

**PROJECT MANUAL
FOR
TACO BELL
DRIVE THRU RESTAURANT
(ENDEAVOR 2.0)**

OWNER: YUM! Brands, Inc.

ARCHITECT: GPD Group, Professional Corp

STRUCTURAL ENGINEER: GPD Group, Professional Corp

CIVIL ENGINEER: GPD Group, Professional Corp

MEP ENGINEER: GPD Group, Professional Corp

PROJECT NO.: 2020088.03

DATE: 07.19.22

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DOCUMENT 002100
INSTRUCTIONS TO BIDDERS

1.1 RELATED DOCUMENTS

- A. Related Documents: Conditions of the Contract, Division 01 - General Requirements, and Drawings apply to Work of this Section.

1.2 DEFINITIONS

- A. Bidding documents include the Advertisement for Bid, Instructions to Bidders, the bid forms, and the proposed Contract Documents including any Addenda issued prior to receipt of Bids.
- B. Addenda are written or graphic instruments issued prior to the execution of the Contract which modify or interpret the bidding documents, including Drawings and Specifications, by additions, deletions, clarifications or corrections. Addenda will become part of the Contract Documents when the Construction Contract is executed.
- C. **GPD** will be hereafter referred to in this Project Manual as "Owner's Representative" and all correspondence shall be addressed to

**GPD Engineering and
Architecture Professional Corp -
520 S. Main St., Suite 200
Akron, OH 44311
330.572.2100 voice
330.572.2102 Facsimile**

- D. A Bid is a complete and properly signed proposal to do the Work for designated portion thereof for the sums stipulated therein, submitted in accordance with the Bidding Documents.
- E. The Base Bid is the sum stated in the Bid for which the Bidder offers to perform the Work described in the Bidding Documents as the base, to which work may be added or from which work may be deleted for sums stated in Alternate Bids.
- F. An Alternate Bid (or Alternate) is an amount stated in the Bid to be added to or deducted from the amount of the Base Bid in the corresponding change in the Work, as described in the Bidding Documents or in the proposed Contract Documents.
- G. A Unit Price is an amount stated in the Bid as a price per unit of measurement for materials or service as described in the Bidding Documents or in the proposed Contract Documents.
- H. A Bidder is a person or entity who submits a Bid.
- I. A Sub-Bidder is a person or entity who submits a bid to a Bidder for materials or labor for a portion of the Work.

1.3 TIME OF COMPLETION

- A. Time of completion of this Contract is of importance to the Owner and may be considered in the award of the Contract. Payments on the Contract shall be made as provided by the Contract.

1.4 EXAMINATION OF DOCUMENTS AND SITE

- A. Each Bidder, by making his Bid, represents that he has read and understands the Bidding Documents.
- B. Each Bidder, by making his Bid, represents that he has visited the site, performed investigations and verifications as he deems necessary, and familiarized himself with the local conditions under which the Work is to be performed and will be responsible for any and all errors in his proposal resulting from his failure to do so.
- C. The location and elevations of the various utilities and pipe work included within the scope of the work are offered as a general guide only, without guarantee as to accuracy. The Contractor shall verify and investigate to his own satisfaction the location and elevation of all utilities, pipe work, and the like and shall adequately inform himself of their relation to the work before submitting a proposal.
- D. Each Bidder by making his Bid represents that his Bid is based upon the materials, systems and equipment required by the Bidding Documents without exception.

1.5 BIDDING PROCEDURES

- A. Prepare Bids on forms provided by Architect and Owner and submitted in accordance with these Instructions to Bidders. The Architect and Owner will furnish Bidders with a Bid Form which will provide for the following Bid Items:
1. A single contract price for each Bid Item as detailed and described in these Specifications.
 2. Acknowledgment of Addenda.
 3. Number of calendar days to complete project.
 4. Alternate Bids (if requested).

