI in the sixteen-inch size and below 250 PSI in the eighteen through thirty-six-inch sizes. Push on joints on ductile iron pipe shall be restrained with Megalug Series 1700 restraint harness.
14. Insulation shall be manufactured by Thermal Pipe Systems, Atlas Insulation, or Insulated Piping Systems Inc., or other approved manufacturer. Insulation shall be factory foamed-in-place polyurethane foam insulation having nominal thickness of 1 1/2-inch, with an in-place density of 2.5 pcf, and a "K" factor of 0.16 BTU*in./hr.*°F*sq. ft. Straight joints between insulated pipe lengths, and the end sections of non-insulated pipe shall be sealed with heat shrinkable wrap-around polyethylene as supplied by manufacturer and installed in field by Contractor. Insulation jacket shall be 20-gauge corrugated aluminum preformed to be fastened with stainless steel screws and bands. Jacket shall have one layer of one mil polyethylene film with a protective coat of 40-pound virgin Kraft paper to act as a moisture and galvanic corrosion barrier.
15. Pipe for use with split couplings shall be as specified except that the ends shall not have bells or beads but shall have cast or machined shoulders or grooves as necessary for the couplings to be used and shall conform to the specifications of the manufacturer of the couplings. If split couplings are used with grooved ductile-iron pipe, the minimum pipe wall thickness shall be as follows:

Nominal Pipe Size (In.)	Thickness Class
4-12	53
14-18	54
20	55
24	56

16. Pipe for use with sleeve-type couplings shall be as specified except that the ends shall be plain (without bells or beads). The ends shall be cast or machined at right angles to the axis.

B. COUPLINGS AND ADAPTERS FOR DUCTILE IRON PIPE

1. Sleeve type couplings for plain end pipe shall be provided with plain rubber gaskets and steel, tee head bolts with nuts. Couplings shall be Dresser style 38 or 138, furnished preassembled, as manufactured by Dresser Industries, Inc., Smith Blair, Coupling Systems, Inc., or equal.

2. Couplings or adapters as required for connecting existing pipe to new pipe or new pipe to new pipe shall be furnished as required and designed for compatibility with the pipe and operating pressures encountered. Couplings shall be Dresser Style 162 as manufactured by Dresser Industries Inc., or equal. Flanged adapters shall be Dresser Style 128, or equal. Couplings for ductile iron to cast iron pipe shall be Style 53, and for ductile iron to transite pipe shall be style 153, as manufactured by Dresser Industries, Inc., or as manufactured by Smith Blair, Coupling Systems, Inc. or equal. Transition couplings shall be Style 162 as manufactured by Dresser Industries, Inc. or approved equal.
3. Split couplings may be used for connecting gray cast iron or ductile iron. If split couplings are used with grooved ductile iron pipe, the minimum pipe wall thickness shall be as specified. Split couplings shall be made of malleable iron and shall be suitable for use with grooved-end or shouldered-end, cast iron pipe. They shall be Victaulic couplings made by the Victaulic Company of America, Elizabeth, New Jersey; Gruvagrip couplings made by Gustin-Bacon Manufacturing Company, Kansas City, Missouri; Groove couplings made by Eastern Malleable Iron Company, Pittsburgh, Pennsylvania; or equal products.
4. Flexible Couplings: Sleeve type couplings for plain end ductile iron pipe shall be provided with plain rubber gaskets and steel, track head bolts with nuts.
5. Couplings shall be furnished pre-assembled by the manufacturer.
6. Couplings shall be given a shop coat compatible with the same outside coating as the pipe specified above.
7. All couplings shall be furnished with the pipe stop removed.
8. Couplings shall be provided with gaskets of a composition suitable for exposure to the liquid within the pipe. The gaskets shall have metallic tips to provide electrical continuity through the joint.
9. The Contractor shall provide suitable filling rings where the layout of the flanged piping is such as to necessitate their use. In materials, workmanship, facing, and drilling, such rings shall conform to the 125-pound ANSI Standard. Filling rings shall be of suitable length with nonparallel faces and corresponding drilling, if necessary, to ensure correct assembly of the adjoining piping or equipment.
10. Couplings for exposed pipe shall be of steel and shall be Dresser Style 38, Smith-Blair Style 411, Baker Allsteel, or equal. The couplings shall be provided with steel bolts and nuts.
11. At the Contractor's option, flexible connections in the piping shall be sleeve-type couplings, split couplings or mechanical joint pipe as herein specified.

C. INSPECTION, TESTS, AND ACCEPTANCE FOR DUCTILE IRON PIPE

1. All pipe delivered to the job site shall be accompanied by test reports certifying that the pipe and fittings conform to "AWWA Standard for Ductile Iron Pipe, for Water and Other Liquids" (AWWA H3) and (AWWA C151).
2. All tests shall be made in accordance with the methods prescribed by the above mentioned AWWA Standards, and the acceptance or rejection shall be based on the test results.
3. Pipe which does not conform to the requirements of this contract shall be immediately removed and replaced by the Contractor.
4. All ductile iron pipe to be installed under this Contract may be inspected at the foundry for compliance with these Specifications by an independent testing laboratory selected by the Owner. The Contractor shall require the manufacturer's cooperation in these inspections. The cost of foundry inspection of all pipe approved for this Contract, plus

the cost of the inspection of a reasonable amount of disapproved pipe, will be borne by the Owner.

D. FLANGED JOINTS FOR DUCTILE IRON PIPE

1. For flanged joints, gaskets shall be ring gaskets of rubber with cloth insertion. Gaskets twelve (12)-inches in diameter and smaller shall be 1/16-inch thick, gaskets larger than twelve (12)-inch shall be 3/32-inch thick.
2. Flanged joints shall be made with bolts, bolt studs with a nut on each end, or studs with nuts where the flange is tapped. The number and size of bolts shall conform to the same ANSI Standard as the flanges. Bolts and nuts shall, except as otherwise specified or noted on the Contract Drawings, be Grade B conforming to the ASTM Standard Specification for Carbon Steel, Externally and Internally Threaded Standard Fasteners, Designation A307. Bolts and studs shall be of the same quality as machine bolts. Flanged ductile iron pipe from 3 to 48-inches in diameter shall be classified by Underwriters Laboratories Inc. in accordance with AWWA C115.

2.2 RESILIENT WEDGE GATE VALVES

- A. Resilient wedge gate valves shall be iron body, resilient seated type. The valves shall be designed for 250 psi working pressure and 400 psi test pressure.
- B. Valves are to have O ring seals and a nonrising stem. Valves shall have a 2-inch operating nut. Valves shall open in the direction required by the City of Newton.
- C. Resilient gate valves shall meet the most recent version of the AWWA standard specification AWWA C509.
- D. Resilient wedge valves shall have mechanical joint ends.
- E. Valves shall be as manufactured by U.S. Pipe and Foundry Company Metroseal 250, American Flow Control Model AFC2500, or Mueller Resilient Wedge Gate Valves.
- F. Valve boxes shall be cast iron, asphalt coated, sliding, heavy pattern type, consisting of three (3) pieces; a flanged bottom piece, a flanged top piece, and a cover with two (2) lifting holes and the word "water" cast on the top. A minimum 6-inch overlap is required between sliding sections. The valve box shall be designed and constructed to prevent direct transmission of traffic loads to the pipe or valve. The inside diameter of boxes shall be at least 4 1/2 inches and lengths shall be as necessary to suit ground elevation. The top of the cover shall be flush with the top of the box rim. Box covers shall be round frame and cover.
- G. Valves shall be connected directly to valve anchor tees at all hydrant branches.

2.3 TAPPING SLEEVES AND VALVES

- A. Tapping sleeves shall be of ductile iron construction, meeting ASTM A536 Grade 65-45-12. Side flange seals shall be O-Ring type of round, oval or rectangular cross-section shape. Sizes 12" and smaller must be capable of working on Class ABCD pipe diameters without changing either half of sleeve. Sizes 14" and larger must be specified to which class is needed. All sleeves are to include the end joint accessories and split glands necessary to assemble sleeve to pipe. Sleeve shall be coated with asphaltic varnish in compliance with NSF-61.
- B. Tapping valves shall conform to the requirements specified above for gate valves except that all Tapping sleeves and valves shall consist of a ductile iron flanged by mechanical joint sleeves and a tapping type gate valve with one flange and one mechanical joint end. The Contractor shall be responsible for verifying the outside diameter of the pipe to be tapped.

- C. The valve shall be provided with an oversized seat to permit the use of full-size cutters. Before backfilling, all exposed portions of any bolts used to hold the two halves of the sleeves together shall be heavily coated with two coats of bituminous paint comparable to Inertol No. 66 Special Heavy. Sleeves shall be of ductile iron furnished with O-ring gaskets.
- D. Bolts on bonnet and stuffing box shall be stainless steel (316 stainless steel), stuffing boxes shall be "O" ring type as indicated. Gaskets shall cover the entire flange surface.

2.4 POST INDICATOR VALVE

- A. Post indicating valve assembly shall consist of a buried butterfly valve and above-grade indicator actuator of the traveling nut type with a tamper-proof switch.
- B. Posts shall have two large window openings that shall be fitted with a heavy clear Plexiglas. Aluminum target plates, with large words OPEN and SHUT cast in large, easy-to-read, raised letters shall be located directly behind each window in such a position that the appropriate words appear as the valve is opened.
- C. The target mechanism shall consist of an internal rotating member that contains a 2¾-inch hole on four sides.
- D. The outer member is stationary and shall contain similar holes.
- E. A fail-safe spring shall be included on the post to preclude accidental closing.
- F. Stem, indicators, and all working parts shall be fully protected from moisture and weather damage.
- G. The butterfly valve and post assembly shall be Underwriters Laboratory listed and Factory Mutual approved.
- H. Valves shall be manufactured in accordance with AWWA C504, Class 150B.

2.5 HYDRANTS

- A. General: Provide Hydrants as indicated. The Hydrants shall be manufactured by an established manufacturer of good reputation in the industry and in a permanent plant adapted to meet all the design requirements of the hydrant.
 - 1. Fire hydrants shall meet or exceed AWWA C-502, latest revision and shall comply with Factory Mutual Research Corporation and Underwriters' Laboratories UL 246 Standard. Rated water working pressure shall be 200 psi, test pressure shall be 400 psi.
 - 2. The main valve closure shall be of the compression type, opening against the pressure and closing with the pressure.
 - 3. Hydrants shall be of the breakaway type: The upper barrel shall connect to the lower barrel with a breakable traffic flange and 8 bolts and nuts. This connection shall allow 360° rotation of the upper nozzle section.
 - 4. The main valve opening shall be 5-1/4 inch and be designed so that removal of seat, drain valve mechanism, internal rod and all working parts can be removed through top of hydrant. These parts shall be removable without disturbing the ground line joint or the nozzle section of the hydrant. The bronze seat shall be threaded into mating threads of bronze for easy field removal.
 - 5. The draining system of the hydrant shall be bronze and activated by the main stem without use of auxiliary rod, toggles, pins, etc. The drain mechanism shall be completely closed after no more than three turns of the operating nut in the opening direction. There should be a minimum of (2) inside ports and (4) drain port outlets to the exterior of the hydrant. Drain shut off to be by direct compression closure.

6. The operating nut, main stem, coupling and main valve assembly shall be capable of withstanding input torque of 200 ft. lbs. in opening or closing directions. There shall be an internal top housing with triple O-Rings to seal operating threads from the waterway and accommodate an anti-friction washer.
7. Fire hydrants shall have 6-inch mechanical joint inlet connections to the main, two 2 ½-inch hose connections, 180-degrees apart, and one 4 ½-inch steamer connection. The hose and steamer connections shall have National Standard Thread. The standpipe shall have an 8 ½-inch minimum diameter. All nozzle caps shall be cast iron and shall be secured to the hydrant barrel with chains.
8. Hydrant shall be marked with an arrow and the word "open" to indicate the direction to turn the stem to open the hydrant. Hydrants shall open to the direction required by the City of Newton and have a bronze operating nut that shall be pentagonal in shape, 1-1/2 inch from point to opposite flat.
9. The upper barrel shall be ductile iron with markings identifying size, model and year of manufacture. The lower barrel shall be ductile iron.
10. The hydrant shall have a minimum working pressure of 200 psi. Hydrant design shall be of positive automatic drain type to prevent freezing.
11. Hydrants shall be thoroughly cleaned and given two (2) shop or field coats of paint in accordance with AWWA C502 and the instruction of the paint manufacturer. Paint color shall be the standard hydrant color of the City of Newton.
12. If the hydrant is delivered with the manufacturer's standard color, the hydrant shall be given one (1) matching field coat of alkyd gloss enamel. If the hydrant is delivered with no standard color, the hydrant shall be given two (2) coats of alkyd gloss enamel according to the colors specified by the City of Newton.
13. All exposed metal surfaces will be painted.
14. Hydrant paint shall be as manufactured by Sherman-Williams, PPG Industries, Pittsburgh, PA; Koppers Company, Inc., Pittsburgh, PA; Tnemec Company, Inc. Kansas City, MO; or approved equal.
15. Alkyd gloss enamel shall be Series 54-300 by PPG; Glamortex by Koppers; 2H-Tnemec by Tnemec or approved equal.
16. Hydrants shall be American Darling (American Flow Control) Model B-62 B, Mueller Centurion, Kennedy Guardian, U. S. Pipe Metropolitan, Waterous WB-67 or others as acceptable to the jurisdictional authority.

B. HYDRANT SAFETY FLANGE REPAIR KIT

1. Safety flange repair kits shall come complete with stem coupling, safety flange, flange gasket, replacement bolts and nuts and hydrant lubricating oil.
2. Safety flange repair kits shall be compatible with hydrant furnished.

2.6 SIAMESE CONNECTION (IF REQUIRED)

- A. Siamese shall be a "two-way" Siamese 4 x 2-1/2 x 2-1/2. Shall be installed with pin lug caps and chains, sleeves, escutcheon plate, and shall be polished chrome. Piping from Siamese connection into the building shall be restrained joint ductile iron.

2.7 IDENTIFICATION

- A. Detectable Underground Warning Tapes: Acid and alkali-resistant polyethylene plastic film warning tape, 6-inches wide by 4-mils. minimum thickness, with continuously printed caption in black letters "CAUTION - xxxxx LINE BURIED BELOW." The text and color of the tape shall be as shown in the table below. The tape shall have a metallic core encased in a

protective jacket for corrosion protection and be detectable by a metal detector when the tape is buried up to 2.5-feet deep.

Color	Utility
Safety Red	Electric
High Visibility Safety Yellow	Gas, Oil, Steam
Safety Alert Orange	Telephone, Communications, Cable Television
Safety Precaution Blue	Water System, Irrigation
Safety Green	Sanitary Sewer, Storm Sewer

PART 3-EXECUTION

3.1 INSPECTION

- A. General: Examine areas and conditions under which potable water system's materials and products are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Engineer.
- B. The Contractor is responsible for the provisions and all test requirements specified in herein. In addition, all pipe and appurtenances may be inspected at the plant for compliance with these specifications by an independent testing laboratory.
- C. All tests shall be made in accordance with the methods prescribed by the above-mentioned AWWA Standards, and the acceptance or rejection shall be based on the test results.
- D. Inspection of the pipe and appurtenances may also be made after delivery. The pipe and appurtenances shall be subject to rejections at any time on account of failure to meet any of the specifications requirements, even though samples may have been accepted as satisfactory at the place of manufacture.
- E. Pipe which does not conform to the requirements of this contract shall be immediately removed and replaced by the Contractor at no cost to the Owner.

3.2 HANDLING PIPE

- A. The Contractor shall take care not to damage pipe by impact, bending, compression, or abrasion during handling, and installation. Joint ends of pipe especially shall be kept clean.
- B. Pipe shall be stored above ground at a height no greater than 5-feet, and with even support for the pipe barrel.
- C. Only nylon protected slings shall be used for handling the pipe. No hooks, chains or bare cables will be permitted.
- D. Gaskets shall be shipped in cartons and stored in a clean area, away from grease, oil, heat, direct sunlight and ozone producing electric motors.

3.3 INSTALLATION OF PIPE AND PIPE FITTINGS

- A. The Contractor shall provide all adapters and fittings such as transition couplings, as determined in the field, necessary to complete all cross connections, whether or not specifically stated in the Contract Drawings and Specifications.

- B. Care shall be taken in loading, transportation, and unloading to prevent injury to the pipe or coatings. Pipe or fittings shall not be dropped. All pipe and fittings shall be examined before placement, and no piece shall be installed which is found to be defective. Any damage to the pipe coatings shall be repaired as directed by the Engineer or Owner's Representative.
- C. If any defective pipe is discovered after it has been placed, it shall be removed and replaced with a sound pipe in a satisfactory manner by the Contractor, at his own expense. All pipe and fittings shall be kept clean until they are used in the work, be thoroughly cleaned before placement, and when placed, shall conform to the lines and grades required. Ductile iron pipe and fittings shall be installed in accordance with requirements of AWWA Standard Specification C600 except as otherwise provided herein. A firm even bearing throughout the length of the pipe shall be constructed by compacting sand gravel borrow around the pipe and up to 18 inches above the pipe.
- D. Blocking will not be permitted.
- E. A minimum horizontal separation of ten (10) feet shall be maintained between and existing, proposed or relocated sewer and the new water main. The distance shall be measured edge to edge. In cases where it is not practical to maintain a ten-foot separation, it is permitted to install a water main closer to a sewer, provided that the water main is laid in a separate trench or on an undisturbed earth shelf located eighteen (18) inches above the top of sewer. Where the horizontal clearance is less than ten (10) feet or the vertical clearance is less than eighteen (18) inches and the sewer crosses under the water main, both water main and sewer main shall be constructed of mechanical joint cement lined ductile iron pipe for 10-feet on either side of the crossing. One (1) full length of water pipe shall be centered over the sewer at the crossing. If the sewer crosses over the water main, regardless of the vertical separation, both pipes shall be concrete encased for a distance of ten (10) feet to either side of the respective centerline.
- F. Provide minimum cover over piping of 5-feet below finished grade.
- G. Extend water systems from the water main located within the public way and terminate potable water piping 10-feet 0-inches from the building foundation. Provide temporary pipe plug for piping extension into building if required by construction progress.
- H. All pipes shall be sound and clean before placement. When pipe laying is not in progress, including lunchtime, the open ends of the pipe shall be temporarily closed by watertight plug or other acceptable means. Alignment shall be maintained during placement. The deflection at joints shall not exceed sixty percent of that recommended by the manufacturer. Fittings, in addition to those shown on the plans, shall be provided, if required, in crossing utilities, which may be encountered upon opening the trench. Solid sleeves shall be used only where allowed by the Engineer.
- I. When cutting pipe is required, the cutting shall be done by machine, leaving a smooth cut at right angles to the axis of the pipe. Cut ends of pipe to be used with a push-on type bell shall be beveled to conform to the manufactured spigot end. Cement lining shall be inspected for damage and shall be re-mortared as required to ensure a continuous lining.
- J. Mechanical joint restraints shall be used for all valves, bends, hydrants and piping section less than 50 feet. The contractor shall restrain all pipe runs to the lengths indicated on the approved restrained joint calculation shop drawings.
- K. Jointing of ductile iron push on pipe and fittings shall be done in accordance with the printed recommendations of the manufacturer and as specified. The last 8 inches of the outside of the spigot end of pipe and the inside of the bell end of pipe shall be thoroughly cleaned. The joint surfaces and the gasket shall be painted with a lubricant just prior to making up the joint. The spigot end shall then be gently pushed home into the bell. The position of the gasket

shall be checked to ensure that the joint has been properly made and is watertight. Care shall be taken not to exceed the manufacturer's recommended maximum deflection allowed for each joint.