5. Unit Prices (if requested).
- B. A Bid is invalid if it has not been deposited at the designated location prior to the time and date for receipt of bids indicated in the Advertisement for Bids, or prior to any extension thereof issued to the Bidders.
 - C. Unless otherwise provided in any supplement to these Instructions to Bidders, no bidder shall modify, withdraw or cancel his Bid or any part thereof for 60 days after the time designated for the receipt of Bids in the Advertisement for Bids.
 - D. Prior to the receipt of Bids, Addenda will be mailed or delivered to each person or firm recorded by the Architect and Owner as having received the Bidding Documents and will be available for inspection wherever the Bidding Documents are kept available for that purpose. Addenda issued after receipt of Bids will be mailed or delivered only to the selected Bidder.
 - E. Bids shall not contain any recapitulation of the Work to be done and no oral or telephone proposals or modifications will be considered.
 - F. Make no additional stipulations on the Bid Form nor limit or qualify Bid in any other manner. Bids so qualified will be subject to disqualification.
 - G. Only written instructions will be binding. The Architect and Owner will not be responsible for any oral, telegraphic or telephonic instructions.
 - H. Submit for approval by the Architect and Owner names of Subcontractors and material suppliers proposed to be employed before they are employed. Subcontractors and material suppliers must be known to perform work of a high standard in their respective trades. If the Architect has reasonable objection to any such proposed person or entity, and notifies the Bidder in writing of such objection, the Bidder shall provide an acceptable substitute person or entity in accordance with the General Conditions.
- 1.6 DISCREPANCIES AND AMBIGUITIES
- A. Each Bidder shall examine the Bidding Documents carefully and, not later than 10 days prior to the date for receipt of Bids, shall make written request to the Architect for interpretations or correction of any ambiguity, inconsistency or error therein which he may discover. Any interpretation or correction will be issued as an Addendum by the Architect. Only a written interpretation or correction by Addendum shall be binding. No Bidder shall rely upon any interpretation or correction given by any other method.
- 1.7 SUBSTITUTIONS
- A. Each Bidder represents that his Bid is based upon the materials and equipment described in the Bidding Documents.
 - B. Product or material substitutions will only be considered by Owner and Architect/ Engineer after receipt of Bid. Bidders are to price the products and materials as specified and documented with the Bid Documents. Bidder shall provide line item pricing (cost or deduct) if any, as well as completed substitution request form for each proposed substitution submitted with their bid, for review by Owner and Architect/ Engineer. All requests for substitution must meet the requirements of section 012500, Substitution Procedures.
- 1.8 BASIS OF BID
- A. Include unit cost items and alternates shown on the Bid Form; failure to comply may be cause for rejection. No segregated Bids or assignments will be considered.
- 1.9 PREPARATION OF BID
- A. Submit Bid on forms furnished by Architect. Correctly fill in blank spaces on forms and state prices, written in words and in figures.
 - B. Where there is discrepancy between the price written in words and the price written in figures, the price written in words shall govern.
 - C. If Bid is submitted by an individual, his name must be signed by him or his duly authorized agency. If the Bid is submitted by a firm, association or partnership, the name and address of each member must be given, and the Bid must be signed by an official or duly authorized agent. Powers of attorney authorizing agents or others to sign Bids must be properly certified and must be in writing and submitted with the Bid.
- 1.10 FILING BID
- A. No Bid will be considered unless it is filed with the Owner within the time limit for receiving Bids as stated in the Advertisement.
- 1.11 MODIFICATION AND WITHDRAWAL OF BID
- A. Bid may not be modified after submittal. Bidders may withdraw at any time before opening, but may not resubmit them.
 - B. No Bid may be withdrawn or modified after the Bid opening except where the award of the Contract has been delayed beyond 60 days after date of Bid.
 - C. If written confirmation of the modified or withdrawn bid received by telegram is not received within two

days from the closing time, no consideration shall be given to the telegram.

1.12 OPENING BID

- A. The Bids submitted will be opened at the time stated in the Advertisement for Bids, privately opened, and shall thereafter remain on file with the Owner.

1.13 IRREGULAR BID

- A. Bids will not be considered if they show any omissions, alterations of form, additions, or conditions not requested, unauthorized alternate Bids or irregularities of any kind.
- B. However, the Owner reserves the right to waive any irregularities and to make the award in the best interest of the Owner.

1.14 REJECTION OF BID

- A. The Bidder acknowledges the right of the Owner to reject any or all Bids and to waive any informality or irregularity in any Bid received.
- B. In addition, the Bidder recognizes the right of the Owner to reject a Bid if the Bidder failed to furnish any required Bid security, or to submit the data required by the Bidding Documents, or if the Bid is any way incomplete or irregular.

1.15 SUBMISSION OF POST-BID INFORMATION

- A. The selected Bidder shall, within 7 calendar days thereafter submit the following:
1. A statement of cost for each major item of Work included in the Bid.
 2. A designation of the Work to be performed by the Bidder with his own forces.
 3. List of anticipated subcontractors.

1.16 AWARD OF CONTRACT

- A. After Bids are opened, the Bids will be tabulated for comparison on the basis of the Bid prices and quantities shown in the Bids. The Owner reserves the right to withhold the award of the Contract for a period of 60 days from the date of opening Bids and no award will be made until the Owner is satisfied as to the responsibilities of the low Bidders. Until final award of the Contract, the Owner reserves the right to reject any or all Bids or proceed to do the work otherwise in the best interest of the Owner.
- B. Upon notification by Owner and prior to award of Contract, Contractor will provide Contractor's Qualifications Statement (AIA Document A 305), and insurance certificate within three (3) working days. Contractor will authorize Owner or Owner Representative to inquire, of any reference, with regard to Contractor's credentials and qualifications in performing the work.

1.17 EXECUTION OF CONTRACT

- A. The person or persons, partnership, company, firm, association or corporation to whom a contract is awarded shall within 10 days after such award, sign the necessary agreements entering into the required Contract with the Owner.
- B. No contract shall be binding on the Owner until it has been executed by the Owner or his duly authorized representative, and delivered to the Contractor.