1. Jointing Ductile Iron Pipe (Push-On Type): Push-on joints shall be made in strict accordance with the manufacturer's instructions. Pipe shall be laid with bell ends looking ahead. A rubber gasket shall be inserted in the groove of the bell end of the pipe, and the joint surfaces cleaned and lubricated. The plain end of the pipe to be entered shall then be inserted in alignment with the bell of the pipe to which it is to be joined, and pushed home with a jack or by other means. After joining the pipe, a metal feeler shall be used to make certain that the rubber gasket is correctly located.
 2. Jointing Mechanical Joint Fittings: Mechanical joints at valves, fittings, and where designated shall be installed in accordance with the "Notes on Method of Installation" under ANSI Specification A 21.11 and the instructions of the manufacturer. To assemble the joints in the field, the Contractor shall thoroughly clean the joint surfaces and rubber gasket with soapy water before tightening the bolts. Bolts shall be tight to the specified torque. Under no condition shall extension wrenches or pipes over handles or ordinary ratchet wrenches be used to secure greater leverage.
- L. Installation and jointing of ductile iron pipe shall be in accordance with AWWA C600, Sections 9b and 9c, latest revision, as applicable.
- M. Service tubing shall be installed with minimum 6-inches of sand bedding and 12-inches sand cover. Service tubing shall have a minimum total cover of 5 feet.

3.4 INSTALLATION OF VALVES AND APPURTENANCES

- A. Cleaning and Prime Coating Valves and Appurtenances (Except Epoxy Coated Valves)
1. Prior to shop prime coating, all surfaces of the valves and appurtenances shall be thoroughly clean, dry, and free from all mill-scale, rust, grease, dirt, paint and other foreign substances to the satisfaction of the Engineer or Owner's Representative.
 2. All ferrous surfaces shall be sand blasted or pickled according to SSPC-SP6 or SSPC-SP8, respectively.
 3. All gears, bearing surfaces and other surfaces not to be painted shall be given a heavy coat of grease or other suitable rust resistant coating unless otherwise specified herein. This coating shall be maintained as required to prevent corrosion during any period of storage and installation and shall be satisfactory through the time of final acceptance.
- B. Installation
1. All valves and appurtenances shall be installed in the location shown, true to alignment and rigidly supported. Any damage to the above items shall be repaired before they are installed.
 2. Care shall be taken to prevent damage to valves and appurtenances during handling and installation. All materials shall be carefully inspected for defects in workmanship and materials, all debris and foreign material cleaned out of valve openings, etc., and all operating mechanisms operated to check their proper functioning, and all nuts and bolts checked for tightness. Valves and other equipment that does not operate easily, or are otherwise defective, shall be repaired or replaced.
- C. Shop Painting Valves and Appurtenances
1. Interior and exterior surfaces of all valves which are not factory epoxy coated shall be given two coats of shop finish of an asphalt varnish conforming to AWWA C504 for Varnish Asphalt. The pipe connection openings shall be capped to prevent the entry of foreign matter prior to installation.

D. Buried Valves

1. Install valves as indicated with stems pointing up. Provide valve box over underground valves. Buried valves and boxes shall be set with the operating stem vertically aligned in the center of the valve box. Valves shall be set on a firm foundation and supported by tamping selected excavated material under and at the sides of the valve.

E. Valve Boxes

1. Valve boxes shall be installed vertically, centered over the operating nut, and if they are within the limits of the roadway or within limits where the plowing of snow will take place in the winter, the tops of the boxes shall be set $\frac{1}{2}$ " below the top of the finished grade. In locations where these boxes are not likely to be disturbed, the tops shall be set flush with the adjoining ground. Boxes shall be adequately supported during backfilling to maintain vertical alignment.

F. Corporation Cocks

1. The tapping machine shall be rigidly fastened to the pipe as near the horizontal diameter as possible. The length of travel of the tap should be so established that when the stop is inserted and tightened with at 14" wrench, not more than one to three threads will be exposed on the outside. When a wet tapping machine is used, the corporation stop shall be inserted and tightened in accordance with the manufacturer's specifications.

3.5 INSTALLATION OF HYDRANTS

- A. Hydrants and hydrant branches shall be tested at 175 psi and chlorinated as specified in this specification.
- B. Hydrants shall be installed in conformance to AWWA C 600, Section 11, latest revision, using thrust blocks and restrained joints in accordance with the details shown on the Contract Drawings.
- C. Hydrants, as detailed on the Contract Drawings, shall be set at the locations designated by the Engineer and shall be bedded on a firm foundation. A drainage pit 2-feet 6-inches in diameter and to the limits shown on the Contract Drawings shall be filled with crushed stone and satisfactorily compacted. During backfilling, additional crushed stone shall be brought up around, and 6-inch over the drain port. Each hydrant shall be set in true vertical alignment and shall be properly braced. Thrust blocks shall be placed between the back of the hydrant inlet and undisturbed soil at the end of the trench. Hydrant shall be set upon a slab of concrete not less than 4-in thick and 15-in square.
- D. Hydrants shall be set plumb with the steamer nozzle facing the roadway and the center of the operating nut located 18-inches back from the face of curb or edge of pavement.
- E. Hydrants shall be set such that the bottom of the breakaway feature shall be a minimum of 2-inches and a maximum of 4-inches above finish grade.
- F. Once installed, hydrants shall be painted once again by the Contractor. Hydrants shall be painted in accordance with the Owner's requirements.
- G. All iron work to be set below ground, after being thoroughly cleaned, shall be painted with two coats of asphalt varnish as specified in AWWA C502, latest revision and iron work to be left above ground shall be shop painted with two coats of paint.
- H. Thrust Blocks: Concrete thrust blocks shall be placed between the back of the hydrant inlet and undisturbed soil at the end of the trench. Minimum bearing area shall be as shown on the Contract Drawings. Felt paper shall be placed as shown on the Contract Drawings. Care must be taken to ensure that concrete does not plug the drain ports.

3.6 BACKFILLING

- A. General: Conduct excavation and backfill operations for utility installations in accordance with Section 312300 – EXCAVATION & FILL FOR UTILITIES AND PAVEMENT, local requirements, and the contract documents.
- B. Initial backfill shall be placed evenly on both sides of the pipe to distribute the load and not to cause movement or deflection of the pipe.

3.7 FIELD QUALITY CONTROL

- A. Testing of Water Main/Service:
 - 1. Prior to pressure testing, the entire line shall be water jetted to remove any rocks or debris that may have inadvertently entered the pipe during construction.
 - 2. The Contractor in accordance with AWWA C651-99 specifications or latest revision will make pressure and leakage tests thereof, to determine that the ductile iron pipe is structurally safe and free of excess leakage. Pipeline shall be subject to a hydrostatic test of 150 pounds per square inch (psi) or 150% of the static pressure, whichever is greater. The Contractor shall furnish all equipment, materials, and labor for testing. Testing shall be done between valved off sections in approximately 1000-foot maximum section of the main. The Contractor shall furnish at his own expense the water needed for all water main testing.
 - 3. Once the pipeline section has been filled at normal pressure and all entrapped air removed from the line, the Contractor shall raise the pressure to the approved test pressure by a special pressure pump taking water from a small tank of proper dimensions for satisfactorily measuring the rate of pumpage into the pipeline. The pipe shall maintain this pressure, within 5 psi, for a minimum of two hours during which time the line shall be checked for leaks. The measured water leakage shall not exceed the maximum allowed leakage as determined by the following equation for the section under test:

$$L = SDP^{1/2} / (133,200)$$

Where:

L = Allowable leakage, gallons per hour

S = Length of pipe section tested, feet
(1,000-foot maximum)

D = Nominal pipe diameter, inches.

P = Average test pressure (psi)

Should leakage exceed this rate, the Contractor shall immediately locate the leak or leaks and repair same at his expense. Pipe shall be flushed and chlorinated when leakage does not exceed above standard. Approval does not absolve the Contractor from his responsibility if leaks develop within the new main or water services (to curb box) later within the period of warranty.

- B. Testing of Fire Protection Service:
 - 1. Testing of fire protection services shall conform to the most current NFPA requirements.
- C. Chlorinating and Flushing:
 - 1. Prior to chlorination, the Contractor shall properly flush mains. In general, flushing shall be performed at a flow rate required to achieve a minimum velocity of 2.5-feet per second (approximately 900 GPM in a 12-inch diameter main and 400 GPM in 8-inch diameter main). Flushing shall be performed for a sufficient period of time to allow for a

minimum of 3 volume changes of water in the main (approximately 20 minutes per 1,000-foot of 8-inch main at the above flow rate).

2. Chlorinating shall be accomplished by pumping a chlorine solution into the mains. Water shall be allowed to enter the new water mains until the mains are full of a solution containing 25-ppm available chlorine. The valves shall then be closed and the chlorinated water allowed to stay in the mains for 24 hours. At the end of this period, the chlorine residual shall be at least 10 mg/l. If it is less than 10 mg/l measured, Contractor shall flush and rechlorinate the mains at no cost to the Owner. All valves and hydrants shall be operated to ensure their proper disinfection and shall be manipulated to prevent superchlorinated water from entering the existing distribution system. After this period, the Contractor shall flush the mains until clear, clean water is being discharged.
3. Chlorinating and flushing shall be done in accordance with AWWA C651-99 Specifications.
4. Twenty-four hours after the main has been flushed of chlorinated water, bacteriological samples shall be taken. Water samples shall be taken from corporation stops along the length of the water main. A minimum of two (2) samples shall be taken, per 3,000 foot of pipe or on each street, whichever is greater, each in duplicate, in sterile bottles and sent to a State approved private laboratory for analyses. The Contractor shall perform all necessary work including delivery of samples to a certified laboratory, and shall include the cost of sampling and analysis in his bid price. The results of the tests on these samples will determine the acceptance of the work and allow these new mains to be connected to the District's system. The failure of any sample to pass the laboratory tests shall require the Contractor to reflush and rechlorinate the mains and resample and test the water until acceptable results are obtained, all at no additional cost to the Owner.
5. The Contractor shall submit a Disinfection report detailing the following:
 - a. Type and form of disinfectant used.
 - b. Date and time of disinfectant injection start and time of completion.
 - c. Test locations.
 - d. Initial and 24-hour disinfectant residuals (quantity in treated water) in ppm for each outlet tested.
 - e. Date and time of flushing start and completion.
 - f. Disinfectant residual after flushing in ppm for each outlet tested.
6. The Contractor shall submit a Bacteriological Report detailing the following:
 - a. Date issued, project name, and testing laboratory name, address, and telephone number.
 - b. Time and date of water sample collection.
 - c. Name of person collecting samples.
 - d. Test locations.
 - e. Initial and 24-hour disinfectant residuals in ppm for each outlet tested.
 - f. Coliform bacteria test results for each outlet tested.
 - g. Certification that water conforms, or fails to conform, to bacterial standards.
7. Contractor shall note that work under this Contract shall NOT be considered completed until satisfactory installation and testing of the water mains have been completed.

3.8 FINAL INSPECTION

- A. Final inspection and acceptance of pipe, valves, appurtenances, and hydrants shall be made by the Owner's Representative and the utility owner having jurisdiction of the particular

system. Prior to placing the systems in service, all components shall be inspected, with the Owner's Representative present, to ensure that no debris or other contaminants are present. If necessary, the Contractor shall clean and flush piping.

- B. The Contractor is responsible for coordinating and scheduling the inspection of the work by local jurisdictional authorities. No additional payment will be made for inspections and permits required in the performance of the work.

END OF SECTION 331000

SECTION 333000

SANITARY SEWERAGE UTILITIES

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all SECTIONS within DIVISION 1 – GENERAL REQUIREMENTS, which are hereby made a part of this Section of Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials, and equipment necessary to construct the sanitary sewer system complete, including connection to existing structures and testing, as indicated on the Drawings and as specified.
- B. Unless otherwise indicated on the Drawings, building sewer service lines shall be installed from a point 10 feet outside the building foundation walls to the point of disposal.
- C. Related Work: The following items are not included in this Section and will be performed under the designated Sections:
 - 1. Section 311000 – SITE CLEARING for site clearing, removal of trees, stumps and other vegetation, topsoil stripping, stockpiling, clearing and grubbing, and removal of site surface and utility improvements.
 - 2. Section 312300 – EXCAVATION & FILL FOR UTILITIES AND PAVEMENT for excavation, backfill, and compaction required for sanitary sewerage system piping and structures.
 - 3. Section 221316 – SANITARY WASTE AND VENT PIPING for building sanitary drain and vent requirements.

1.3 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.
 - 1. Product Data: Submit manufacturer's technical product data and installation instructions for sanitary sewer system materials and products.
 - 2. Submit descriptive literature for piping, fittings, couplings, and appurtenances showing dimensions, pipe and joint materials, and other details for each class or type of pipe or product to be furnished for this contract. All pipe furnished under the contract shall be manufactured in accordance with these Specifications.
 - 3. Shop Drawings: The precast concrete structure shop drawing submittals for the manholes, septic tanks, dosing chambers, tight tanks, grease traps, wet wells, and valve pits shall contain erections drawings showing connections, cast-in items, waterproofing

details, lifting hooks, and production drawings showing elevations, sections, and details indicating sizes and quantities of reinforcement.

4. Submit shop drawings for structure hatches and frames and covers.
5. The Contractor shall submit buoyancy calculations for sanitary sewerage structures assuming groundwater is one (1) foot below finish grade. If buoyancy is an issue the structure(s) shall be modified to prevent uplift. All buoyancy calculations and precast concrete structure designs shall be prepared and stamped by a professional Civil Engineer licensed in the Commonwealth of Massachusetts.
6. Material Certificates: Provide copies of material certificates signed by material producer and Contractor, certifying that each material item complies with, or exceeds specified requirements.
7. Prior to the acceptance of the sanitary sewerage system, the Contractor shall submit to the Engineer, for review and approval, As-Built Drawings that indicate the true measurement and location, horizontal and vertical, of all new construction. As-Built drawings shall be stamped and signed by a Massachusetts Licensed Land Surveyor or Licensed Professional Engineer. The as-built plans shall also be submitted electronically as an AutoCAD drawing file (release 2010 or higher).
8. Prior to the acceptance of the sanitary sewerage system, the Contractor shall submit the results of the leakage tests, pipe deflection measurements, and the video inspection reports.

1.4 REFERENCE STANDARDS

- A. The following standards are applicable to the work of this Section to the extent referenced herein:
 1. ASTM: American Society for Testing and Materials.
 2. ANSI: American National Standards Institute.
 3. Reference is made herein to the Commonwealth of Massachusetts, Department of Transportation (MassDOT), formerly Massachusetts Highway Department (MHD) Standard Specifications for Highways and Bridges, latest edition, hereinafter referred to as the "Standard Specifications". All references to method of measurement, basis of payment, and payment items in the "Standard Specifications" are hereby deleted. References made to particular sections or paragraphs in the "Standard Specifications" shall include all related articles mentioned therein.
 4. MassDOT Construction Standards, latest edition with amendments, hereinafter referred to as the "Construction Standards".
 5. City Sewer Department Regulations.

1.5 EXAMINATION OF SITE AND DOCUMENTS

- A. It is hereby understood that the Contractor has carefully examined the site and all conditions affecting work under this Section. No claim for additional costs will be allowed because of a lack of knowledge of existing conditions as indicated in the Contract Documents, or obvious from observation on the site.

- B. Plans, surveys, measurements, and dimensions under which the work is to be performed are believed to be correct, but the Contractor shall have examined them for himself during the bidding period and formed his own conclusions as to the full requirements of the work involved.

1.6 QUALITY ASSURANCE

- A. Environmental Compliance: Comply with applicable portions of local environmental agency regulations pertaining to sanitary sewerage systems.
- B. Utility Compliance: Comply with the City of Newton Water and Sewer Division regulations, standards, and guidelines pertaining to sanitary sewerage system installation and inspections.
- C. Sanitary sewerage system installation shall be in conformance with the latest edition of TR-16, Guides for the Design of Wastewater Treatment Works.
- D. Plumbing Code Compliance: Comply with the applicable portions of the latest editions of the Massachusetts Plumbing Code and National Standard Plumbing Code pertaining to the selection and installation of sanitary sewerage system materials and products.
- E. Subsurface Disposal System Code Compliance: Comply with the applicable portions of the Commonwealth of Massachusetts State Environmental Code Title V, 310 CMR 15.00, latest revision and the local Board of Health Regulations pertaining to the installation of sanitary sewerage system materials and products.
- F. Manufacturer's Qualifications: Firms regularly engaged in manufacturing of sanitary sewer system products of type, materials, and sizes required, whose products have been in satisfactory use in similar service for not less than five years.
- G. Installer's Qualifications: Firms with at least three years of successful installation experience on projects with sanitary sewer work similar to that required for the project.

1.7 PROJECT CONDITIONS

- A. Site Information: Perform site inspection and survey, research utility records, and verify existing utility locations and elevations. Verify that sewerage system structures and piping may be installed in compliance with Contract Drawings and referenced standards.
- B. Interruption of Existing Sanitary Sewer Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to the requirements indicated:
 - 1. Notify Architect no fewer than two days in advance of proposed interruption of service.
 - 2. Do not proceed with interruption of service without Architect's written permission.

1.8 SEQUENCING AND SCHEDULING

- A. Coordinate with interior building sanitary sewerage system piping.
- B. Coordinate with other utility work.