1.18 BID GUARANTY

- A. No Bid shall be considered unless it is accompanied by a certified check on any State or National Bank in Texas or acceptable Bid Bond, payable unconditionally to the Owner.
- B. The certified check or Bid Bond shall be in the amount of not less than 5 percent of the total amount of the Bid.
- C. The Bid guaranty is required by the Owner as evidence of good faith and as a guarantee that, if awarded the contract, the Bidder will execute the contract and furnish the required bonds within 10 days after the Bid is accepted. Said bonds shall further guarantee that if the Bid is withdrawn after the Bids have been opened or if the Contractor refuses to execute the contract in accordance with his Bid, the Contractor and the Surety shall become liable to the Owner for damages incurred.
- D. If a Bidder's bond is used, the Surety thereon shall designate an agent resident in the local county, to whom requisite notices may be delivered and upon whom service of process may be had. If a Bidder's bond is used, an acceptable Surety shall be determined from the latest United States Treasury Department list of companies holding certificates of authority as acceptable Sureties on Federal Bonds.
- E. As soon as possible after prices have been tabulated for comparison of Bids, the Owner may, at the Owner's discretion, return the Bid guaranties accompanying the Bids, which in the Owner's judgment, would not be considered in the award; all other Bid guaranties will be retained by the Owner until the required contract and bonds have been executed, after which they will be returned. No Bid guaranties will

be returned until at least 2 days have elapsed from time of opening Bids.

- 1.19 PERFORMANCE BOND AND LABOR AND MATERIAL PAYMENT BOND
- A. The Owner will require Performance and Labor and Material Payment Bonds.

END OF DOCUMENT

DOCUMENT 003132

GEOTECHNICAL DATA

1.1 SUMMARY

- A. This document includes information pertaining to geotechnical data.

1.2 INVESTIGATION

- A. An investigation of subsurface soil conditions at the building site was authorized by the Owner, and is included in the bid documents

1.3 REPORT

- A. The Geotechnical Investigation Report is for information only, and is not a warranty of subsurface conditions.
- B. The Report is made available for information only, and is not a Contract Document.
- C. The information contained in the Report represents design criteria, recommendations, and guidelines that were utilized as the basis of design for the engineering of the earthwork operations, paving design, and foundation design indicated in the Contract Documents. No changes in this design criteria will be considered or permitted. Where options are indicated, the options were considered by the respective design team members and implemented in the construction documents.

1.4 RESPONSIBILITY

- A. Bidders are expected to examine the site and subsurface investigation reports and then decide for themselves the character of the materials to be encountered.
- B. The Architect and Owner assume no responsibility for variations in subsoil conditions, quality, or stability, or for the presence, level, and extent of underground water.
- C. The Architect and Owner assume no responsibility for Bidder's interpretation of data contained in the Report.

END OF DOCUMENT

DOCUMENT 004100

BID FORM

DATE: [_____]

TO: [_____]

RE: [_____]

Gentlemen:

Pursuant to the Instruction to Bidders, the undersigned has thoroughly examined the Bidding Documents and the Site, understands the work to be done, and hereby proposes to do all the work as provided in the Bidding Documents and subject to the observation and approval of the Owner and Architect, and binds themselves on acceptance of this bid by Owner for performing and completing the said work within the time stated and to furnish all required guarantees for the following prices:

BASE BID

For the construction of the additions to the [_____] and including all labor, materials, services, and equipment necessary for the completion of the Work as indicated in the construction documents.

The Sum of _____ DOLLARS

ALTERNATES

Alternate No. 1: [_____]

The Sum of _____ DOLLARS

UNIT PRICES

Unit Price No. 1: [_____]

The Sum of _____ DOLLARS

EXTRA WORK FEES

The undersigned agrees that for additional work added to the Contract and for extra costs resulting from changes in the work, the allowance for overhead and profit combined shall be in accordance with the following schedule, but in no case shall it exceed a maximum of 15 percent, (Overhead shall include payroll taxes and supervision):

- A. For the Contractor, for any work provided by his own forces: 10% of the cost.
- B. For the Contractor, for work produced by his subcontractors: 5% of the amount due the subcontractor.
- C. The General Contractor shall not be allowed to charge the Owner for "extended overhead" charges relating to change orders or weather delays.

ADDENDA

This will acknowledge receipt of the following addenda which are part of the Bidding Documents:

Addendum No. _____ Addendum No. _____

Addendum No. _____ Addendum No. _____

Addendum No. _____ Addendum No. _____

DOCUMENT 007000

GENERAL CONDITIONS

1.1 **GENERAL CONDITIONS**

- A. The "General Conditions of the Contract for Construction", AIA Document A201, Sixteenth Edition, 2007, Articles 1 through 15 inclusive, is a part of this Contract, and is available for review from the Architect. The General Conditions and all modifications listed hereinafter shall apply to all various subcontracts and sub-subcontractors.
- B. Refer to Document 008000 for Supplementary Conditions.

END OF DOCUMENT

DOCUMENT 008000**SUPPLEMENTARY CONDITIONS**

- 1.1 SUPPLEMENTS
- A. The following supplements modify, change, delete from or add to the "General Conditions of the Contract for Construction", AIA Document A201, **Sixteenth Edition, 2017**. Where any Article of the General Conditions is modified or any Paragraph, Subparagraph or Clause thereof is modified or deleted by these supplements, the unaltered provision of the Article, Paragraph, Subparagraph or Clause shall remain in effect.
- 1.2 REFERENCE TO DIVISION 01
- A. With regard to provisions of General Conditions related to project administrative or work-related requirements of the Contract, some of those paragraphs are modified or deleted from General Conditions, and are specified in Division 01, "General Requirements" of the Specifications.

ARTICLE 1 - GENERAL PROVISIONS

Add the following new paragraphs:

1.1.9 MISCELLANEOUS DEFINITIONS

1.1.9.1 The term "Product" as used in these Contract Documents includes materials, systems, and equipment.

1.1.9.2 The term "provide" as used in this Project Manual means to furnish and install.

1.2 CORRELATION AND INTENT OF THE CONTRACT DOCUMENTS

Add the following new subparagraphs:

1.2.4 The inter-relation of the Project Manual, the Drawings and the schedules is as follows: The Project Manual determines the quality, nature and setting of the several materials; the Drawings establish the quantities, dimensions and details; and the schedules give the location. The documents are to be considered as one and whatever is called for by any one shall be as binding as if called for by all.

1.2.5 Should the drawings disagree in themselves, or with the Project Manual, or if proprietary information disagrees with performance requirements in either the Drawings or the Project Manual, the better quality or greater quantity of the Work or materials shall be estimated upon, and unless otherwise ordered by the Architect in writing, shall be performed or furnished. Should discrepancies or doubt occur, do not proceed with the Work without clarification from the Architect. Contractor shall request clarification in sufficient time to avoid delays and increases in the contract sum.

ARTICLE 3 - CONTRACTOR**3.2 REVIEW OF CONTRACT DOCUMENTS AND FIELD CONDITIONS BY CONTRACTOR**

Add following sentences to subparagraph **3.2.2**:

3.2.2.1 If a dimensional discrepancy exists, Contractor shall take field measurements required for proper fabrication and installation of work. Upon commencement of any item of work, Contractor shall be responsible for dimensions related to such item of Work and shall make any corrections necessary to make work properly fit at no additional cost to Owner.

3.2.2.2 Before ordering any material or doing any work, Contractor shall verify dimensions and check conditions in order to assure himself that they properly reflect those on the Drawings. Any inconsistency shall be brought to attention of the Architect. In the event that discrepancies occur between ordered material and actual conditions, of which Architect was not notified beforehand, costs to correct such discrepancies shall be borne by Contractor.

3.3 SUPERVISION AND CONSTRUCTION PROCEDURES

Supplement as provided in Division 1.

3.4 LABOR AND MATERIALS

Add the following new paragraph:

3.4.4 After the Contract has been executed, the Owner and the Architect will consider a formal request for the substitution of products in place of those specified only under the conditions set forth in the General Requirements of the Specifications, Division 1. Refer to Division 01 for supplemental information.

3.5 WARRANTY

Supplement as provided in Division 01.

3.8 ALLOWANCES

Supplement as provided in Division 01.

3.10 CONTRACTOR'S CONSTRUCTION SCHEDULES

Supplement as provided in Division 01.

3.11 DOCUMENTS AND SAMPLES AT THE SITE

Supplement as provided in Division 01.

3.12 SHOP DRAWINGS, PRODUCT DATA AND SAMPLES

Supplement as provided in Division 01.

3.13 USE OF SITE

Supplement as provided in Division 01.

3.14 CUTTING AND PATCHING

Supplement as provided in Division 01.

3.15 CLEANING UP

Supplement as provided in Division 01.

ARTICLE 6 - CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS

Add the following new paragraph

6.1.5 Coordinated construction work under this Contract includes, but not be limited to, providing concealed blocking as noted for attachment of separate contract items in locations necessary for the actual items to be installed. Providing proper dimensional coordination of separate contract supplied items for general construction work and trim that is to meet and/or adjoin Furniture, Fixtures, Equipment and Accessories.

6.1.6 It is a requirement of the Contractor's work schedule to provide the cooperation, coordination and exchange of information necessary for a timely execution of separate contract work.

ARTICLE 7 - CHANGES IN THE WORK

7.1 GENERAL

Supplement as provided in Division1.

Add the following new paragraphs:

7.1.4 Except as provided in this article, no oral statement, or direction of Architect or Owner shall be treated as a Change Order or entitle Contractor to an adjustment to the Contract Sum or the Contract Time.

7.1.5 Unit prices shall be inclusive of all costs including mark-up for overhead and profit and shall be applied to units of measure as defined in the Contract Documents for each category of Work.

ARTICLE 8 - TIME

8.3 DELAYS AND EXTENSIONS OF TIME

Add the following new paragraphs

8.3.4 Apart from extension of time, no payment or claim for damages shall be made to Contractor as compensation for damages for any ordinary delays or hindrances from any cause whatsoever in the progress of the Work, notwithstanding whether such delay be avoidable or unavoidable.

8.3.5 In order to claim an inclement weather delay day, Contractor must:

8.3.5.1 Document, in writing, that the weather on the particular day was of such nature (rain, wind, snow, ice, and subsequent resultant effects) that it significantly impacted its ability to make progress on critical path work items. Inclement weather delay days will not be granted for weekends or holidays unless Contractor can demonstrate that it had been and intended to work on these days.