- C. The Contractor is responsible for developing a sequence of work to maintain existing services in operation until the new services are operational.
- D. The Contractor is responsible for coordinating and scheduling the inspection of the work by the jurisdictional authority. All permits and inspection costs and fees shall be included in the bid prices and no additional costs will be paid to the Contractor.

PART 2 - PRODUCTS

2.1 PRECAST CONCRETE MANHOLES

- A. General: Provide precast reinforced concrete structures as indicated and complying with ASTM C 478.
- B. Manhole Top: Precast concrete of concentric cone, eccentric cone, or flat slab top type, as necessary for the installation as indicated in the Contract Drawings. Tops shall be designed to meet H20 loadings.
- C. Base and Riser Sections: Precast concrete, with base riser section with integral floor. Diameter, base and riser thicknesses shall be as indicated on the Contract Drawings.
- D. Cement: Type II.
- E. Concrete strength: 4,000 psi minimum.
- F. Precast concrete sections shall have tongue and groove joints.
- G. Horizontal Joints: Joints between sections of concrete structures shall be sealed with a flexible, watertight joint, made with preformed butyl rubber joint sealant conforming to ASTM C990 or with a rubber gasket joint conforming to ASTM C443. Sealants and/or gaskets shall be installed in accordance with the manufacturer's written instructions.
- H. Manhole Steps: Steps for manholes shall be non-skid raised edge-front steel reinforced polypropylene plastic type with at least 13-inch-wide stepping surface. Steps shall meet the requirements of ASTM C-478 and AASHTO M-199. Steel shall be 1/2-inch grade 60 conforming to ASTM A615 encapsulated with molded copolymer polypropylene. The polypropylene shall conform to ASTM D-4101. Rungs shall protrude no more than 6 inches from the wall. The portion of the legs to be embedded in the precast section shall have fins and be tapered to ensure a secure bond. Steps shall start a foot above the shelf of the manhole floor and continued twelve inches on center spacing up through the completed height of the unit. The steps shall finish no lower than twenty-four (24)-inches below the rim elevation. Placement into precast walls shall be by a method recommended by the supplier of the precast manhole sections. Steps shall be installed per the manufacturer's specifications.
- I. Pipe Connections: Sewer manhole shall have pipe openings to accept the type of pipe specified. Pipe opening shall be minimum size require to receive the pipe and shall be accurately set to conform to the required line and grade. Sewer pipe shall be joined to the wall of the concrete manhole with flexible manhole sleeves as indicated on the drawings. Flexible manhole sleeves shall be cast in the walls of the manholes during the manufacturing process. Flexible manhole sleeves shall be NPC Kor-N-Seal Pipe-to-Manhole Connector as manufactured by Trelleborg Pipe Seals Milford, Inc., Milford, NH; Z-Lok as manufactured by

A-Lok Products, Inc., Tullytown, PA; Tylox CIB Series Cast-In Boot Connector as manufactured by Hamilton Kent, Winchester, TN; or approved equal.

- J. Waterproofing: The exterior surfaces of precast structures shall be given two heavy coats of waterproofing concrete sealer. The material shall be Aqua-Safe Concrete Sealer as manufactured by Bay Oil Company, Chicopee, MA; Bitumastic 300M as manufactured by Carbolite Company, St. Louis, MO; Sonoshield HLM 5000 as manufactured by BASF Corporation Building Systems, Shakopee, MN; ConSeal CS-1800 as manufactured by Concrete Sealants, Inc., Tipp City, OH; or acceptable equivalent products. The waterproofing material shall be applied by brush or spray and in accordance with the instructions of the manufacturer. Time shall be allowed between coats to permit sufficient drying so that the application of the second coat has no effect on the first coat.
- K. Sanitary Sewer Brick Masonry: Bricks shall be sound, hard, uniformly burned, regular, and uniform in shape and size. Underburned or salmon brick shall not be acceptable. Only whole brick shall be used.
1. Bricks for channels and shelves shall conform to ASTM C32, Grade SS except that the mean of five tests for absorptions shall not exceed 8 percent and no individual brick exceed 11 percent.
 2. Brick for raising manhole frames to finished grade shall conform to ASTM C32, Grade MS.
 3. Mortar shall be in conformance with ASTM C270, Type M. The mortar shall be composed of one-part Portland cement, 3-1/2 parts sand, and 1/4 parts hydrated lime, by volume. Portland cement shall be ASTM C150, Type II; hydrated lime shall be Type S conforming to ASTM D207.
 4. Sand shall be washed, cleaned, screened, well-graded with all particles passing a No. 4 sieve, and conform to ASTM C33.
- L. In sewer manholes, the invert channel within the structure shall be an inverted arch with bricks laid as stretchers and on edge and so constructed as to conform in shape to the lower half of the pipe. The shelf in manholes shall consist of bricks laid flat and the top of the shelf shall be at the elevation of the top of the pipe, as indicated on the Contract Drawings, and shall be sloped to flow toward the channel.
- M. Inverts in sewer manholes shall conform accurately to size of the adjoining pipe. Side inverts and main inverts where the direction changes shall be laid out in smooth curves of the longest possible radius which is tangent, within the manhole, to the centerline of the adjoining pipe lines.
- N. Sewer manholes shall be constructed with drop connections when the proposed invert of the connection is at least 2 feet above the manhole invert. All drop connections will be of the external type. The drop pipe shall be constructed of SDR 35 PVC sewer pipe. The drop piping and horizontal cleanout sections will be sized the same as the sewer main piping and shall enter the manhole at the invert elevation of the main. The drop portion of the piping shall be secured with anchor straps. The drop piping shall be encased with control density fill.
- O. For all manhole depths greater than 10 feet, the inside diameter of the manholes shall be at least 5'-0".

- P. Safety landings shall be installed inside manholes greater than 16-feet in depth.
- Q. When installing manholes on existing lines and when flows cannot be diverted, drop-over manholes shall be used. Drop-over manholes shall be precast with openings cast in the sidewalls of sufficient size to fit over the existing line(s) to remain in service. Drop-over manholes shall be set on a precast or cast-in-place concrete base slab. Drop-over manholes shall be manufactured to the same requirements and dimensions as standard manholes.

2.2 MANHOLE FRAMES AND COVERS

- A. Frames and covers shall be of cast iron conforming to the requirements of ASTM A48, Class No. 30 and shall be manufactured by General Foundries Inc., North Brunswick, New Jersey; East Jordan Iron Works (formerly LeBaron Foundry, Inc.), East Jordan, Michigan; Neenah Foundry Company, Neenah, Wisconsin; or approved equal. Manhole covers shall be machined to fit securely and evenly on the frame. Frames and covers shall be designed to accept H20 loads, have a diamond surface finish, and frame height of 6 to 9-inches. Covers shall bear the word "SEWER" in 3-inch high letters. Covers shall be equal to Item Numbers 12665 and 12685 (6" and 8-1/8" frame heights, respectively) as manufactured by General Foundries Inc. Catalog numbers are provided to establish a standard of quality and configuration of castings.

2.3 PVC PIPE

- A. General: Provide pipes of the following materials of class indicated. Provide pipe fittings and accessories of same materials and class as pipes with joining method, as indicated. The piping shall be manufactured by an established manufacturer of good reputation in the industry and in a permanent plant adapted to meet all the design requirements of the pipe.
- B. PVC Sewer Pipe
 - 1. PVC (Polyvinyl Chloride) Gravity Sewer Pipe and Fittings: ASTM D3034, SDR 35, for elastomeric gasket joints. Pipe 18 to 36 inches in diameter shall conform to ASTM F679, T-1 heavy wall. The pipe shall have a SDR ratio of 35 and a pipe stiffness of 46 psi.
 - 2. Joints: PVC pipe shall have an integral wall bell and spigot push-on joint with elastomeric gaskets secured in place in the bell of the pipe. The bell shall consist of an integral wall section with solid cross section elastomeric gasket, factory assembled, securely locked in place to prevent displacement during assembly. Pipe joints shall conform to ASTM D3212 and elastomeric gaskets shall conform to ASTM F477.
 - 3. Spigot pipe ends shall be supplied with bevels from the manufacturer to ensure proper insertion. Each spigot end shall have an "assembly stripe" imprinted thereon to which the bell end of the mated pipe will extend upon proper joining of the two pipes.
 - 4. PVC gravity sewer fittings and accessories shall be as manufactured and furnished by the pipe supplier or approved equal and have bell and spigot configurations compatible with that of the pipe.

2.4 CLEANOUTS

- A. General: Provide cast-iron ferrule and countersunk brass cleanout plug, with round cast-iron access frame and heavy-duty, secured, scoriated cast-iron cover.

- B. The sewer cleanouts shall be minimum 6-inch diameter or sized to match the service pipe, whichever is greater. The cleanout shall be complete with a flush mount over. The cleanout cover shall be clearly marked "SEWER" and shall be minimum eight inches in diameter or two inches greater than the cleanout size, whichever is greater. Cleanouts shall include a watertight cap.

2.5 SEWER COUPLINGS

- A. Sewer Couplings shall be pressure rated at least equal to that of the pipe. The coupling sleeve shall be 1/4-inch minimum thickness elastomeric polyvinylchloride with a minimum tensile strength of 1500 psi. The sleeve shall fit snugly onto the pipe to be joined and be resistant to common chemicals present in sewerage. Adjustable pipe clamps shall consist of a slotted band that mate with the worm gear screw and a screw housing all manufactured of stainless steel, and suitable for underground service.

2.6 IDENTIFICATION

- A. Detectable Underground Warning Tapes: Acid and alkali-resistant, polyethylene plastic film warning tape, 6-inches wide by 4-mils. minimum thickness, with continuously printed caption in black letters "CAUTION – xxxxx LINE BURIED BELOW." The text and color of the tape shall be as shown in the table below. The tape shall have a metallic core encased in a protective jacket for corrosion protection and be detectable by a metal detector when the tape is buried up to 2.5 feet deep.

Color	Utility
Safety Red	Electric
High Visibility Safety Yellow	Gas, Oil, Steam
Safety Alert Orange	Telephone, Communications, Cable Television
Safety Precaution Blue	Water System, Irrigation
Safety Green	Sanitary Sewer, Storm Sewer

PART 3-EXECUTION

3.1 GENERAL INSTALLATION

- A. General Locations and Arrangements: Contract Drawings indicate the general location and arrangement of the underground sanitary sewer system piping. Location and arrangement of piping layout take into account many design considerations. Install the piping as indicated, to the extent practical. Any modifications to the layout of the sewer system shall be submitted to the Engineer for review and approval at least five days prior to the start of the affected work.
- B. Install piping beginning at low point of systems, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings in accordance with manufacturer's recommendations, accepted practices, and utility owner's requirements. Maintain swab or drag in line and pull past each joint as it is completed.
- C. All piping shall be laid in the dry. Adequate measures shall be taken to prevent floatation of pipe in the trench.

- D. Whenever encountered within the trench, existing abandoned water, sewer, and/or drain lines shall be removed within the trench limits, unless otherwise noted. The remaining portion of the abandoned lines shall be plugged at all open ends.
- E. When bell and spigot pipes are used, bell holes shall be dug in the bedding to accommodate the bells. They shall be deep enough to ensure that the bell does not bear on the bottom of the hole but shall be excessively wide in the longitudinal direction of the installation.
- F. Use manholes for changes in direction, except where a fitting is indicated. Use fittings for branch connections, except where direct tap into existing sewer is indicated.
- G. Use proper size increasers, reducers, and couplings, where different size or material of pipes and fittings are connected. Reduction of the size of piping in the direction of flow is prohibited without the written approval of the Engineer.
- H. Install piping pitched down in direction of flow as indicated on the Contract Drawings.
- I. Extend sanitary sewerage system piping to connect to building sanitary drains, of sizes and in locations indicated on the Contract Drawings.
- J. Install piping in accordance with governing authorities having jurisdiction, except where more stringent requirements are indicated.
- K. Acceptance of Pipe: Acceptance will be on the basis of tests specified herein before. The quality of all materials used in the pipe, the process of manufacture, and the finished pipe shall be subject to review by the Engineer. Inspection may be made at the place of manufacture, or on the work site after delivery or at both places and the pipe shall be subject to rejection at any time on account of failure to meet any of the specification requirements, even though sample pipe units may have been accepted as satisfactory at the place of manufacture. All pipe which is rejected shall be immediately removed from the project site by the Contractor.
- L. Pipe Storage: Pipe sections shall not be stored on areas over the newly laid pipe or other pipelines which might be damaged by the superimposed load, and storage sections shall be restricted to approved areas.
- M. Handling Pipe: Each pipe unit shall be handled into its position in the trench only in such manner and by such means, as the Engineer accepts as satisfactory. The Contractor will be required to furnish suitable devices to permit satisfactory support of all parts of the pipe unit when it is lifted.
- N. Laying Pipe: Except where a concrete cradle or envelope is required, the pipe shall be laid in a crushed stone cradle. In trenches, no blocking or supporting of the piping by concrete, stones, bricks, wooden wedges, or method other than bedding the pipe on crushed stone will be permitted. Each length of pipe shall be shoved home against the pipe previously laid and held securely in position. Joints shall not be "pulled" or "cramped" without approval of the Engineer.
- O. Jointing Pipe: After the pipe are aligned in the trench and are ready to be jointed, all joint surfaces shall be cleaned.
- P. Alignment and Placement: All pipe shall be laid with extreme care as to grade and alignment. Each pipe shall be so laid as to form a close joint with the next adjoining pipe and bring the inverts continuously to the required grade.

1. Stakeout of drain work and setting of line and grade is the responsibility of the Contractor.
 2. The Contractor shall establish centerline and offset stakes at each manhole, plus one intermediate centerline and offset stake as a check point between manholes. Laser aligning shall not be used to establish a continuous line in excess of 400-feet.
- Q. Cleaning: Care shall be taken to prevent earth, water, and other materials from entering the pipeline. As soon as possible after the pipe and manholes are completed, the Contractor shall clean out the pipeline and manholes being careful to prevent soil, water, and debris from entering any existing sewer system.
1. Place plugs in end of uncompleted conduit at end of day or whenever work stops.
 2. Flush lines between manholes to remove collected debris.
- R. Review of Completed Sanitary Sewer System: The completed sewer system shall be visually inspected by the Owner's Representative. If the visual observation of the completed sewer or any part thereof shows any pipe, manhole, or joint to be of defective work or material, the defect shall be replaced or repaired as directed by the Engineer or the Owner's Representative. The Contractor shall coordinate and provide site access for inspection. All repairs or replacement of deficient or incomplete work shall be performed by the Contractor at no cost to the Owner.

3.2 INSTALLATION OF SEWER MANHOLES

- A. The bases shall be supported on a compacted level foundation of gravel borrow a minimum of 12 inches thick. Crushed stone may be substituted for gravel borrow if field conditions at the bottom of the excavation are wet.
- B. The Contractor shall install the manholes as soon as the pipe laying reaches the location of the manhole.
- C. The Contractor shall accurately locate each manhole and set accurate templates to conform to the required line and grade. Any manhole which is not installed in the correct location or oriented improperly shall be removed and rebuilt in its proper location, alignment, and orientation at no additional cost to the Owner.
- D. Manhole risers and tops shall be installed using approved butyl rubber sealant or rubber gasket for sealing joints of manhole risers and tops; jointing shall be performed in accordance with the manufacturer's recommendations. Manhole risers and tops shall be installed level and plumb. Water shall not be permitted to rise over newly made joints, nor until after inspection as to their acceptability. All jointing shall be done in a manner to ensure watertight joints.
- E. Openings shall be provided in the precast concrete manhole risers to receive entering pipes and these openings shall be made at the place of manufacture. Connection of sanitary pipes to manholes shall be made by means of a flexible rubber sleeve/boot cast integral with the structure sidewall.
- F. Care shall be taken to ensure the openings are made to permit setting of the entering pipe at its correct elevation as indicated or directed. Manhole risers and tops shall be installed so the manhole steps shall be in alignment.

- G. All holes used for handling shall be thoroughly plugged with non-shrink grout.
- H. Cutting or tampering in the field, for purpose of creating new sidewall openings or altering existing openings, will not be permitted without approval of the Engineer.
- I. All interior manhole joints where the sealing material is not flush with the inside wall shall be grouted with non-shrink mortar and finished by hand/wet-brush.
- J. Clean all debris, mortar, and soil from the bottom of all structures prior to final acceptance of the project.

3.3 SETTING MANHOLE FRAMES AND COVERS

- A. Manhole frames shall be set with tops conforming accurately to the grade of the pavement or finished ground surface as indicated on the Contract Drawings or as directed.
- B. Brick shall be used to bring the frame and cover to the required elevation.
 - 1. Frames shall be set concentric with the opening in the top of the manhole on two to four courses of brick in a full bed of mortar. A thick ring of mortar extending to the outer edge of brick or concrete shall be placed all around the bottom flange of the cast iron frame. The mortar shall be smoothly finished to a height of 5 inches above the flange for 8-inch frames and sloped to shed water away from the frame.
 - 2. Completed brick installation shall be coated with mortar at least a $\frac{3}{4}$ inch thick on the outside to provide a fully sealed and watertight collar between the top manhole section and the cover frame.
 - 3. Only clean bricks shall be used in brick work to adjust frame elevations. The brick shall be moistened by suitable means.
- C. The castings of structures located within the pavement area shall not be completely set to the established grade until the bottom course of pavement has been laid. The final setting of all other casting shall be performed at the proper stage of construction.
- D. Manhole covers shall be left in place in the frame until completion of other work at the manholes.

3.4 PVC PIPE

- A. General: Install piping in accordance with governing authorities having jurisdiction, except where more stringent requirements are indicated.
- B. PIPE HANDLING
 - 1. All pipe and fittings shall be carefully handled from the truck onto the ground and into the trench or excavation so as to prevent damage to the pipe. Pipes shall be kept free of dirt and foreign material especially on the inside. Joint ends of pipe shall especially be kept clean.
 - 2. Pipe stored on site shall be protected from direct sun light and suitably ventilated.
 - 3. Pipe or fittings shall not be dropped. All pipe or fittings shall be examined before laying, and no piece shall be installed which is found to be defective.