8.3.5.2 Submit such delay claims on a weekly basis, not more than 7 days following the day of occurrence.

8.3.5.3 Summarize the number of days claimed for the entire month accompanying each month's application for payment.

ARTICLE 9 - PAYMENTS AND COMPLETION

9.2 SCHEDULE OF VALUES

Supplement as provided in Division 01.

9.3 APPLICATIONS FOR PAYMENT

Supplement as provided in Division 01.

Add the following new subparagraph:

9.3.4 Unless otherwise stated in the Owner-Contractor Agreement, the Owner will retain, until Final Payment, 10 percent of the amount due the Contractor on account of progress payments, payable 30 days after Substantial Completion and/or satisfactory evidence to the owner that all payments, bills, and claims have been paid.

Add following Sub-subparagraphs:

9.3.5 Monthly Applications for Payment shall include waivers of liens for all work included in previous months' application for payment. Waiver of Liens for subcontractors and materialmen shall be total amount paid prior to previous months' application for payment.

9.5 DECISIONS TO WITHHOLD CERTIFICATION

Add following Sub-subparagraph **9.5.1.8** to Subparagraph **9.5.1**:

9.5.1.8 Failure to submit written plan indicating action by Contractor to regain time schedule for completion of Work within Contract Time.

9.5.1.9 Failure to keep record documents current.

9.8 SUBSTANTIAL COMPLETION

Supplement as provided in Division 01.

9.10 FINAL COMPLETION AND FINAL PAYMENT

Add the following new paragraph

9.10.2.1 In addition to the items listed in 9.10.2, the Contractor shall deliver 4 sets of the following items to the Owner before final payment will be made:

1. Other close-out submittals as specified in Division 01.
2. Project record documents as specified in Division 01.
3. Operations and maintenance data as specified in Division 01.
4. All warranties as required on specific products or portions of the Work, in format outlined in Division 01.
5. Spare parts, overages, and maintenance materials as outlined in Division 1 and described in the various technical sections.
6. Certificates of occupancy.
7. Copies of all inspection tags from authorities having jurisdiction.
8. Executed Certificate of Substantial Completion.

ARTICLE 11 - INSURANCE AND BONDS

11.1 CONTRACTOR'S LIABILITY INSURANCE

Add the following new Sub-subparagraphs:

11.1.1.9 Liability insurance shall include all major divisions of coverage and be on a comprehensive basis including:

- .1 Premises Operations (including X-C-U).
- .2 Independent Contractor's Protective.
- .3 Products and Completed Operations.
- .4 Contractual including specified provisions for the Contractor's obligations under Paragraph 3.18.
- .5 Broad Form Property Damage including Completed Operations.

- .6 Personal Injury Liability with Employment Exclusion Deleted.
- .7 Owner's and Contractor's Protective.
- .8 Excess Umbrella.

11.1.1.10 Insurance certificate(s) shall specify Owner as the certificate holder and (except for Workers' Compensation) as an additional insured.

11.1.2 Add the following to the first sentence after the word "law"

"or as otherwise required by the Owner"

ARTICLE 13 - MISCELLANEOUS PROVISIONS

13.5 TESTS AND INSPECTIONS

Supplement as provided in Division 01.

END OF DOCUMENT

SECTION 011000**SUMMARY****PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

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

1.2 SUMMARY

- A. Section includes:
 - 1. Project information.
 - 2. Work covered by Contract Documents.
 - 3. Owner-furnished products.
 - 4. Access to site.
 - 5. Specification and drawing conventions.

1.3 PROJECT INFORMATION

- A. Project Identification: IRV19-0275-00 – Taco Bell Drive Through Restaurant Endeavor 1.0
- B. Owner: N/A
 - 1. Owner's Representative: N/A
- C. Architect: Ware Malcomb Architecture.
- D. Contractor: None has been engaged as Contractor for this Project.

1.4 WORK COVERED BY CONTRACT DOCUMENTS

- A. The Work of the Project is defined by the Contract Documents and consists of the following:
 - 1. New construction of a restaurant prototype following YumBlueLine requirements. Alternate material options included. Exterior cladding materials consist of EIFS, Fiber Cement Panels and Boards, single-ply roofing membrane with interior finish out as indicated, Food Prep and Equipment to be provided by others. Site amenities and materials as indicated on Drawings and documents shared between others.
- B. Type of Contract
 - 1. Project will be constructed under a single prime contract.

1.5 OWNER-FURNISHED PRODUCTS

- A. Owner will furnish products indicated. The Work includes receiving, unloading, handling, storing, protecting, and installing Owner-furnished products and making building services connections.
- B. Owner-Furnished Products:
 - 1. TBD.

1.6 ACCESS TO SITE

- A. General: Contractor shall have full use of Project site for construction operations during construction period. Contractor's use of Project site is limited only by Owner's right to perform work or to retain other contractors on portions of Project.
- B. General: Contractor shall have limited use of Project site for construction operations as indicated on Drawings by the Contract limits and as indicated by requirements of this Section.
- C. Use of Site: Limit use of Project site to work in areas indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated.

1.7 SPECIFICATION AND DRAWING CONVENTIONS

- A. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:
 - 1. Imperative mood and streamlined language are generally used in the Specifications. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is

- used within a sentence or phrase.
2. Specification requirements are to be performed by Contractor unless specifically stated otherwise.
- B. Division 01 General Requirements: Requirements of Sections in Division 01 apply to the Work of all Sections in the Specifications.
- C. Drawing Coordination: Requirements for materials and products identified on the Drawings are described in detail in the Specifications. One or more of the following are used on the Drawings to identify materials and products:
1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.
 2. Abbreviations: Materials and products are identified by abbreviations published as part of the U.S. National CAD Standard and scheduled on Drawings.
 3. Keynoting: Materials and products are identified by reference keynotes referencing Specification Section numbers found in this Project Manual.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

**SECTION 012300
ALTERNATES**

PART 1 - GENERAL

- 1.1 RELATED DOCUMENTS
- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.
- 1.2 SUMMARY
- A. Section includes administrative and procedural requirements for alternates.
- 1.3 DEFINITIONS
- A. Alternate: An amount proposed by bidders and stated on the Bid Form for certain work defined in the Bidding Requirements that may be added to or deducted from the base bid amount if Owner decides to accept a corresponding change either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.
1. Alternates described in this Section are part of the Work only if enumerated in the Agreement.
 2. The cost or credit for each alternate is the net addition to or deduction from the Contract Sum to incorporate alternate into the Work. No other adjustments are made to the Contract Sum.
- 1.4 PROCEDURES
- A. Coordination: 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.
- B. Notification: Immediately following award of the Contract, notify each party involved, in writing, of the status of each alternate. Indicate if alternates have been accepted, rejected, or deferred for later consideration. Include a complete description of negotiated modifications to alternates.
- C. Execute accepted alternates under the same conditions as other work of the Contract.
- D. Schedule: A schedule of alternates is included at the end of this Section. Specification Sections referenced in schedule contain requirements for materials necessary to achieve the work described under each alternate.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

- 3.1 SCHEDULE OF ALTERNATES
- A. Alternate No. [Insert number]: [Insert title of alternate].
1. Base Bid: [Insert brief description of base bid requirement] [as indicated on Sheet] [Insert title of sheet]] [and] [as specified in Division [Insert Division number] Section "[Insert Section Title]"].
 2. Alternate: [Insert brief description of alternate requirement] [as indicated on Sheet] [Insert title of sheet]] [and] [as specified in Division [Insert Division number] Section "[Insert Section Title]"].

END OF SECTION

SECTION 012500
SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for substitutions.

1.3 DEFINITIONS

- A. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.
1. Substitutions for Cause: Changes proposed by Contractor that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms.
 2. Substitutions for Convenience: Changes proposed by Contractor or Owner that are not required in order to meet other Project requirements but may offer advantage to Contractor or Owner.

1.4 SUBMITTALS

- A. Substitution Requests: Submit one PDF file of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
1. Substitution Request Form: Use CSI Form 13.1A.
 2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:
 - a. Statement indicating why specified product or fabrication or installation can not be provided, if applicable.
 - b. Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by Owner and separate contractors that will be necessary to accommodate proposed substitution.
 - c. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Include annotated copy of applicable specification section. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.
 - d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
 - e. Samples, where applicable or requested.
 - f. Certificates and qualification data, where applicable or requested.
 - g. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners.
 - h. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
 - i. Research reports evidencing compliance with building code in effect for Project, from ICC-ES.
 - j. Detailed comparison of Contractor's construction schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.
 - k. Cost information, including a proposal of change, if any, in the Contract Sum.
 - l. Contractor's certification that proposed substitution complies with requirements in the Contract Documents except as indicated in substitution request, is compatible with related materials, and is appropriate for applications indicated.
 - m. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.
 3. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within 7 days of receipt of a request for substitution. Architect will notify Contractor of

acceptance or rejection of proposed substitution within 15 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.

- a. Forms of Acceptance: Change Order, Construction Change Directive, or Architect's Supplemental Instructions for minor changes in the Work.
- b. Use product specified if Architect does not issue a decision on use of a proposed substitution within time allocated.

1.5 QUALITY ASSURANCE

- A. Compatibility of Substitutions: Investigate and document compatibility of proposed substitution with related products and materials. Engage qualified testing agency to perform compatibility tests recommended by manufacturers.