C. ALIGNMENT AND PLACEMENT OF PVC PIPE

1. Bedding material for the pipe must be installed with care in the area around the pipe. Bedding material must be placed to provide uniform and adequate support under pipe. Do not use blocking to bring pipe up to grade.
2. Provide bell holes at each joint to permit joint to be assembled properly while maintaining uniform pipe support.
3. Place and consolidate the bedding material under the pipe haunch to provide adequate side support while avoiding both vertical and lateral displacement of pipe.
4. Initial backfill must be completed to a point at least 12-inches over the top of the pipe and be hand placed. Use little or no tamping of initial backfill directly over the top of pipe. Compaction methods may be utilized during final backfilling.
5. No length of pipe shall be laid until the proceeding lengths of pipe have been thoroughly embedded in place, to prevent movement or disturbance of the pipe alignment.
6. Full lengths of pipe shall be used in the installation except that partial lengths may be used at the entrance to structures, and to accommodate the required locations of service connection fittings.
7. Pipe entrances to structures shall be cut flush with the inside face of the structure, and cut ends of the pipe surface within the structure shall be properly rounded and finished so that there will be no protrusion, ragged edges or imperfections that will impede or affect the hydraulic characteristics of the sewage flow. The method of cutting and finishing shall be subject to the approval of the Engineer.
8. The Contractor shall protect the installation at all times during construction. The movement of construction equipment, vehicles and loads over and adjacent to any pipe shall be performed at the Contractor's own risk.
9. Sewer pipes shall be laid to the required grades by use of a laser and target system, unless otherwise specifically approved by the Engineer.
10. Separation Between Sewer Lines and Water Lines:
 - a. A minimum horizontal separation of ten (10) feet shall be maintained between proposed sewer lines and existing water lines. The distance shall be measured edge to edge. In cases where it is not practical to maintain a ten foot separation, it is permitted to install a sewer line closer to a water line, provided that the sewer line is laid in a separate trench or on an undisturbed earth shelf located eighteen (18) inches above the top of sewer. In either case, the elevation of the top of the sewer shall be at least 18 inches below the bottom of the water line.
 - b. Whenever sewers must cross under water lines, the sewer shall be laid at such an elevation that the top of the sewer is at least 18 inches below the bottom of the water line. When the elevation of the sewer cannot be varied to provide the 18 inches of vertical clearance, the water line shall be relocated to provide this separation or reconstructed with mechanical –joint pipe for a distance of 10 feet on each side of the sewer. One full length of water pipe shall be centered over the sewer so that both joints will be as far from the sewer as possible.

- c. When it is impossible to obtain horizontal and/or vertical separation as indicated above, both the water line and sewer line shall be constructed of mechanical joint ductile iron pipe for a distance of ten (10) feet to either side of the respective centerline. The water line shall be cement lined and the sewer line shall be provided with ceramic epoxy lining for sewer applications. Both pipes shall be pressure tested by an approved method to assure water-tightness or both pipes shall be encased in control density fill. One (1) full length of water pipe shall be centered over the sewer at the crossing.
- 11. Jointing of PVC sewer pipe and fittings shall be done in accordance with the printed recommendations of the manufacturer and as specified. The bell end of the pipe shall be thoroughly cleaned. The joint surfaces and the gasket shall be lubricated prior to making up the joint. The position of the gasket shall be checked to ensure the joint has been properly made and is watertight. Care shall be taken not to exceed the manufacturer's recommended maximum deflection allowed for each joint.
 - 12. PVC pipe shall be pushed home by hand or with the use of bar and block. The use of power equipment, such as a backhoe bucket, is not acceptable.
 - 13. Field-cut pipe ends shall be cut square and the pipe surface beveled to the size and shape of a factory-finished beveled end. All sharp edges shall be rounded off.
 - 14. Detectable warning tape shall also be installed 2-feet below the existing ground surfaces for later use in locating the pipe's exact position.

3.5 CLEANOUTS

- A. Install cleanouts and extensions from sewer pipe to grade as indicated on the Contract Drawings. Set cleanout frame and cover in concrete 18 by 18 by 6-inches deep, except where location is in bituminous or concrete paving. Set top of cleanout 1-inch above surrounding earth grade or flush with grade when installed in paving.

3.6 SEWER COUPLINGS

- A. Couplings which are factory manufactured shall be installed at all connections from existing pipe to proposed pipe unless the existing pipe is the same material as the proposed pipe and the bell and spigot end of the pipes to be connected are compatible and free from defects. All sewer couplings shall be installed in accordance with the manufacturer's recommendations for the types of pipe to be connected.

3.7 TAP CONNECTIONS

- A. Make connections to existing piping and underground structures so that finished work will conform as nearly as practicable to the requirements specified for new work. The contractor shall verify the location, size, invert, and type of existing pipes at all points of connection prior to make the connections.
- B. Make branch connections from side into existing piping by installing a wye or T-wyes, and couplings manufactured for use with the same type of pipe as indicated on the Contract Drawings. The Contractor shall install a 45° wye branch or 90° tee fittings in the sewer pipe at all locations where building sewer service pipe connections are shown on the Drawings. Connections of the sewer service pipes shall be made into the wye branches or tees by means of 45° bends. The connections shall be made thoroughly watertight and concrete

shall be placed under each connection to bear on undisturbed earth and firmly support the connection.

- C. Protect existing piping and structures to prevent concrete or debris from entering while making tap connections. Remove debris, concrete, or other extraneous material that may accumulate.
- D. Connections into existing sewer facilities shall be performed in accordance with the requirements of the City of Newton. The Contractor shall comply with all such requirements, including securing of all required permits and paying the costs thereof.

3.8 INSTALLATION OF IDENTIFICATION

- A. Install continuous plastic underground warning tape during back-filling of trench for underground sanitary sewerage system piping. Locate tape two-feet below finished grade, directly over piping.

3.9 BACKFILLING

- A. General: Conduct excavation and backfill operations for structure and pipe installations in accordance with Section 312300 – EXCAVATION & FILL FOR UTILITIES AND PAVEMENT, local requirements, and the contract documents.
- B. Initial backfill shall be placed evenly on both sides of the pipe to distribute the load and not to cause movement or deflection of the pipe.

3.10 FIELD QUALITY CONTROL

- A. Testing: Perform testing of completed piping in accordance with local authorities having jurisdiction and the following:
 - 1. Testing shall be witnessed by the Owner's Representative and the local authority.
 - 2. The test shall be by vacuum or by water exfiltration as described herein:
 - 3. Vacuum Testing of Precast Concrete Manholes
 - a. The vacuum test shall be conducted on each manhole in accordance with ASTM C1244. Test results will be judged by the length of time it takes for the applied vacuum to drop from 10 inches of mercury to 9 inches. If the time is less than that listed in Table 1 of ASTM C1244, the manhole will have failed the test. Test times from Table 1 are excerpted below.

TABLE 1

Minimum Test Times for Various Manhole Diameters

<u>Depth (Feet)</u>	<u>Diameter (Inches)</u>		
	48	60	72
	<u>Times (Seconds)</u>		
0-12	30	39	49
12-16	40	52	67

16-20	50	65	81
20-24	59	78	97
26-30	74	98	121

- b. If the manhole fails the initial test, the Contractor shall locate the leaks and make the proper repairs. Leaks may be filled with a wet slurry of accepted quick setting material. If the manhole should again fail the vacuum test, additional repairs shall be made, and the manhole water tested as specified below.
4. Water Exfiltration Testing of Precast Concrete Manholes
 - a. After the manhole has been assembled in place, all lifting holes shall be filled and pointed with an approved non-shrinking mortar. All pipes and other openings into the manhole shall be suitably plugged and the plugs braced to prevent flow out. The test shall be made prior to placing the shelf and invert. If the groundwater table has been allowed to rise above the bottom of the manhole, it shall be lowered for the duration of the test.
 - b. The manhole shall be filled with water to the top of the cone section. If the excavation has not been backfilled and observation indicates no visible leakage, that is, no water visibly moving down the surface of the manhole, the manhole may be considered to be satisfactorily water tight. If the test, as described above, is unsatisfactory as determined by the Owner's Representative and/or the City of Newton's Inspector or if the manhole excavation has been backfilled, the test shall be continued. A period of time may be permitted if the Contractor so wishes, to allow for absorption by the manhole. At the end of this period, the manhole shall be refilled to the top of the cone, if necessary, and a measuring time of at least 8 hours begun. At the end of the test period, the manhole shall be refilled to the top of the cone, measuring the volume of water added. This amount shall be extrapolated to a 24-hour loss rate and the leakage determined on the basis of depth. The leakage for each manhole shall not exceed one gallon per vertical foot for a 24-hour period. If the manhole fails this requirement, but the leakage does not exceed 3 gallons per vertical foot per day, repairs by approved methods may be made as required by the Owner's Representative and/or City of Newton's Inspector to bring the leakage within the allowable rate of one gallon per foot per day. Leakage due to a defective section or joint or exceeding the 3 gallons per vertical foot per day shall be cause for rejection of the manhole. It shall be the Contractor's responsibility to uncover the rejected manhole as necessary and to disassemble, reconstruct or replace it as required by the Owner's Representative. The manhole shall then be retested and, if satisfactory, interior joints shall be filled and pointed.
 - c. No adjustment in the leakage allowance will be made for unknown causes such as leaking plugs, absorption, etc. It shall be assumed that all loss of water during the test is a result of leaks through joints or through the concrete. Furthermore, the Contractor shall take any steps necessary to assure the Owner's Representative and/or City of Newton's Inspector that the water table is below the bottom of the manhole throughout the test.
 - d. If the groundwater table is above the highest joint in the manhole, and there is no leakage into the manhole, as determined by the Owner's Representative and/or the City of Newton's Inspector, such a test can serve to evaluate water-tightness of the manhole. However, if the Owner's Representative and/or the City of

Newton's Inspector is not satisfied with the results, the Contractor shall lower the water table and carry out the test as described hereinbefore.

5. Leakage Testing of Gravity Sewer Piping and Fittings

- a. On completion of a section of sewer, including building connections, the Contractor shall install suitable bulkheads as required, dewater and test the sewer for leakage.
- b. Unless otherwise approved, the section shall be tested using low-pressure air test procedures. If circumstances permit, the Owner's Representative and/or the City of Newton's Inspector may allow testing by infiltration or exfiltration in lieu of air testing.
- c. The air test procedures shall conform to the Uni-Bell Recommended Practice for Low-Pressure Air Testing of Installed Sewer Pipe, UNI-B-6. The starting air pressure for the test shall be 4 psig (greater than the average groundwater back pressure of any groundwater above the pipe, but not greater than 9.0 psig). The minimum duration permitted for the prescribed low-pressure air exfiltration pressure drop between two consecutive manholes shall not be less than provided in Table I or Table II of UNI-B-6. Note that UNI-B-6 suggests that use of the 0.5 psig pressure drop is more efficient since the time requirements are half of the 1.0 psig-pressure drop.
- d. Using the air pressure test, if there has been no leakage (zero psig drop) after one hour of testing, the section undergoing test shall have passed.
- e. If either infiltration or exfiltration testing is permitted by the Engineer, the test shall be conducted for at least 24 hours. The amount of infiltration or exfiltration shall not exceed 100 gallons per inch diameter per mile of sewer per 24 hours.
- f. The infiltration test measures leakage into a section of sewer and may be used only where the groundwater level is one foot or more above the crown of the section of sewer pipe at its upper end and at least one foot above the top of building connections and chimneys. For making the infiltration tests, underdrains, if used, shall be plugged and other groundwater drainage shall be stopped to permit the groundwater to return to its normal level insofar as practicable. Allowances shall be made for water that may enter the sewer through pipe connections and inlets during the infiltration test.
- g. Where the groundwater level is less than 1 foot above the top of the pipe at its upper end, the exfiltration test may be used. The sewers shall be subjected to an internal pressure by plugging the pipe at the lower end and then filling the pipelines and manholes with clean water to a height of 2 feet above the highest point in the system to be tested, including main pipeline, service connections, and chimneys. When slopes between manholes are steep, the Contractor shall ensure that this test can be accomplished without danger of forcing stoppers from wye or tee branches.
- h. The rate of exfiltration from the sewers shall be determined by measuring the amount of water required to maintain the water level at the elevation established at the beginning of the test

- i. The Contractor shall construct such weirs or other means of measurements as may be required, shall furnish water, and shall do all necessary pumping to enable the test to be properly made.
 - j. The Contractor shall be responsible for the satisfactory water-tightness of the entire section of sewer. Should the sections under test fail to meet the requirements, the Contractor shall do all work of locating and repairing leaks and retesting as the Engineer may require without additional compensation. A plan of the method of repairing any leaks that are found shall be submitted to the Engineer for review.
- 6. Pipe Deflection Measurement
 - a. In accordance with ASTM D3034, no less than 30 days after completion of the PVC sewer pipe installation, the Contractor shall test the pipeline for deflection using a "go/no go" deflection mandrel having a minimum of nine evenly spaced arms or prongs. The "go/no go" gauge shall be hand pulled through all sections of the pipeline by the Contractor. The Contractor shall submit drawings of the "go/no go" gauge to the Owner's Representative and/or the City of Newton's Inspector for approval prior to testing. Complete dimensions of the gauge for each diameter of pipe to be tested shall be in accordance with ASTM D3034.
 - b. Any section of pipe found to exceed 7.5 percent deflection shall be deemed a failed pipe and shall be excavated and replaced by the Contractor at his own expense.
- 7. Video Inspections: Seven days after the completion of the backfilling of each section of new pipe, as defined as a length of pipe between two manholes, the Contractor shall provide a televised inspection of the pipe to be submitted to the Designer. The Owner's Representative shall be present during the recording. The recording shall be in DVD color format with audio and shall show a clear picture of the inside of the new pipe. If the Designer determines that the DVD is unacceptable for review the contractor shall re-televisize the line until an acceptable DVD has been submitted. In the event that the pipe is not acceptable for any reason relating to the proper construction of the pipe according to these specifications, the Contractor will be responsible to re-excavate and repair the defects to the satisfaction of the Designer at no additional cost.
- B. Cleaning: Clear interior of piping and structures of dirt and other superfluous material as work progresses. Maintain swab or drag in piping and pull past each joint as it is completed.
 - 1. In large, accessible piping, brushes and brooms may be used for cleaning.
 - 2. Place watertight plugs in ends of uncompleted pipe at end of day or whenever work stops. If water is in the trench when work is resumed, the plug shall not be removed until the trench has been dewatered and all danger of water entering the pipe eliminated.
 - 3. Flush piping between manholes to remove collected debris.
- C. Interior Inspection: Inspect piping to determine whether line displacement or other damage has occurred.
 - 1. Make inspections after pipe between manholes has been installed and approximately 2 feet of backfill is in place, and again at completion of project.

2. If inspection indicates poor alignment, debris, displaced pipe, infiltration or other defects, the Contractor shall correct such defects and reinspect.
- D. Prior to acceptance of the sanitary sewerage system, the Contractor shall submit the following to the Architect and to the local authority:
 1. System As-Built Plan stamped by a Professional Land Surveyor or Engineer Registered in the Commonwealth of Massachusetts.
 2. Video inspection DVDs and report: The report shall document the observations of the video inspections.
 3. Deflection test report: The report shall fully describe the test procedures and list the test results. The report shall be signed by the Contractor's superintendent.
 4. Leakage test report: The report shall fully describe the test procedures and list the test results. The report shall be signed by the Contractor's superintendent.

3.11 FINAL INSPECTION

- A. Final inspection and acceptance of the sanitary sewer system shall be made by the Owner's Representative and the utility owner having jurisdiction of the particular system.
- B. Prior to placing the systems in service, all components shall be inspected, with the Owner's Representative present, to ensure that no debris or other contaminants are present. If necessary, the Contractor shall clean the structures and flush piping.
- C. The Contractor is responsible for coordinating and scheduling the inspection of the work by local jurisdictional authorities. No additional payment will be made for inspections and permits required in the performance of the work.

END OF SECTION

SECTION 334000

STORM DRAINAGE UTILITIES

PART 1 – GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all SECTIONS within DIVISION 1 – GENERAL REQUIREMENTS, which are hereby made a part of this section of Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials, and equipment necessary to construct the storm drainage system complete, including connections to existing structures and testing, as indicated on the Drawings and as specified.
- B. Unless otherwise indicated on the Drawings, building drain service lines shall be installed from a point 10 feet outside the building foundation walls to the point of disposal.
- C. Related Work: The following items are noted and included in this Section and will be performed under the designated sections:
 - 1. Section 312300 – EXCAVATION & FILL FOR UTILITIES AND PAVEMENT for excavation, backfill, & compaction requirements.

1.3 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.
 - 1. Product Data: Submit manufacturer's technical product data and installation instructions for storm drain system materials and products.
 - 2. Submit descriptive literature for piping, fittings, couplings, and appurtenances showing pipe dimensions, pipe and joint materials and dimensions, and other details for each class or type of pipe or product to be furnished for this contract. All pipe furnished under the contract shall be manufactured in accordance with these Specifications.
 - 3. Submit shop drawings for storm drain systems, showing piping and manhole materials and sizes.
 - 4. Submit shop drawings of complete layout of detention/retention structures, including all fittings and appurtenances.
 - 5. The precast concrete structure shop drawing submittals for the manholes, catch basins, vaults, and tanks shall contain erection drawings showing connections, cast-in items, waterproofing details, lifting hooks, and production drawings showing elevations, sections, and details indicating sizes and quantities of reinforcement.
 - 6. Submit shop drawings for structure frames, grates, and covers.

7. Filter fabric: Submit the manufacturer's information.
8. For trench drains submit shop drawings showing a schematic plan of the entire trench drain system, listing all parts being provided with exact centerline dimensions suitable for installation. Copies of the manufacturer's recommended method of installation and assembly shall be submitted for review.
9. For water quality structures and stormwater quality filter treatment structures submit shop drawings for the structure and performance. Shop drawings shall detail the structures precast concrete components, inserts, and castings. Where an external bypass is required, the manufacturer shall provide calculations and designs for all structures, piping and any other required material applicable to the proper functioning of the system, stamped by a Professional Engineer.
10. The Contractor shall submit buoyancy calculations for storm drainage structures assuming groundwater is one (1) foot below finish grade. If buoyancy is an issue the structure(s) shall be modified to prevent uplift. All buoyancy calculations and precast concrete structure designs shall be prepared and sealed by a professional Civil Engineer licensed in the state of Massachusetts.
11. Prior to the acceptance of the storm drainage system, the Contractor shall submit to the Engineer, for review and approval, As-Built Drawings that indicate the true measurement and location, horizontal and vertical, of all new construction. As-Built drawings shall be stamped and signed by a Massachusetts Licensed Land Surveyor or Licensed Professional Engineer. The as-built plans shall also be submitted electronically as an AutoCAD drawing file (release 2010 or higher).
12. Prior to acceptance of the storm drainage system, the Contractor shall submit the results of the pipe deflection measurements and the video inspection reports.

1.4 REFERENCE STANDARDS

- A. The following standards are applicable to the work of this Section to the extent referenced herein:
 1. ASTM: American Society for Testing and Materials.
 2. ANSI: American National Standards Institute.
 3. AASHTO: American Association of State Highway and Transportation Officials.
 4. Reference is made herein to the Commonwealth of Massachusetts, Department of Transportation (MassDOT), Formerly Massachusetts Highway Department (MHD) Standard Specifications for Highways and Bridges, latest edition, hereinafter referred to as the "Standard Specifications". All references to method of measurement, basis of payment, and payment items in the "Standard Specifications" are hereby deleted. References made to particular sections or paragraphs in the "Standard Specifications" shall include all related articles mentioned therein.
 5. MassDOT Construction Standards, latest Edition with amendments, hereinafter referred to as the "Construction Standards."

1.5 EXAMINATION OF SITE AND DOCUMENTS

- A. It is hereby understood that the Contractor has carefully examined the site and all conditions affecting work under this Section. No claim for additional costs will be allowed because of a lack of knowledge of existing conditions as indicated in the Contract Documents, or obvious from observation of the site.
- B. Plans, surveys, measurements, and dimensions under which the work is to be performed are believed to be correct, but the Contractor shall have examined them for himself during the bidding period and formed his own conclusions as to the full requirements of the work involved.

1.6 QUALITY ASSURANCE

- A. Environmental Compliance: Comply with applicable portions of local environmental agency regulations pertaining to storm drain systems.
- B. Utility Compliance: Comply with the City of Newton regulations, standards, and guidelines pertaining to storm drainage system installation and inspections.
- C. Plumbing Code Compliance: Comply with applicable portions of Massachusetts Plumbing Code and National Standard Plumbing Code, latest editions, pertaining to selection and installation of storm drain system's materials and products.
- D. Manufacturer's Qualifications: Firms regularly engaged in manufacturing of storm drain system's products of types, materials, and sizes required, whose products have been in satisfactory use in similar service for not less than five years.
- E. Installer's Qualifications: Firms with at least three years of successful installation experience on projects with storm drain work similar to that required for the project.

1.7 PROJECT CONDITIONS

- A. Site Information: Perform site inspection and survey, research utility records, and verify existing utility locations and elevations. Verify that storm drainage system structures and piping may be installed in compliance with Contract Drawings and referenced standards.
- B. Interruption of Existing Storm Drainage System: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to the requirements indicated:
 - 1. Notify Architect no fewer than two days in advance of proposed interruption of service.
 - 2. Do not proceed with interruption of service without Architect's written permission.

1.8 SEQUENCING AND SCHEDULING

- A. Coordinate with interior building storm drain system piping.
- B. Coordinate with other utility work.
- C. The Contractor is responsible for developing a sequence of work to maintain existing services in operation until the new services are operational.

- D. The Contractor is responsible for coordinating and scheduling the inspection of the work by the jurisdictional authority. All permits and inspection costs and fees shall be included in the bid prices and no additional costs will be paid to the Contractor.

PART 2 – PRODUCTS

2.1 MANHOLES AND CATCH BASINS

- A. General: Provide precast reinforced concrete structures as indicated and complying with ASTM C 478.
- B. Manhole Top: Precast concrete, of concentric cone, eccentric cone, or flat slab top type, as indicated in the Contract Drawings. Tops shall be designed to meet H20 loadings.
- C. Base and Riser Sections: Precast concrete, with base riser section with integral floor. Diameter, base and riser thicknesses shall be as indicated on the Contract Drawings.
- D. Cement: Type II.
- E. Concrete strength: 4,000 psi minimum.
- F. Precast concrete sections shall have tongue and groove joints.
- G. Horizontal Joints: Joints between sections of concrete structures shall be sealed with a flexible, watertight joint, made with preformed butyl rubber joint sealant conforming to ASTM C990 or with a rubber gasket joint conforming to ASTM C443. Sealants and/or gaskets shall be installed in accordance with the manufacturer's written instructions.
- H. Manhole Steps: Steps for manholes shall be non-skid raised edge-front steel reinforced polypropylene plastic type with at least 13-inch-wide stepping surface. Steps shall meet the requirements of ASTM C-478 and AASHTO M-199. Steel shall be 1/2-inch grade 60 conforming to ASTM A615 encapsulated with molded copolymer polypropylene. The polypropylene shall conform to ASTM D-4101. Rungs shall protrude no more than 6 inches from the wall. The portion of the legs to be embedded in the precast section shall have fins and be tapered to ensure a secure bond. Steps shall start a foot above the shelf of the manhole floor and continued twelve inches on center spacing up through the completed height of the unit. The steps shall finish no lower than twenty-four (24)-inches below the rim elevation. Placement into precast walls shall be by a method recommended by the supplier of the precast manhole sections. Steps shall be installed per the manufacturer's specifications.
- I. Pipe Connections: Drainage structures shall have plain beveled openings to accept the type of pipe specified. Pipe openings shall be minimum size required to receive the pipe and shall be accurately set to conform to the required line and grade. Drain pipe shall be joined to the wall of the concrete manhole or catch basin with non-shrink grout or flexible manhole sleeve as indicated on the drawings. Grout mixture shall follow instructions provided by manufacturer. Flexible manhole sleeves shall be cast in the walls of the manholes during the manufacturing process. Flexible manhole sleeves shall be NPC Kor-N-Seal Pipe-to-Manhole Connector as manufactured by Trelleborg Pipe Seals Milford, Inc., Milford, NH; Z-Lok as manufactured by A-Lok Products, Inc., Tullytown, PA; Tylox CIB Series Cast-In Boot Connector as manufactured by Hamilton Kent, Winchester, TN; or approved equal.

- J. Waterproofing: The exterior surfaces of precast structures shall be given two heavy coats of waterproofing concrete sealer. The material shall be Aqua-Safe Concrete Sealer as manufactured by Bay Oil Company, Chicopee, MA; Bitumastic 300M as manufactured by Carboline Company, St. Louis, MO; Sonoshield HLM 5000 as manufactured by BASF Corporation Building Systems, Shakopee, MN; ConSeal CS-1800 as manufactured by Concrete Sealants, Inc., Tipp City, OH; or acceptable equivalent products. The waterproofing material shall be applied by brush or spray and in accordance with the instructions of the manufacturer. Time shall be allowed between coats to permit sufficient drying so that the application of the second coat has no effect on the first coat.
- K. Storm Drainage Brick Masonry: Bricks shall be sound, hard, uniformly burned, regular, and uniform in shape and size. Underburned or salmon brick shall not be acceptable. Only whole brick shall be used.
 - 1. Bricks for raising manhole and catch basin frames to finished grade shall conform to ASTM C32, Grade MS.
 - 2. Mortar shall be in conformance with ASTM C270, Type M. The mortar shall be composed of one-part Portland cement, 3-1/2 parts sand, and ¼ parts hydrated lime, by volume. Portland cement shall be ASTM C150, Type II; hydrated lime shall be Type S conforming to ASTM D207.
 - 3. Sand shall be washed, cleaned, screened, well-graded with all particles passing a No. 4 sieve, and conform to ASTM C33.
- L. Inverts in drain manholes shall be constructed of cement concrete shaped to conform accurately to size of the adjoining pipe. Side inverts and main inverts where the direction changes shall be laid out in smooth curves of the longest possible radius which is tangent, within the manhole, to the centerline of the adjoining pipe lines.
- M. For all manhole depths greater than 10 feet, the inside diameter of the manholes shall be at least 5'-0".
- N. Safety landings will be installed inside manholes greater than 16-feet in depth.
- O. When installing manholes on existing lines and when flows cannot be diverted, drop-over manholes shall be used. Drop-over manholes shall be precast with opening cast in the sidewalls of sufficient size to fit over the existing line(s) to remain in service. Drop-over manholes shall be set on a precast or cast-in-place concrete base slab. Drop-over manholes shall be manufactured to the same requirements and dimensions as standard manholes.

2.2 MANHOLE FRAMES AND COVERS

- A. Frames and covers shall be of cast iron conforming to the requirements of ASTM A48, Class No. 30 and shall be manufactured by General Foundries Inc., North Brunswick, New Jersey; East Jordan Iron Works (formerly LeBaron Foundry, Inc.), East Jordan, Michigan; Neenah Foundry Company, Neenah, Wisconsin; or approved equal. Manhole covers shall be machined to fit securely and evenly on the frame. Frames and covers shall be designed to accept H20 loads, have a diamond surface finish, and frame height of 6 to 9-inches. Covers shall be equal to Item Numbers 12665 and 12685 (6" and 8-1/8" frame heights, respectively) as manufactured by General Foundries Inc. Catalog numbers are provided to establish a standard of quality and configuration of castings. Covers shall bear the word "DRAIN" in 3-inch-high letters.

2.3 CATCH BASIN FRAMES AND GRATES

- A. Catch basin grates located at low points shall consist of a 24-inch square grate with a minimum frame height of 8 inches unless otherwise noted on the drawings. Frames and grates shall be of cast iron and designed to accept H20 loads. Catch Basin Frames and Grates shall be manufactured by General Foundries Inc., North Brunswick, New Jersey; East Jordan Iron Works (formerly LeBaron Foundry, Inc.), East Jordan, Michigan; Neenah Foundry Company, Neenah, Wisconsin; or approved equal. Single frames and grates shall be equal to Item Numbers 22444-SQH, 22464-SQH, and 22484-SQH (4", 6", and 8" frame heights, respectively) as manufactured by General Foundries Inc. ADA Compliant frames and grates shall be equal to Item Numbers 22444-ADA, 22464-ADA, and 22484-ADA (4", 6", and 8" frame heights, respectively) as manufactured by General Foundries Inc. Double frames and grates shall be equal to Item Numbers 24844-SQH, 24864-SQH, and 24884-SQH (4", 6", and 8" frame heights, respectively) as manufactured by General Foundries Inc. Four and three-flange frames shall be provided as required. Catalog numbers are provided to establish a standard of quality and configuration of castings.
- B. Catch basin cascade frames and grates shall consist of a 24-inch square grate with a minimum frame height of 8 inches unless otherwise noted on the drawings. Frames and grates shall be of cast iron and designed to accept H20 loads. Cascade frames and grates shall be manufactured by General Foundries Inc., North Brunswick, New Jersey; East Jordan Iron Works (formerly LeBaron Foundry, Inc.), East Jordan, Michigan; Neenah Foundry Company, Neenah, Wisconsin; or approved equal. Cascade frames and grates shall be equal to Item Numbers 22444-CAS, 22464-CAS, and 22484-CAS (4", 6", and 8" frame heights, respectively) as manufactured by General Foundries Inc. Four and three-flange frames shall be provided as required. Catalog numbers are provided to establish a standard of quality and configuration of castings.

2.4 CATCH BASIN HOODS

- A. All catch basins shall have hoods installed over the outlet pipe. Hoods shall be cast iron removable or hinged traps that fit over the catch basin outlet pipe. Traps shall be approximately 19-inches wide by 18-inches high and extend 11-inches from the wall of the structure. Catch Basin Hoods shall be manufactured by General Foundries Inc., North Brunswick, New Jersey; East Jordan Iron Works (formerly LeBaron Foundry, Inc.), East Jordan, Michigan; Neenah Foundry Company, Neenah, Wisconsin; or approved equal. Hoods shall be equal to Item Number MATRP as manufactured by General Foundries Inc. Catalog numbers are provided to establish a standard of quality and configuration of castings.

2.5 AREA DRAIN

- A. Area drains required for this contract shall be manufactured from PVC pipe stock, utilizing a thermo-molding process to reform the pipe stock to the specified configuration. The drainage pipe connection stubs shall be manufactured from PVC pipe stock and formed to provide a watertight connection with the specified pipe system. This joint tightness shall conform to ASTM D3212 for joints for drain and sewer plastic pipe using flexible elastomeric seals conforming to ASTM F477. The pipe bell spigot shall be joined to the main body of the area drain. A PVC cap shall be installed at the bottom of the area drain sump. The raw material used to manufacture the pipe stock that is used to manufacture the main body and pipe stubs of the surface drainage inlets shall conform to ASTM D1784 cell class 12454. Area drains shall be manufactured by Nyloplast or approved equal.
- B. Grates and frames furnished for all area drainage shall be ductile iron for sizes 8", 10", 12", 15", 18" and 24" and shall be made specifically for each basin so as to provide a round bottom flange that closely matches the diameter of the surface drainage inlet. Grates for area drains

shall be capable of supporting H-20-wheel loading for vehicular traffic areas or H-10 loading for pedestrian traffic areas unless otherwise noted. 12" and 15" square grates shall be hinged to the frame using pins. Metal used in the manufacture of the castings shall conform to ASTM A536 grade 70-50-05 for ductile iron. Grates shall be provided painted black. Grates in walkways shall meet ADA requirements. Grates in planting beds shall be domed grates. The grates furnished for area drains bioretention areas shall be 24" in diameter. All area drain grates should include a locking device. Area drain grates shall be manufactured by Nyloplast or approved equal.

2.6 INLINE DRAINS

- A. The inline drain required for this contract shall be manufactured from PVC pipe stock, utilizing a thermos-molding process to reform the pipe stock to the furnished configuration. The drainage pipe connection stubs shall be manufactured from PVC pipe stock and formed to provide a watertight connection with the specified pipe system. This joint tightness shall conform to ASTM D3212 for joints for drain and sewer plastic pipe using flexible elastomeric seals. The flexible elastomeric seals shall conform to ASTM F477. The pipe bell spigot shall be joined to the inline drain body by use of a swage mechanical joint. The ram material used to manufacture the pipe stock that is used to manufacture the inline drain body and pipe stubs of the surface drainage inlets shall conform to ASTM D1784 cell class 12454.
- B. The grates furnished for all surface drainage inlets shall be ductile iron grates for sizes 8", 10", 12", 15", 18", and 30" shall be made specifically for each fitting so as to provide a round bottom flange that closely matches the diameter of the surface drainage inlet. Grates for inline drains shall be capable of supporting H-20-wheel loading for traffic areas or H-10 loading for pedestrian areas. 12" and 15" square grates will be hinged to the frame using pins. Metal used in the manufacture of the castings shall conform to ASTM A536 grade 70-50-05 for ductile iron. Grates shall be provided painted black.

2.7 MANUFACTURED TRENCH DRAINS

- A. Trench drains shall be a pre-engineered, manufactured system that conforms to the design loading requirements of AASHTO H-20 and HS-20 (minimum) with the following minimum requirements:
 - 1. Channels shall be manufactured from polyester resin polymer concrete with an integrally cast-in ductile iron edge rail. Each edge rail shall be at least 1/4" thick.
 - 2. The polymer concrete shall be frost proof, dilute acid and alkali resistant, and salt proof (B117 Salt Spray Test Compliant) with the minimum properties as follows:
 - a. Compressive Strength: 14,000 psi
 - b. Flexural Strength: 4,000 psi
 - c. Tensile Strength: 1,500 psi
 - d. Water Absorption: 0.07%
 - 3. The system shall be 12" nominal internal width with a 14.2" overall width and a built-in slope of 0.5%. Channel invert shall have a partial radius in the trench bottom. All channels shall be interlocking with a male/female joint.
 - 4. Trench drain grates shall be slotted ductile iron conforming to ASTM 536-84, Grade 65-45-12. After removal of grates, there shall be uninterrupted access to the trench to aid maintenance.
 - 5. Units shall have horizontal cast in anchoring keys on the outside wall to ensure maximum mechanical bond to the surrounding bedding material and pavement surface.
 - 6. The trench drain shall have a locking device that directly connects the grate to the frame.

7. Channel shall be designed to withstand loading to Load Class F as outlined by EN 1433. Grate type shall be appropriate to meet the system load class specified.
8. Trench drain system shall be installed in strict accordance with manufacturer's installation instructions, recommendations, and shop drawings.

2.8 WATER QUALITY STRUCTURE

- A. The water quality drainage structure models indicated on the Contract Drawings are Stormceptor® as manufactured by the Stormceptor Corporation, Rockville, MD. Equivalent structures include Vortechs as manufactured by Vortech, Inc. of Portland, ME, and Downstream Defender as manufactured by Hydro International of Portland, ME. Other acceptable equivalent manufactured devices may be used if following requirements are met. Prior to acceptance, the contractor shall receive written approval for use of said substitution from the City of Newton and/or their authorized representatives.
- B. The water quality structure shall have a proven laboratory test record of having the capability to remove a minimum of 80% of the sediment load from the low-flow storm conditions from the total catchment area of the drainage system. Laboratory testing methods shall conform to the "Technology Acceptance Reciprocity Partnership" (TARP) Tier II protocol or other acceptable equivalent method and shall have the capability of removing clay and silt size particles.
- C. The available water quality structure laboratory performance documentation shall achieve a grade of "2" or better as rated through the "Massachusetts Stormwater Evaluation Project" (MAStep).
- D. The water quality structure shall be installed underground as part of the stormwater system.
- E. The structure shall be constructed of precast concrete components.
- F. Precast Concrete Sections: All precast concrete components shall be designed and manufactured to a minimum live load of AASHTO HS-20 truck loading.
- G. Joints: The concrete joints shall be watertight and meet the design criteria according to ASTM C443.
- H. Frame and Cover: The frame and cover shall clearly indicate with lettering the unit's name cast into the cover to allow for easy identification in the field.
- I. Concrete: Precast concrete components shall meet the requirements of ASTM C478.
- J. Fiberglass: The fiberglass portion of the water treatment structure shall be constructed in accordance with ASTM D409, Contact Molded Glass Fiber Reinforced Chemical Resistant Tanks. The internal fiberglass insert shall be bolted and sealed watertight inside the reinforced concrete component.
- K. The water quality structure shall be vertically oriented with easy access to facilitate maintenance.
- L. The first 16 inches of oil storage should be lined with fiberglass or other coating acceptable to the Engineer to provide double-wall containment of any hydrocarbon-based material.
- M. Water quality structure shall be equipped with high flow bypass that shall be physically separated from the separation area to prevent mixing.