1.6 PROCEDURES

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

PART 2 - PRODUCTS

2.1 SUBSTITUTIONS

- A. Substitutions for Cause: Submit requests for substitution immediately upon discovery of need for change, but not later than 15 days prior to time required for preparation and review of related submittals.
 1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:
 - a. Requested substitution is consistent with the Contract Documents and will produce indicated results.
 - b. Substitution request is fully documented and properly submitted.
 - c. Requested substitution will not adversely affect Contractor's construction schedule.
 - d. Requested substitution has received necessary approvals of authorities having jurisdiction.
 - e. Requested substitution is compatible with other portions of the Work.
 - f. Requested substitution has been coordinated with other portions of the Work.
 - g. Requested substitution provides specified warranty.
 - h. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.
- B. Substitutions for Convenience: Not allowed, unless otherwise indicated.
- C. Substitutions for Convenience: Architect will consider requests for substitution if received within 60 days after commencement of the Work. Requests received after that time may be considered or rejected at discretion of Architect.
 1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:
 - a. Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include compensation to Architect for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.
 - b. Requested substitution does not require extensive revisions to the Contract Documents.
 - c. Requested substitution is consistent with the Contract Documents and will produce indicated results.
 - d. Substitution request is fully documented and properly submitted.
 - e. Requested substitution will not adversely affect Contractor's construction schedule.
 - f. Requested substitution has received necessary approvals of authorities having jurisdiction.
 - g. Requested substitution is compatible with other portions of the Work.
 - h. Requested substitution has been coordinated with other portions of the Work.
 - i. Requested substitution provides specified warranty.
 - j. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

PART 3 - EXECUTION (Not Used)

END OF SECTION

**SECTION 012500.13
SUBSTITUTION REQUEST FORM**

PROJECT: _____

(After Contract Award)

TO: _____

NO. _____

DATE: _____

Contractor hereby requests acceptance of the following product or system as a substitution in accordance with provisions of Division 01 Section "Substitution Procedures."

1. SPECIFIED PRODUCT OR SYSTEM

Substitution request for: _____

Specification Section No.: _____ Article/ Paragraph: _____

2. REASON FOR SUBSTITUTION REQUEST

SPECIFIED PRODUCT . . .

PROPOSED PRODUCT . . .

- | | |
|--|---|
| <input type="checkbox"/> Is no longer available. | <input type="checkbox"/> Will reduce construction time |
| <input type="checkbox"/> Is unable to meet project schedule. | <input type="checkbox"/> Will result in cost savings of |
| <input type="checkbox"/> Is unsuitable for the designated application. | \$ _____ to Project |
| <input type="checkbox"/> Cannot interface with adjacent materials. | <input type="checkbox"/> Is for supplier's convenience |
| <input type="checkbox"/> Is not compatible with adjacent materials. | <input type="checkbox"/> Is for subcontractor's convenience |
| <input type="checkbox"/> Cannot provide the specified warranty. | <input type="checkbox"/> Other: _____ |
| <input type="checkbox"/> Cannot be constructed as indicated | _____ |
| <input type="checkbox"/> Cannot be obtained due to one or more of the following: | |
| <input type="checkbox"/> Strike | <input type="checkbox"/> Bankruptcy of manufacturer or supplier |
| <input type="checkbox"/> Lockout | <input type="checkbox"/> Similar occurrence (explain below) |

3. SUPPORTING DATA

- Drawings, specifications, product data, performance data, test data, and any other necessary information to facilitate review of the Substitution Request are attached.
- Sample is attached. Sample will be sent if requested.

4. QUALITY COMPARISON

Provide all necessary side-by-side comparative data as required to facilitate review of Substitution Request:

SPECIFIED PRODUCT PROPOSED PRODUCT

Manufacturer: _____

Name / Brand: _____

Catalog No.: _____

Vendor: _____

Variations: _____

(Add Additional Sheets If Necessary)

Local Distributor or Supplier: _____

Maintenance Service Available: Yes No

Spare Parts Source: _____

Warranty: Yes No _____ Years

5. PREVIOUS INSTALLATIONS

Identification of at least three similar projects on which proposed substitution was used:

PROJECT #1:

Project: _____

Address: _____

Architect: _____

Owner: _____

Contractor: _____

Date Installed: _____

PROJECT #2:

Project: _____

Address: _____

Architect: _____

Owner: _____

Contractor: _____

Date Installed: _____

6. EFFECT OF SUBSTITUTION

Proposed substitution affects other work or trades: No Yes (if Yes, explain)

Proposed substitution requires dimensional revisions or redesign of architectural, structural, M-E-P, life safety, or other work:

- No
- Yes (if Yes, attach data explaining revisions)

7. STATEMENT OF CONFORMANCE OF REQUEST TO CONTRACT REQUIREMENTS

Contractor and Subcontractor have investigated the proposed substitution and hereby represent that:

- A. They have personally investigated the proposed substitution and believe that it is equal to or superior in all respects to specified product, except as stated above;
- B. The proposed substitution is in compliance with applicable codes and ordinances;
- C. The proposed substitution will provide same warranty as specified for specified product;
- D. They will coordinate the incorporation of the proposed substitution into the Work, and will include modifications to the Work as required to fully integrate the substitution;
- E. They have included complete cost data and implications of the substitution (attached);
- F. They will pay any redesign fees incurred by the Architect or any of the Architect’s consultants, and any special inspection costs incurred by the Owner, caused by the use of this product;
- G. They waive all future claims for added cost or time to the Contract related to the substitution, or that become known after substitution is accepted.
- H. The Architect’s approval, if granted, will be based upon reliance upon data submitted and the opinion, knowledge, information, and belief of the Architect at the time decision is rendered and Addendum is issued; and that Architect’s approval therefore is interim in nature and subject to reevaluation and reconsideration as additional data, materials, workmanship, and coordination with other work are observed and reviewed.