- N. The structure shall be maintainable from the surface via access points without requiring entry into the structure.
- O. The structure shall be designed to prevent the formation of secondary eddy currents or scour conditions.
- P. The structure shall be able to be installed to the invert elevations of the drainage system as detailed on the Contract Drawings.
- Q. The water quality structure shall be capable of containing floatable substances such as oil and gasoline within the structure during normal operation as well as periods of service and repair. Floatables containment shall be achieved without the use of floatable additives.
- R. The water quality structure shall not be compromised by backwater conditions i.e., trapped pollutants should not be resuspended and scoured from the interceptor during backwater conditions.
- S. Calculations stamped by a Professional Engineer shall be supplied to demonstrate that the water quality structures will accept the design flow rates without causing a backwater condition.
- T. Inspection: All precast concrete sections shall be inspected to ensure that dimensions, appearance, and quality of the product meet the requirements of ASTM C478.

2.9 STORMWATER QUALITY FILTER TREATMENT STRUCTURE

- A. The structure shall be cylindrical or rectangular and constructed from precast concrete riser and slab components or monolithic precast structure(s), installed to conform to ASTM C891 and to any required state highway, municipal or local specifications.
- B. The stormwater quality filter treatment structure indicated on the Contract Drawings is a Jellyfish® Filter as manufactured by the Contech Engineered Solutions, West Chester, OH.
- C. CARTRIDGE DECK
 - 1. The cylindrical concrete structure shall include a fiberglass deck.
 - 2. The rectangular concrete structure shall include a coated aluminum deck.
 - 3. The deck insert for either the cylindrical or rectangular concrete structure shall be bolted and sealed watertight inside the precast concrete chamber. The insert shall serve the following functions:
 - a. A horizontal divider between the lower treatment zone and the upper treated effluent zone;
 - b. A deck for attachment of filter cartridges such that the membrane filter elements of each cartridge extend into the lower treatment zone;
 - c. A platform for maintenance workers to service the filter cartridges; and
 - d. A conduit for conveyance of treated water to the effluent pipe.
- D. MEMBRANE FILTER CARTRIDGES
 - 1. Filter cartridges shall be comprised of cylindrical membrane filter elements connected to a perforated head plate.
 - 2. The number of membrane filter elements per cartridge shall be eleven 2.75-inch diameter elements.
 - 3. The length of each filter element shall be a minimum of 15 inches.

4. Each cartridge shall be fitted into the cartridge deck by insertion into a cartridge receptacle that is permanently mounted into the cartridge deck.
5. Each cartridge shall be secured by a cartridge lid that is threaded onto the receptacle.
6. The maximum treatment flow rate of a filter cartridge shall be controlled by an orifice in the cartridge lid and based on a design flux rate (surface loading rate) determined by the maximum treatment flow rate per unit of filtration membrane surface area. The maximum flux rate shall be 0.21 gpm/ft².
7. Each lightweight membrane filter cartridge shall allow for manual installation and removal.
8. Each filter cartridge shall have filtration membrane surface area and dry installation weight as follows:

Filter Cartridge		Filtration Cartridge		Filter Cartridge	
Length		Membrane		Dry Weight	
		Surface Area			
in	mm	ft ²	m ²	lbs	kg
15	381	106	9.8	10	4.5
27	686	190	17.7	14.5	6.6
40	1,016	282	26.2	19.5	8.9
54	1,372	381	35.4	25	11.4

E. BACKWASHING CARTRIDGES

1. The filter structure shall have a weir extending above the cartridge deck that encloses the high flow rate filter cartridges when placed in their respective cartridge receptacles within the cartridge deck.
2. The weir shall collect a pool of filtered water during inflow events that subsequently automatically backwashes the high flow rate cartridges each time the inflow event subsides.
3. All filter cartridges shall allow for use of a manual backwashing or filtration membrane rinsing procedure to restore flow capacity and sediment capacity and extend cartridge service life.

F. Maintenance Access to Captured Pollutants: The filter structure shall contain an opening(s) that provides suitable maintenance access for removal of accumulated floatable pollutants and sediment.

G. Bend Structure: The structure shall be able to be used as a bend structure with minimum angles between inlet and outlet pipes of 90-degrees or less in the stormwater conveyance system.

H. Double-Wall Containment of Hydrocarbons: The cylindrical precast concrete structure shall provide double-wall containment for hydrocarbon spill capture by a combined means of an inner wall of fiberglass, to a minimum depth of 12 inches below the cartridge deck, and the precast vessel wall.

I. BAFFLE

1. The filter structure shall provide a baffle that extends from the underside of the cartridge deck to a minimum length equal to the length of the membrane filter elements.
2. The baffle shall serve to protect the membrane filter elements from contamination by floatables.

- a. In the cylindrical structure, the baffle shall be a flexible continuous skirt secured to the fiberglass deck.
 - b. In the rectangular structure, the baffle shall be a concrete or metal wall, secured to the precast chamber.
- J. Sump: The structure shall include a minimum 24 inches of total sump depth below the bottom of the cartridges for sediment accumulation unless otherwise specified in the shop drawings or by the design engineer.
- K. Precast Concrete Sections: All precast concrete components shall be manufactured to a minimum live load of HS-20 truck loading or greater based on local regulatory specifications unless otherwise modified or specified by the design engineer.
- L. Horizontal Joints: Joints between sections of concrete structures shall be sealed with a flexible, watertight joint, made with preformed butyl rubber joint sealant conforming to ASTM C990 or with a rubber gasket joint conforming to ASTM C443. Sealants and/or gaskets shall be installed in accordance with the manufacturer's written instructions.
- M. Frame and Cover: Frame and covers must be manufactured from cast-iron and embossed with the name of the structure manufacturer or the structure brand name.
- N. Doors and Hatches: If provided shall meet designated loading requirements at a minimum for AASHTO H-20 traffic loading.
- O. Concrete: All concrete components shall meet the requirements of ASTM C478.
- P. Steps: Steps shall be constructed according to ASTM D4101 of copolymer polypropylene, and be driven into preformed or pre-drilled holes after the concrete has cured, installed to conform to applicable sections of state, provincial and municipal building codes, highway, municipal or local specifications for the construction of such structures.
- Q. Inspection: All precast concrete sections shall be inspected to ensure that dimensions, appearance, and quality of the product meet the requirements of ASTM C478.

2.10 CORRUGATED POLYETHYLENE PIPE

- A. General: Provide pipes of the following materials of class indicated. Provide pipe fittings and accessories of same materials and class as pipes with joining method, as indicated. The piping shall be manufactured by an established manufacturer of good reputation in the industry and in a permanent plant adapted to meet all the design requirements of the pipe.
 - 1. Corrugated polyethylene pipe shall have an interior surface that is smooth and even, free from roughness, projections, indentations, offsets, or irregularities of any kind.
 - a. Pipe shall conform to AASHTO M252, Type S for 4- through 10-inch diameter pipes.
 - b. Pipe shall conform to AASHTO M294, Type S or ASTM F2306 for 12- through 60-inch diameter pipes.
 - c. Fittings shall conform to AASHTO M252, AASHTO M294 or ASTM F2306. Bell and spigot connections shall utilize a spun-on or welded bell and valley or saddle gasket meeting the watertight joint performance requirements of AASHTO M252, AASHTO M294 or ASTM F2306.

2. Pipe and fittings shall be high-density polyethylene meeting the requirements of ASTM D3350.
3. Pipe units shall have a minimum laying length of 20-feet except as otherwise indicated or allowed by the Engineer.
4. Pipe shall be installed with a minimum 12-inch cover for AASHTO H-20 loading.

B. CORRUGATED POLYETHYLENE FLARED END SECTION

1. The pipe shall have an interior surface that is smooth and even, free from roughness, projections, indentations, offsets, or irregularities of any kind. Flared end section shall be high-density polyethylene meeting ASTM D3350 minimum cell classification 213320C. Metal threaded fastening rods shall be stainless steel.

C. JOINTS ON CORRUGATED POLYETHYLENE PIPE

1. The pipe and fitting joints shall be bell-and spigot with watertight gaskets in accordance with the requirements of ASTM D3212.
2. Gaskets shall meet the requirements of ASTM F477. Gaskets shall be installed by the pipe manufacturer and covered with a removable, protective wrap to ensure the gasket is free from debris. A joint lubricant available from the manufacturer shall be used on the gasket and bell during assembly.
3. Pipe entrances at catch basins shall be made with a mortar made with Type II cement. Mortar mixture shall follow instructions provided by cement manufacturer. Pipe connections at drain manholes and water quality structures shall be made with integral flexible rubber sleeves and Corrugated Pipe Adapters designed for use with the pipe and sleeves.

2.11 REINFORCED CONCRETE PIPE (CLASS IV; 12 THROUGH 48 INCHES)

- A. General: Provide pipes of the following materials of class indicated. Provide pipe fittings and accessories of same materials and class as pipes with joining method, as indicated. The piping shall be manufactured by an established manufacturer of good reputation in the industry and in a permanent plant adapted to meet all the design requirements of the pipe.
1. The pipe shall have an interior surface, which is smooth and even, free from roughness, projections, indentations, offsets, or irregularities of any kind. Pipe shall conform to ASTM "Specifications for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe," Designation: C76 and shall be Wall B for the Class IV and V, as noted on the drawings, and with additions and exceptions as follows:
 2. Type II cement shall be used unless otherwise approved by the Engineer. Admixtures shall not be used except with prior approval of the Engineer.
 3. Elliptical reinforcement will not be permitted. Longitudinal reinforcement shall be continuous. Reinforcement shall have a minimum cover of $\frac{3}{4}$ inch. Pipe shall have no lifting holes.
 4. Absorption shall be as specified under "Tests of Materials and Pipe Units."

5. Pipes manufactured by the centrifugal process or in vertical forms shall be cast of wet mix concrete. Concrete cast in vertical forms shall be consolidated by internal or external mechanical vibration or both. The vibrating equipment shall be operated at high speed (more than 5,000 rpm) and have a low amplitude. Pipes manufactured by the modified packer process shall have a supplementary concrete densification operation that shall assure the attainment of full bond between reinforcement and concrete and also eliminate any displacement of the reinforcement. Additional passes with the revolving packerhead or the use of additional vibrators attached to the platform or exterior forms will not be acceptable.
6. Pipe units shall have a minimum laying length of 8-feet except as otherwise indicated or allowed by the Engineer.
7. Pipe may be rejected for any of the following reasons:
 - a. Exposure of any wires, positioning spacers or chairs used to hold the reinforcement cage in position, or steel reinforcement in any surface of the pipe, except as permitted by Section 8.2 of ASTM C76.
 - b. Transverse reinforcing steel found to be in excess of 1/4-inch out of specified position after the pipe is molded.
 - c. Any shattering or flaking of concrete as a crack.
 - d. Voids, with the exception of a few minor bugholes, on the interior and exterior surfaces of the pipe exceeding 1/4-inch in depth, unless properly and soundly pointed with mortar or other approved material.
 - e. A hollow spot (identified by tapping the internal surface of the pipe) which is greater than 30-inches in length or wider than 3 times the specified wall thickness.
 - f. Defects that indicate imperfect molding of concrete; or any surface defect indicating honeycomb or open texture (rock pockets) greater in size than area equal to a square with a side dimension of 2½ times the wall thickness or deeper than two times the maximum graded aggregate size; or local deficiency of cement resulting in loosely bonded concrete.
 - g. Any of the following:
 - 1) A crack having a width of 0.005 to 0.01-inches throughout a continuous length of 36-inches or more.
 - 2) A crack having a width of 0.0 to 0.03-inches or more throughout a continuous length of 1-foot or more.
 - 3) Any crack greater than 0.005-inches extending through the wall of the pipe and having a length in excess of the wall thickness.
 - 4) Any crack showing two visible lines of separation for a continuous length 2-feet or more, or an interrupted length of 3-feet or more anywhere in evidence, both inside and outside.
 - 5) Cracks anywhere greater than 0.03-inches in width.

- h. Application of any wash coat of cement or grout to the pipe will not be permitted without approval of the Engineer. Any pipe dressing procedures shall be subject to the approval of the Engineer.

B. Joints on Reinforced Concrete Pipe:

- 1. Pipe joints for all reinforced concrete pipe shall be of the rubber gasket type in which the gaskets are in compression and which will permit both longitudinal and angular movement. Each unit of pipe shall be provided with proper ends made of concrete formed true to size and formed on machined rings to ensure accurate joint surfaces.
- 2. Joints and gaskets for pipe shall be the O-ring gasket type and shall conform to the requirements of ASTM C443 and the additional requirements specified.
- 3. Joints shall be of such design that when tested under an average internal hydrostatic pressure of 13 pounds per square inch for a period of 10 minutes, no visible leakage will result. The diameters of the joint surfaces which compress the gasket shall not vary from the true diameters by more than 1/16-in or the amount permitted by the appropriate above-mentioned ASTM Standard Specifications, whichever is less.
- 4. Gaskets shall be of a composition and texture which is resistant to common ingredients of sewage, industrial wastes, and groundwater, and which will endure permanently under the conditions likely to be imposed by this service. Gaskets shall be the product of a manufacturer regularly engaged in the manufacture of rubber gaskets for pipe joints.

- C. Flared End Sections: Reinforced Concrete Pipe flared end sections shall conform to requirements of AASHTO M170, minimum Class IV.

2.12 SUBSURFACE INFILTRATION CHAMBERS

- A. Subsurface detention chambers shall be HDPE chamber system as manufactured by StormTech, Cultec, or similar. The chambers will be handled, stored, and installed according to manufacturer's specifications and details. The chambers will be placed on a drainage course bed with a minimum of depth of six inches. The chambers shall not be placed with backfill depths greater than 96" to surface as per manufacturer's details.
- B. The nominal storage volume of stormwater chambers shall be 110 cubic feet per larger chamber, and 14.7 cubic feet per smaller chamber.
- C. The galley shall have both of its ends open to allow for unimpeded hydraulic flows and for visual inspection and maintenance of the row's entire length. The galley shall have a circular, indented, flat surface on the top for an inspection port or clean-out.
- D. The galley shall be analyzed and designed using AASHTO methods for thermoplastic culverts contained in the LRFD Bridge Design Specifications, 2nd Edition, including Interim Specifications through 2001. Design live load shall be the AASHTO HS20 vehicle. Design shall consider earth and live loads as appropriate for the specified depth of fill.
- E. The end cap shall be designed to fit into any corrugation of a galley, which allows capping a galley that has its length trimmed and segmenting rows into storage basins of various lengths.
- F. The end cap shall have saw guides to allow easy cutting for various diameters of pipe that may be used to inlet the system. The end cap shall have excess structural adequacies to allow cutting an orifice of the required size at any invert elevation.

- G. The primary face of an end cap shall be curved outward to resist horizontal loads generated near the edges of beds.

2.13 FILTER FABRIC

- A. Filter Fabric used, as a drainage medium shall consist of a non-woven fabric made from polypropylene or polyethylene filaments or yarns. The fabric shall be inert to organic chemicals commonly encountered in the soil. Edges of filter fabric shall overlap a minimum of one foot. The fabric shall conform to the following recommended property tests:

Property	Unit	Test Method	Minimum Value
Weight	oz/sy	ASTM D-5261-92	4.8
Grab Strength	lbs	ASTM D-4632-91	120
Grab Elongation	percent	ASTM D-4632-91	50
Trapezoid Tear Strength	lbs	ASTM D-4533-91	50
Mullen Burst Strength	psi	ASTM D-3786-87	225
Puncture Strength	lbs	ASTM D-4833-00	65
Apparent Opening Size (AOS)	U.S. std. Size Sieve	ASTM D-4751-99A	70

2.14 CRUSHED STONE

- A. Crushed stone shall consist of durable crushed rock or durable crushed gravel stone, free from ice and snow, sand, clay, loam, or other deleterious or organic material. The crushed stone shall be uniformly blended and shall conform to the following requirements.

Percent Passing by Weight		
Sieve Size	3/4-inch Stone	1/2-inch Stone
1-inch	100	---
3/4-inch	90-100	---
5/8-inch	---	100
1/2-inch	10-50	85-100
3/8-inch	0-20	15-45
No. 4	0-5	0-15
No. 8	---	0-5

2.15 DRAIN COUPLINGS

- A. Drain Couplings shall be pressure rated at least equal to that of the pipe. The coupling sleeve, shall be 1/4-inch minimum thickness elastomeric polyvinylchloride with a minimum tensile strength of 1500 psi. The sleeve shall fit snugly onto the pipe to be joined and be resistant to common chemicals present in storm water. Adjustable pipe clamps shall consist of a slotted band that mate with the worm gear screw and a screw housing all manufactured of stainless steel, and suitable for underground service.

2.16 CLEANOUTS

- A. General: Provide cast-iron ferrule and countersunk brass cleanout plug, with round cast-iron access frame and heavy-duty, secured, scoriated cast-iron cover.
- B. The drain cleanouts shall be minimum 6-inch diameter or sized to match the service pipe, whichever is greater. The cleanout shall be complete with a flush mount over. The cleanout cover shall be clearly marked "DRAIN" and shall be minimum eight inches in diameter or two inches greater than the cleanout size, whichever is greater. Cleanouts shall include a watertight cap.

2.17 IDENTIFICATION

- A. Detectable Underground Warning Tapes: Acid and alkali-resistant polyethylene plastic film warning tape, 6-inches wide by 4-mils. minimum thickness, with continuously printed caption in black letters "CAUTION - xxxxx LINE BURIED BELOW." The text and color of the tape shall be as shown in the table below. The tape shall have a metallic core encased in a protective jacket for corrosion protection and be detectable by a metal detector when the tape is buried up to 2.5-feet deep.

Color	Utility
Safety Red	Electric
High Visibility Safety Yellow	Gas, Oil, Steam
Safety Alert Orange	Telephone, Communications, Cable Television
Safety Precaution Blue	Water System, Irrigation
Safety Green	Sanitary Sewer, Storm Sewer

PART 3 – EXECUTION

3.1 GENERAL INSTALLATION

- A. General: General Locations and Arrangements: Contract Drawings indicate the general location and arrangement of the underground storm drainage system piping. Location and arrangement of piping layout take into account many design considerations. Install the piping as indicated, to the extent practical. Any modifications to the layout of the storm drainage system shall be submitted to the Engineer for review and approval at least five days prior to the start of the affected work.
- B. Install piping beginning at low point of systems, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings in accordance with manufacturer's recommendations, accepted practices, and utility owner's requirements. Maintain swab or drag in line and pull past each joint as it is completed.
- C. All pipe shall be laid in the dry. Adequate measures shall be taken to prevent floatation of pipe in the trench.
- D. Whenever encountered within the trench, existing abandoned water, sewer, and/or drain lines shall be removed within the trench limits, unless otherwise noted. The remaining portion of the abandoned lines shall be plugged at all open ends.

- E. When bell and spigot pipes are used, bell holes shall be dug in the bedding to accommodate the bells. They shall be deep enough to ensure that the bell does not bear on the bottom of the hole but shall be excessively wide in the longitudinal direction of the installation.
- F. Use manholes for changes in direction, except where a fitting is indicated. Use fittings for branch connections, except where direct tap into an existing storm drain is indicated.
- G. Use proper size increasers, reducers, and couplings, where different size or material of pipes and fittings are connected. Reduction of the size of piping in the direction of flow is prohibited without the written approval of the Engineer.
- H. Install piping pitched down in direction of flow as indicated on the Contract Drawings.
- I. Extend storm drainage system piping to connect to building drain services, of sizes and in locations indicated on the Contract Drawings.
- J. Install piping in accordance with governing authorities having jurisdiction, except where more stringent requirements are indicated.
- K. Acceptance of Pipe: Acceptance will be on the basis of tests specified herein before. The quality of all materials used in the pipe, the process of manufacture, and the finished pipe shall be subject to review by the Engineer. Inspection may be made at the place of manufacture, or on the work site after delivery or at both places and the pipe shall be subject to rejection at any time on account of failure to meet any of the specification requirements, even though sample pipe units may have been accepted as satisfactory at the place of manufacture. All pipe which is rejected shall be immediately removed from the project site by the Contractor.
- L. Pipe Storage: Pipe sections shall not be stored on areas over the newly laid pipe or other pipelines which might be damaged by the superimposed load, and storage sections shall be restricted to approved areas.
- M. Handling Pipe: Each pipe unit shall be handled into its position in the trench only in such manner and by such means, as the Engineer accepts as satisfactory. The Contractor will be required to furnish suitable devices to permit satisfactory support of all parts of the pipe unit when it is lifted.
- N. Laying Pipe: Except where a concrete cradle or envelope is required, the pipe shall be laid in a crushed stone cradle. In trenches, no blocking or supporting of the piping by concrete, stones, bricks, wooden wedges, or method other than bedding the pipe on crushed stone will be permitted. Each length of pipe shall be shoved home against the pipe previously laid and held securely in position. Joints shall not be "pulled" or "cramped" without approval of the Engineer.
- O. Jointing Pipe: After the pipe are aligned in the trench and are ready to be jointed, all joint surfaces shall be cleaned.
- P. Alignment and Placement: All pipe shall be laid with extreme care as to grade and alignment. Each pipe shall be so laid as to form a close joint with the next adjoining pipe and bring the inverts continuously to the required grade.
 - 1. Stakeout of drain work and setting of line and grade is the responsibility of the Contractor.

2. The Contractor shall establish centerline and offset stakes at each manhole, plus one intermediate centerline and offset stake as a check point between manholes. Laser aligning shall not be used to establish a continuous line in excess of 400-feet.
- Q. Cleaning: Care shall be taken to prevent earth, water, and other materials from entering the pipeline. As soon as possible after the pipe and manholes are completed, the Contractor shall clean out the pipeline and manholes being careful to prevent soil, water and debris from entering any existing drainage system.
1. Place plugs in end of uncompleted conduit at end of day or whenever work stops.
 2. Flush lines between manholes to remove collected debris.
- R. Review of Completed Storm Drain System: The completed drain system shall be visually inspected by the Owner's Representative. If the visual observation of the completed drain or any part thereof shows any pipe, manhole, or joint to be of defective work or material, the defect shall be replaced or repaired as directed by the Engineer or the Owner's Representative. The Contractor shall coordinate and provide site access for inspection.

3.2 INSTALLATION OF REINFORCED CONCRETE PIPE AND PIPE FITTINGS

- A. General: Install piping in accordance with ASTM D2321, the governing authorities having jurisdiction of the utility, and the manufacturer's instructions, except where more stringent requirements are required by the Contract Documents.
- B. Acceptance of Pipe: Acceptance will be on the basis of tests specified hereinbefore. The quality of all materials used in the pipe, the process of manufacture, and the finished pipe shall be subject to review by the Engineer. Inspection may be made at the place of manufacture, or on the work site after delivery or at both places and the pipe shall be subject to rejection at any time on account of failure to meet any of the specification requirements, even though sample pipe units may have been accepted as satisfactory at the place of manufacture. All pipe which is rejected shall be immediately removed from the project site by the Contractor at no cost to the Owner.
- C. Pipe Storage: Pipe sections shall not be stored on areas over the newly laid pipe or other pipelines which might be damaged by the superimposed load, and storage sections shall be restricted to approved areas.
- D. Laying Pipe: Except where a concrete cradle or envelope is required, the pipe shall be laid in a crushed stone cradle. In trenches, no blocking or supporting of the piping by concrete, stones, bricks, wooden wedges, or method other than bedding the pipe on crushed stone will be permitted. Each length of pipe shall be shoved home against the pipe previously laid and held securely in position. Joints shall not be "pulled" or "cramped" without approval of the Engineer.
- E. Jointing Pipe: After the pipes are aligned in the trench and are ready to be jointed, all joint surfaces shall be cleaned.
- F. Alignment and Placement: All pipes shall be laid with extreme care as to grade and alignment. Each pipe shall be so laid as to form a close joint with the next adjoining pipe and bring the inverts continuously to the required grade.
1. Stakeout of drain work and setting of line and grade is the responsibility of the Contractor.

2. The Contractor shall establish centerline and offset stakes at each manhole, plus intermediate centerline and offset stakes as needed to ensure proper alignment and grade. Laser aligning shall not be used to establish a continuous line in excess of 400-feet.
- G. Cleaning: Care shall be taken to prevent earth, water, and other materials from entering the pipeline. As soon as possible after the pipe and manholes are completed, the Contractor shall clean out the pipeline and manholes being careful to prevent soil, water, and debris from entering any existing Drain.
1. Place plugs in end of uncompleted conduit at end of day, or whenever work stops.
 2. Flush lines between manholes to remove collected debris.
- H. Review of Completed Reinforced Concrete Pipe System: If the visual observation of the completed drain or any part thereof shows any pipe, manhole, or joint to be of defective work or material the defect shall be replaced or repaired as directed at no cost to the Owner. The visual observation shall be conducted by the Engineer and any defects shall be as identified by such. The Contractor shall coordinate and provide site access for the Owner.

3.3 INSTALLATION OF CORRUGATED POLYETHYLENE PIPE AND PIPE FITTINGS

- A. General: Install Corrugated Polyethylene Pipe in accordance with ASTM D2321 and governing authorities having jurisdiction, except where more stringent requirements are indicated.
- B. Acceptance of Pipe: Acceptance will be on the basis of tests specified herein before. The quality of all materials used in the pipe, the process of manufacture, and the finished pipe shall be subject to review by the Engineer. Inspection may be made at the place of manufacture, or on the work site after delivery or at both places and the pipe shall be subject to rejection at any time on account of failure to meet any of the specification requirements, even though sample pipe units may have been accepted as satisfactory at the place of manufacture. All pipe which is rejected shall be immediately removed from the project site by the Contractor.
- C. Pipe Storage: Pipe sections shall not be stored on areas over the newly placed pipe or other pipelines which might be damaged by the superimposed load, and storage sections shall be restricted to approved areas.
- D. Handling Pipe: Each pipe unit shall be handled into its position in the trench only in such manner and by such means, as the Engineer accepts as satisfactory. The Contractor will be required to furnish suitable devices to permit satisfactory support of all parts of the pipe unit when it is lifted.
- E. Alignment and Placement: All pipe shall be placed with extreme care as to grade and alignment. Each pipe shall be so placed as to form a close joint with the next adjoining pipe and bring the inverts continuously to the required grade.
1. Stakeout of drain work and setting of line and grade is the responsibility of the Contractor.
 2. The Contractor shall establish centerline and offset stakes at each manhole, plus intermediate centerline and offset stake as needed to ensure proper alignment and

grade between manholes. Laser aligning shall not be used to establish a continuous line in excess of 400-feet.

3. Bedding material for the pipe must be installed with care in the area around the pipe. Bedding material must be placed to provide uniform and adequate support under pipe. Do not use blocking to bring pipe up to grade. Bedding shall be crushed stone.
4. Provide bell holes at each joint to permit joint to be assembled properly while maintaining uniform pipe support.
5. Place and consolidate the bedding material under the pipe haunch to provide adequate side support while avoiding both vertical and lateral displacement of pipe.
6. Initial backfill must be completed to a point at least 12-inches over the top of the pipe and be hand placed. Use little or no tamping of initial backfill directly over the top of pipe. Compaction methods may be utilized during final backfilling.
7. No length of pipe shall be laid until the proceeding lengths of pipe have been thoroughly embedded in place, to prevent movement or disturbance of the pipe alignment.
8. Full lengths of pipe shall be used in the installation except that partial lengths may be used at the entrance to structures, and to accommodate the required locations of service connection fittings.
9. Pipe entrances to structures shall be cut flush with the inside face of the structure, and cut ends of the pipe surface within the structure shall be properly finished so that there will be no protrusion, ragged edges or imperfections that will impede or affect the hydraulic characteristics of the stormwater flow. The method of cutting and finishing shall be subject to the approval of the Engineer.
10. The Contractor shall protect the installation at all times during construction. The movement of construction equipment, vehicles and loads over and adjacent to any pipe shall be performed at the Contractor's own risk.
11. Jointing of pipe and fittings shall be done in accordance with the printed recommendations of the manufacturer and as specified. The bell end of the pipe shall be thoroughly cleaned. The joint surfaces and the gasket shall be lubricated prior to making up the joint. The position of the gasket shall be checked to ensure the joint has been properly made and is watertight. Care shall be taken not to exceed the manufacturer's recommended maximum deflection allowed for each joint.
12. Each length of pipe shall be pushed home by hand or with the use of bar and block. The use of power equipment, such as a backhoe bucket, is not acceptable.
13. Field-cut pipe ends shall be cut square.

3.4 INSTALLATION OF DRAIN MANHOLES AND CATCH BASINS

- A. The bases shall be supported on a compacted level foundation of gravel borrow a minimum of 12 inches thick. Crushed stone may be substituted for gravel borrow if field conditions at the bottom of the excavation are wet.
 1. The Contractor shall install the manholes and catch basins as soon as the pipe laying reaches the location of the structures.

2. The Contractor shall accurately locate each manhole and catch basin and set accurate templates to conform to the required line and grade. Any manhole or catch basin which is not installed in the correct location or oriented improperly shall be removed and rebuilt in its proper location, alignment, and orientation at no additional cost to the Owner.
3. Manhole risers and tops shall be installed using approved butyl rubber sealant or rubber gasket for sealing joints of manhole risers and tops; jointing shall be performed in accordance with the manufacturer's recommendations. Manhole risers and tops shall be installed level and plumb. Water shall not be permitted to rise over newly made joints, nor until after inspection as to their acceptability. All jointing shall be done in a manner to ensure watertight joints.
4. Openings shall be provided in the precast concrete manhole sections to receive entering pipes and these openings shall be made at the place of manufacture. Pipe entrances at catch basins shall have plain beveled openings to accept the type of pipe specified and to be sealed with non-shrink grout. Grout mixture shall follow instructions provided by manufacturer. Pipe connections at drain manholes shall be made as indicated on the Drawings with either non-shrink grout or integral flexible rubber sleeves and Corrugated Pipe Adapters designed for use with the pipe and sleeves. For grouted joints, surface between pipe and wall shall be completely filled with non-shrink grout and troweled to provide a smooth surface conforming to both the outside and inside structure wall.
5. Care shall be taken to ensure that the openings are made to permit setting of the entering pipe at its correct elevation as indicated or directed. Manhole risers and tops shall be installed so that the manhole steps shall be in alignment.
6. All holes used for handling shall be thoroughly plugged with non-shrink grout.
7. Cutting or tampering in the field, for purpose of creating new sidewall openings or altering existing openings, will not be permitted except at the discretion of the Engineer or if necessary concrete block manhole(s) shall be used.
8. All interior manhole joints where the sealing material is not flush with the inside wall shall be grouted with non-shrink mortar and finished by hand/wet-brush.
9. A cast-in-place concrete invert shelf and channel shall be poured and shaped to the lower half of the pipes
10. Clean all debris, mortar, and soil from the bottom of all structures prior to final acceptance of the project.

3.5 SETTING MANHOLE FRAMES AND COVERS AND CATCH BASIN FRAMES AND GRATES

- A. Manhole and catch basin frames shall be set with tops conforming accurately to the grade of the pavement or finished ground surface or as indicated on the Contract Drawings or as directed.
- B. Brick shall be used to bring the frames to the required elevation.
 1. Frames shall be set centered with the opening in the top of the precast structure on two to four courses of brick in a full bed of mortar. A thick ring of mortar extending to the outer edge of brick or concrete shall be placed all around the bottom flange of the cast

iron frame. The mortar shall be smoothly finished to a height of 5 inches above the flange for 8-inch frames and sloped to shed water away from the frame.

2. Completed brick installation shall be coated with mortar at least a $\frac{3}{4}$ inch thick on the outside to provide a fully sealed and watertight collar between the top manhole section and the cover frame.
 3. Only clean bricks shall be used in brick work to adjust frame elevations. The brick shall be moistened by suitable means.
- C. Manhole covers shall be left in place in the frame until completion of other work at the manholes.
- D. Where directed, the castings shall be temporarily set at such grades as to provide drainage during construction. The castings of structures located within the pavement area shall not be completely set to the established grade until the bottom course of pavement has been laid. The final setting of all other casting shall be performed at the proper stage of construction.

3.6 CHANGE IN TYPE

- A. When an existing catch basin is to be converted to a manhole, the frame and grate shall be carefully removed and a new frame and cover installed to finish grade. If in the opinion of the Engineer the existing casting is reusable, it may be reused in the work, otherwise, it shall be disposed of off-site.
1. The sump of the catch basin shall be thoroughly cleaned of debris and silt and the interior surfaces brushed to remove contaminants.
 2. The sump shall be thoroughly filled with compacted gravel to a level no greater than 6 inches below the pipe invert. A cast-in-place concrete invert shelf and channel shall be poured and shaped to the lower half of the pipes.
 3. New openings in existing structures shall be carefully cut with power saws of the proper size and elevation to accept the new connection. Damage to the structure caused by the Contractor's construction methods shall be repaired at no additional cost.

3.7 STRUCTURE REBUILT

- A. When in the opinion of the Engineer existing masonry structure walls show deterioration, the structure shall be rebuilt. The casting and deteriorated masonry shall be removed in a careful and neat manner until only a sound condition remains. Concrete blocks shall be used to rebuild the structure. The new masonry construction, replacing of the casting, and other incidental work shall be performed as specified above.
1. The Contractor's base bid shall include rebuilding 10 vertical linear feet of existing manhole or catch basin structures.

3.8 INSTALLATION OF WATER QUALITY STRUCTURES

- A. Contractor shall take appropriate action to protect all structure components throughout the installation and construction process. Care shall be taken in loading, transporting, and unloading to prevent damage to materials during storage and handling.
- B. Install water quality structures per manufacturer's specifications.

- C. The installation of a precast concrete structure should conform to ASTM C 891 for the construction of manholes.
- D. The precast concrete structure shall be installed in sections in the following sequence:
 - 1. Aggregate Base: Structure shall be supported on a compacted level foundation of gravel borrow or crushed stone a minimum of 12 inches thick.
 - 2. Base Slab
 - 3. Treatment chamber section(s)
 - 4. Transition slab (if required)
 - 5. Bypass Section
 - 6. Connect inlet and outlet pipes
 - 7. Riser section and/or transition slab (if required)
 - 8. Maintenance rider section(s) (if required)
 - 9. Frame and access cover
- E. The precast base shall be placed level at the specified grade. The entire base should be in contact with the underlying compacted granular material. Subsequent sections, complete with joint seals, shall be installed in accordance with the precast concrete manufacturer's installation requirements.
- F. Adjustment of the stormwater quality treatment structure can be performed by lifting the upper sections free of the excavated area, re-leveling the base, and re-installing the sections. Damaged sections and gaskets shall be repaired or replaced as necessary. Once the stormwater quality treatment structure has been constructed, any lift holes shall be plugged watertight with mortar or non-shrink grout.
- G. Internal components requiring field installation shall be installed by the Contractor in accordance with the manufacturer's specifications and installation requirements.
- H. Inlet and outlet pipes should be securely set into the structure using approved pipe seals (flexible boot connections) so that the structure is watertight.
- I. Grade rings shall be installed to set the frame and cover at the required elevation. The grade rings shall be laid in a full bed of mortar with successive units being joined using sealant recommended by the manufacturer. Frames for the cover shall be set in a full bed of mortar at the elevation specified.
- J. If precast tank sections are to be field assembled, adequate waterproofing shall be used at the joint to resist the waterhead at that joint.
- K. Couplings which are factory manufactured shall be installed at all connections from existing pipe to proposed pipe unless the existing pipe is the same material as the proposed pipe and the bell and spigot end of the pipes to be connected are compatible and free from defects. All drain couplings shall be installed in accordance with the manufacturer's recommendations for the types of pipe to be connected.

3.9 INSTALLATION OF STORMWATER QUALITY FILTER TREATMENT STRUCTURE

- A. Contractor shall take appropriate action to protect all of the structures' internal components throughout the installation and construction process. No lifting shall be conducted or lifting mechanisms shall be connected to or come into contact with the stormwater quality treatment structures' deck or cartridge receptacles.
- B. Install stormwater quality filter treatment structure per manufacturer's specifications.
- C. PRECAST STRUCTURE CONSTRUCTION SEQUENCE
 1. The installation of a precast concrete structure should conform to ASTM C 891 for the construction of manholes.
 2. The precast concrete structure shall be installed in sections in the following sequence:
 - a. Aggregate Base: Structure shall be supported on a compacted level foundation of gravel borrow or crushed stone a minimum of 12 inches thick.
 - b. Base Slab
 - c. Treatment chamber and cartridge deck riser section(s)
 - d. Bypass Section
 - e. Connect inlet and outlet pipes
 - f. Riser section and/or transition slab (if required)
 - g. Maintenance rider section(s) (if required)
 - h. Frame and access cover
 3. The precast base shall be placed level at the specified grade. The entire base should be in contact with the underlying compacted granular material. Subsequent sections, complete with joint seals, shall be installed in accordance with the precast concrete manufacturer's recommendations.
 4. Adjustment of the stormwater quality treatment structure can be performed by lifting the upper sections free of the excavated area, re-leveling the base, and re-installing the sections. Damaged sections and gaskets shall be repaired or replaced as necessary. Once the stormwater quality treatment structure has been constructed, any lift holes shall be plugged watertight with mortar or non-shrink grout.
 5. Inlet and outlet pipes should be securely set into the structure using approved pipe seals (flexible boot connections, where applicable) so that the structure is watertight.
 6. Grade rings shall be installed to set the frame and cover at the required elevation. The grade rings shall be laid in a full bed of mortar with successive units being joined using sealant recommended by the manufacturer. Frames for the cover shall be set in a full bed of mortar at the elevation specified.
- D. MAINTENANCE ACCESS WALL: In some instances the Maintenance Access Wall, if provided, shall require an extension attachment and sealing to the precast wall and cartridge deck at the job site, rather than at the precast facility. In this instance, installation, attachment, and sealing of these components shall be performed according to instructions provided by the manufacturer.
- E. STRUCTURE PROTECTION PRIOR TO FILTER CARTRIDGE INSTALLATION
 1. Filter cartridges shall not be installed until the project site is clean and free of debris, by the contractor. The project site includes any surface that contributes storm drainage to the treatment structure. All impermeable surfaces shall be clean and free of dirt and debris. All catch basins, manholes and pipes shall be free of debris, dirt, and sediments.

2. It is the contractor's full responsibility to properly protect the treatment structure, and keep the structure offline during construction.

F. FILTER CARTRIDGE INSTALLATION

1. The Contractor shall confirm the project site and stormwater quality filter treatment structure is clean and free of debris prior to pursuing cartridge installation. Filter cartridges and lids shall be installed in the cartridge deck only after the construction site is fully stabilized and the unit clean and free of debris by the contractor.
2. Contractor shall notify and coordinate with the manufacturer three weeks prior to requiring filter cartridges installed on-site. Filter cartridges and lids shall be delivered and installed to commission the stormwater quality filter treatment structure.

3.10 CLEANOUTS

- A. Install cleanouts and extensions from drain pipe to cleanout at grade as indicated on the Contract Drawings. Set cleanout frame and cover in concrete 18 by 18 by 6-inches deep, except where location is in bituminous or concrete paving. Set top of cleanout 1-inch above surrounding earth grade or flush with grade when installed in paving.

3.11 TAP CONNECTIONS

- A. Make connections to existing underground drainage structures, so that finished work will conform as nearly as practicable to requirements specified for new work. The contractor shall verify the location, size, invert, and type of existing pipes at all points of connection prior to make the connections.
- B. Make branch connections from side into existing piping by installing a wye or T-wyes, and couplings manufactured for use with the same type of pipe as indicated on the Contract Drawings. The Contractor shall install a 45-degree wye branch or 90-degree tee fittings in the drain pipe at all locations where storm service pipe connections are shown on the Drawings. Connections of the storm service pipes shall be made into the wye branches or tees by means of 45-degree bends. The connections shall be made thoroughly watertight and concrete shall be placed under each connection to bear on undisturbed earth and firmly support the connection.
- C. Protect existing piping and structures to prevent concrete or debris from entering while making tap connections. Remove debris, concrete, or other extraneous material that may accumulate.
- D. Connections into existing drainage facilities shall be performed in accordance with the requirements of the City of Newton. The Contractor shall comply with all such requirements, including securing of all required permits and paying the costs thereof.

3.12 BACKFILLING

- A. General: Conduct excavation and backfill operations for structure and pipe installations in accordance with Section 312000 – EARTH MOVING, local requirements, and the contract documents.
- B. Initial backfill shall be placed evenly on both sides of the pipe to distribute the load and not to cause movement or deflection of the pipe.

3.13 INSTALLATION OF IDENTIFICATION

- A. Install continuous plastic underground warning tape during back-filling of trench for underground storm drainage system piping. Locate tape two-feet below finished grade, directly over piping.

3.14 FIELD TESTING OF CORRUGATED POLYETHYLENE PIPING

- A. The pipe shall be cleaned and visually inspected for offsets and obstructions prior to testing.
- B. The total length of each pipe installed on the project shall be tested or inspected for deflection. Conveyance pipes connecting at both ends to concrete drainage structures (catch basins, manholes, outlet control structures, water quality structures, etc.) shall be mandrel tested. Deflection of pipes used for stormwater detention/retention/infiltration systems, and pipes connecting to wye connections, building connections, trench drains, and other connections that do not allow mandrel testing shall be verified by visual inspection by the Owner's Representative during installation.
- C. Mandrel tests shall be performed by the Contractor and observed by the Owner's Representative not sooner than 20 days after completion of installation and compaction of backfill. Testing for pipes greater than 24-inch in diameter shall be tested prior to the installation of drainage structure cone and frame.
- D. Installed pipe shall be tested to ensure that the maximum deflection of the pipe does not exceed 7.5 percent of its base inside diameter. The base inside diameter is defined as the specified nominal diameter minus the allowable inside diameter tolerance of 1.5% but not more than 1/2 inch.
- E. A mandrel shall be pulled through the pipe by hand to ensure that maximum allowable deflections have not been exceeded. The mandrel diameter shall be verified and approved by the Owner's Representative prior to use. Use of an unapproved mandrel will invalidate the test. If the mandrel fails to pass through the pipe, the pipe will be deemed to be over-deflected.
- F. The mandrel shall be a rigid device, with an odd number of legs (9 legs minimum) having an effective length not less than its nominal diameter. The mandrel shall be fabricated of steel with pulling rings at each end.
- G. The minimum diameters at any point along the full length are as follows:

Nominal Size	Minimum Mandrel Diameter
6"	5.3"
8"	7.0"
10"	8.8"
12"	10.6"
15"	13.2"
18"	15.8"
24"	21.1"
30"	26.4"
36"	31.7"
42"	37.0"
48"	42.2"
54"	47.5"

60"	52.8"
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3.15 FIELD QUALITY CONTROL

- A. Testing: Perform testing of completed piping in accordance with local authorities having jurisdiction.
- B. Video Inspections: Seven days after the completion of the backfilling of each section of new pipe, as defined as a length of pipe between two manholes, the Contractor will provide a televised inspection of the pipe to be submitted to the Designer. The Owner's Representative shall be present during the recording. The recording shall be in DVD color format with audio and will show a clear picture of the inside of the new pipe. If the Designer determines that the DVD is unacceptable for review the contractor shall re-televisize the line until an acceptable DVD has been submitted. In the event that the pipe is not acceptable for any reason relating to the proper construction of the pipe according to these specifications, the Contractor will be responsible to re-excavate and repair the defects to the satisfaction of the Designer at no additional cost.
- C. Cleaning: Clear interior of piping and structures of dirt and other superfluous material as work progresses. Maintain swab or drag in piping and pull past each joint as it is completed.
 - 1. In large, accessible piping, brushes and brooms may be used for cleaning.
 - 2. Place watertight plugs in ends of uncompleted pipe at end of day or whenever work stops. If water is in the trench when work is resumed, the plug shall not be removed until the trench has been dewatered and all danger of water entering the pipe eliminated.
 - 3. Flush piping between manholes to remove collected debris.
- D. Interior Inspection: If deemed necessary by the Owner's Representative, inspect piping to determine whether line displacement or other damage has occurred.
 - 1. Make inspections after pipe between manholes has been installed and approximately 2 feet of backfill is in place, and again at completion of project.
 - 2. If inspection indicates poor alignment, debris, displaced pipe, infiltration or other defects, the Contractor shall correct such defects and reinspect.
- E. Prior to acceptance of the storm drainage system, the Contractor shall submit the following to the Architect and to the local authority:
 - 1. System As-Built Plan stamped by a Professional Land Surveyor or Engineer Registered in the Commonwealth of Massachusetts.
 - 2. Video inspection DVDs and report: The report shall document the observations of the video inspections.
 - 3. Deflection test report: The report shall fully describe the test procedures and list the test results. The report shall be signed by the Contractor's superintendent.

3.16 FINAL INSPECTION

- A. Final inspection and acceptance of the storm drainage system shall be made by the Owner's Representative and the utility owner having jurisdiction of the particular system.
- B. Prior to placing the systems in service, all components shall be inspected, with the Owner's Representative present, to ensure that no debris or other contaminants are present. If necessary, the Contractor shall clean the structures and flush piping.
- C. The Contractor is responsible for coordinating and scheduling the inspection of the work by local jurisdictional authorities. No additional payment will be made for inspections and permits required in the performance of the work.

END OF SECTION

SECTION 340000

RECTANGULAR RAPID FLASHING BEACON ASSEMBLY

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. The Contractor shall furnish and install Rectangular Rapid Flashing Beacon (RRFB) Assemblies for installation at the locations shown on the plans, including signal pedestal posts (14' high or as required), RRFB indications, signs, APS push button assemblies, solar panel, backup battery, post-mounted NEMA electrical enclosure for flasher component and relays, and all incidental necessary materials for a complete functioning RRFB system. The Contractor shall furnish and install all wiring, electrical conduit, pre-cast cement concrete foundations, grounding rods, cabling, conduit, cabling and all miscellaneous materials required to complete the installation of the RRFB's as part of this work. The work shall also include all excavation, backfill, and all pavement restoration associated with installation of new RRFB assembly and removal and stacking of existing/conflicting pedestrian crossing signs, if any.

1.3 SUBMITTALS

- A. Product Data: Rectangular Rapid Flashing Beacon (RRFB) shall be fully compliant with the following:
 - 1. National Electric Code (NEC)
 - 2. Massachusetts Electric Code
 - 3. National Electrical Manufacturers Association (NEMA)
 - 4. Underwriters Laboratory (UL)
 - 5. UL 1703 Standard for Flat-plate Photovoltaic Modules and Panels
 - 6. Manual on Uniform Traffic Control Devices, latest edition (MUTCD)
- B. Shop Drawings: Show fabrication and installation details of Rectangular Rapid Flashing Beacon (RRFB) for review and approval

1.4 QUALITY ASSURANCE

- A. Unless otherwise specified herein, all RRFB sign assemblies at the crosswalk must be double-sided and include a RRFB LED light bar on each side of the sign assembly between the bottom of the fluorescent yellow-green S1-1 (pedestrian) and the top of the supplemental diagonal downward arrow (W16-7pL/R).
- B. Size Variations: Each RRFB indication must be a minimum of approximately 5 inches wide by 2 inches high. The two RRFB indications on each side must be aligned horizontally, with the

longer dimension horizontal and with a minimum space between the two indications of approximately seven inches, measured from inside edge of one indication to inside edge of the other indication. The outside edges of the RRFB indications, including any housings, must not project beyond the outside edges of the S1-1 sign.

1.5 COORDINATION

A. Requirements

1. When activated, the two yellow indications in each RRFB must flash in a rapidly flashing sequence (left light on, then right light on).
2. The RRFB flash rate must be 75 flashing sequences per minute. Each beacon must have alternating flash rates, but approximately equal periods, of 50 milliseconds, of rapid pulsing light emissions and dark operation. The flashing requirements shall comply with the latest MUTCD guidelines.
3. The LED light outputs and flash pattern must be completely programmable, with the capability to be reconfigured in the field if future MUTCD or State guidelines specify a different flash pattern.
4. The flash rate of each indication shall not be between 5 and 30 flashes per second to avoid frequencies that might cause seizures.
5. The daytime light intensity shall meet the specifications for Class 1 yellow peak luminous intensity in the Society of Automotive Engineers Standard J595.
6. To reduce glare during night time operations, an automatic dimming device shall be used to reduce the light intensity.

B. Operation

1. RRFB assemblies must be normally dark, initiate operation only upon pedestrian actuation via a pedestrian pushbutton, and cease operation at a predetermined time after the pedestrian actuation.
2. The duration of the predetermined period must be programmable and capable of matching the pedestrian clearance time for pedestrian signals as determined by MUTCD procedures.
3. The timer that controls flashing must automatically reset each time a pedestrian call is received.
4. All RRFB units associated with a given crosswalks shall be actuated simultaneously and ceased simultaneously

PART 2 - PRODUCTS

2.1 MAJOR PART LIST

A. The following is a list of major components to be included in the RRFB system:

1. (2) concrete foundations;
2. (2) traffic signal posts and pedestals (15' height or as required);
3. (2) APS pushbutton systems;
4. (4) dual rectangular yellow LED beacons in NEMA enclosures;
5. (2) 9"x12" R10-25 (PUSH BUTTON TO TURN ON WARNING LIGHTS) signs;
6. (4) 30"x30" S1-1 (School Crossing) signs;
7. (2) 24"x12" W16-7PR and (2) 24"x12" W16-7PL (Diagonal Downward Arrow) signs;
8. (2) solar panels;
9. (2) NEMA Type 3R or higher enclosures to house:
10. Electrical components, including wiring and solid-state circuit boards;

11. On-board user interface;
12. Battery; and Frequency hopping spread spectrum (or other alternate FCC approved) wireless activation unit with a minimum 150' range; and
13. All mounting and supporting hardware and wiring necessary to complete a working system.

2.2 POSTS AND BASES

- A. Signal posts and bases shall be aluminum shafts with cast pedestal bases and shall be supplied as a single unit. All posts shall be painted BLACK. Signal base foundations shall not obstruct a sidewalk or crosswalk so that passage by physically-challenged persons is impaired.
- B. All RRFB posts, cabinets, push buttons, etc shall be BLACK.
 1. Foundation installations shall be per Subsection 801.62. The top of the foundation shall be $\frac{1}{4}$ " to 1" proud of the sidewalk and chamfered at 45 degrees. Gaps between the sidewalk and foundation shall be no larger than $\frac{1}{4}$ " and grouted with preformed joint filler.

2.3 PEDESTRIAN PUSHBUTTON

- A. Each assembly must have a pedestrian pushbutton.
- B. Pedestrian pushbuttons must be an ADA compliant with a directional arrow that vibrate upon actuation.
 1. Each APS pushbutton shall have a tactile arrow and locator tone. The tactile arrow shall be oriented to point in the direction of the crosswalk. The locator tone shall have a duration of 0.15 seconds or less and shall repeat at 1-second intervals. The locator tone shall be set 2 to 5 dBA above ambient sound, shall automatically adjust intensity, but cap at a maximum volume of 100 dBA. The tone shall be audible whenever the LED modules are not active.
- C. A R10-25 (PUSH BUTTON TO TURN ON WARNING LIGHTS) sign must be mounted adjacent to or integral with each pedestrian pushbutton.

2.4 SOLAR POWER SYSTEM FOR RRFB

- A. RRFB shall be solar powered with a battery reserve. Each RRFB shall be powered by a multi-panel solar array and bank of deep-cycle maintenance free rechargeable batteries designed for photovoltaic applications. Solar powered RRFB shall operate year-round, 24 hours per day, with a load of 25 percent of pixels ON with no external charge required.
- B. RRFB shall also include power inputs for connections to external power sources from either utility company AC line service or generator supplied power. The solar powered RRFB system shall also include the ability to be connected to an external generator for battery recharging purposes.
- C. The solar power system shall furnish enough energy to supply the total daily power consumption of the sign and to recharge batteries in the New England temperature and solar exposure environment to be found at the location of the RRFB deployment. (Solar power calculations shall be supplied to the Engineer for review before the RRFB is approved for installation).

- D. The RRFB solar power system shall be designed for optimum efficiency utilizing a proper balance between batteries and solar panels. A solid state charge controller shall be used to control the charging of the batteries from the solar panels.
 - E. The solar power system shall conform to the following:
 - 1. The solar panel array shall provide sufficient power to meet all RRFB operational performance specifications identified in this Special Provision.
 - 2. A photovoltaic controller shall be provided to monitor batteries and maintain the maximum power level without over-charging the batteries. The photovoltaic controller shall provide an automatic load disconnect if a low voltage condition is detected and shall automatically reconnect the load upon power restoration.
 - 3. The solar panel array shall be inclinable in two axes to optimize the solar collection and charging capabilities of the solar panels. The solar panels shall rotate a full 360° and shall tilt up to 70° from horizontal.
 - F. The battery bank shall supply enough energy to provide the RRFB with at least 21 days of operational autonomy without any charge from any device (solar panels disconnected) considering all environmental impacts (heat and cold) on the battery bank as per IEEE Recommended practice for sizing Lead-Acid Batteries. (Battery power calculations shall be supplied shall be supplied to the Engineer for review before the flasher is approved for installation).
 - 1. Batteries shall be installed in the battery box for ease of access and maintenance.
 - 2. Batteries shall be deep-cycle type, suitable for solar power applications.
 - 3. Batteries shall be in a lockable cabinet. This cabinet shall have enough ventilation to evacuate the gas generated by the batteries
 - G. Battery Box Requirements: A chest style battery box enclosure shall be provided for the bank of batteries. The battery box shall be installed on the concrete pad provided as indicated on the plans. The battery box shall meet or exceed the following requirements:
 - 1. Constructed of .125" 5052-H32 aluminum, or Approved Equivalent.
 - 2. White polyester powder coat finish
 - 3. NEMA 3R environmental rating
 - 4. Stainless steel continuous hinge
 - 5. Include screened louvers on both sides to provide filtered ventilation
 - 6. Include 2" extruded polystyrene insulation
 - 7. Include stainless steel padlock hasp
 - 8. All welds shall be sanded smooth
 - H. Contractor shall provide a warranty valid for a minimum of 2 years for all batteries and solar panels.:
- 2.5 REQUIREMENTS FOR AC LINE OR GENERATOR SOURCED POWER SURGE PROTECTORS
- A. The AC Power Line Surge Protector shall:
 - 1. Be sized for the incoming current and loads to be protected.
 - 2. Utilize three stages for power line voltage spike and RFI suppression.
 - 3. Filter and absorb power line noise and switching transients.
 - 4. Provide an appropriate degree of lightning and lightning induced voltage surge protection.
 - 5. Shall be DIN rail mountable.
 - 6. Shall meet or exceed these Technical Specifications:

- a. Total Peak Surge Current 18,000 kAmp per mode
- b. Maximum Attenuation -55 dB @ 100 MHz, typical
- c. Maximum Leakage Current <0.3 mA
- d. Lines Protected L, N, G
- e. Operating Temperature -40-degrees C to + 85-degrees C
- f. Relative Humidity 95% Non-Condensing
- g. Regulatory Requirements UL 1449 Compliant

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with manufacturer's written instructions for installing Rectangular Rapid Flashing Beacons (RRFB).
- B. RRFB shall be located at STA 14+46, offset 18.66 R and STA 14+53, offset 19.09 L. Location shall comply with ADA and MUTCD 4E.

END OF SECTION