Contractor: _____
(Name of Contractor)

Date: _____ By: _____

Subcontractor: _____
(Name of Subcontractor)

Date: _____ By: _____

Note: Unresponsive or incomplete requests will be rejected and returned without review.

8. ARCHITECT'S REVIEW AND ACTION

- Substitution is accepted.
- Substitution is accepted, with the following comments: _____

- Resubmit Substitution Request:
 - Provide more information in the following areas: _____

 - Provide proposal indicating amount of savings / credit to Owner
 - Bidding Contractor shall sign Bidder's Statement of Conformance
 - Bidding Subcontractor shall sign Bidder's Statement of Conformance

- Substitution is not accepted:
 - Substitution Request received too late.
 - Substitution Request received directly from subcontractor or supplier.
 - Substitution Request not submitted in accordance with requirements.
 - Substitution Request Form is not properly executed.
 - Substitution Request does not indicate what item is being proposed.
 - Insufficient information submitted to facilitate proper evaluation.
 - Proposed product does not appear to comply with specified requirements.
 - Proposed product will require substantial revisions to Contract Documents.

By: _____

Date: _____

Architect has relied upon the information provided by the Contractor, and makes no claim as to the accuracy, completeness, or validity of such information. If an accepted substitution is later found to be not in compliance with the Contract Documents, Contractor shall provide the specified product.

9. OWNER'S REVIEW AND ACTION

- Substitution is accepted; Architect to prepare Change Order.
- Substitution is not accepted.
- Owner will pay Architect directly for redesign fees.
- Include Architect's Additional Service fee for implementing the substitution in the Change Order.

By: _____
(Owner/Owner's Representative)

Date: _____

END OF FORM

SECTION 012600
CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for handling and processing Contract modifications.
- B. Related Sections:
1. Division 01 Section "Product Requirements" for administrative procedures for handling requests for substitutions made after Contract award.

1.3 MINOR CHANGES IN THE WORK

- A. Architect will issue supplemental instructions authorizing minor changes in the Work, not involving adjustment to the Contract Sum or the Contract Time, on AIA Document G710, "Architect's Supplemental Instructions." or Architect's Bulletin form.

1.4 PROPOSAL REQUESTS

- A. Owner-Initiated Proposal Requests: will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.
1. Proposal Requests issued by are not instructions either to stop work in progress or to execute the proposed change.
 2. Within time specified in Proposal Request after receipt of Proposal Request, submit a quotation estimating the cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.
 - a. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
 - b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
 - c. Include costs of labor and supervision directly attributable to the change.
 - d. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
 - e. Quotation Form: Use CSI Form 13.6B "Proposal Worksheet Summary" and 13.6C "Proposal Worksheet Detail". AIA G709 or Architect's Bulletin form.
- B. Contractor-Initiated Proposals: If latent or changed conditions require modifications to the Contract, Contractor may initiate a claim by submitting a request for a change to [the Owner] [the Architect].
1. Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.
 2. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
 3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
 4. Include costs of labor and supervision directly attributable to the change.
 5. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
 6. Comply with requirements in Division 01 Section "Substitution Procedures" if the proposed change requires substitution of one product or system for product or system specified.
 7. Proposal Request Form: Use Contractors standard proposal request form as approved by Owner and Architect.

1.5 ADMINISTRATIVE CHANGE ORDERS

- A. Allowance Adjustment: Refer to Division 01 Section "Allowances" for administrative procedures for preparation of Change Order Proposal for adjusting the Contract Sum to reflect actual costs of allowances.
- B. Unit Price Adjustment: Refer to Division 01 Section "Unit Prices" for administrative procedures for preparation of Change Order Proposal for adjusting the Contract Sum to reflect measured scope of unit price work.

1.6 CHANGE ORDER PROCEDURES

- A. On Owner's approval of a Proposal Request, prepare and issue a Change Order for signatures of Owner, Architect and Contractor on AIA Document G701 or Contractors standard change order document.

1.7 CONSTRUCTION CHANGE DIRECTIVE

- A. Work Change Directive: Owner may instruct the Architect to issue a Work Change Directive on AIA Document G714 or Architect's Bulletin form. Work Change Directive instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.
 - 1. Work Change Directive contains a complete description of change in the Work. It also designates method to be followed to determine change in the Contract Sum or the Contract Time.
- B. Documentation: Maintain detailed records on a time and material basis of work required by the Work Change Directive.
 - 1. After completion of change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 012900
PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section specifies administrative and procedural requirements necessary to prepare and process Applications for Payment.

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 SCHEDULE OF VALUES

- A. Coordination: Coordinate preparation of the schedule of values with preparation of Contractor's construction schedule.
1. Correlate line items in the schedule of values with other required administrative forms and schedules, including the following:
 - a. Application for Payment forms with continuation sheets.
 - b. Submittal schedule.
 - c. Items required to be indicated as separate activities in Contractor's construction schedule.
 2. Sub-schedules for Phased Work: Where the Work is separated into phases requiring separately phased payments; provide sub-schedules showing values correlated with each phase of payment.
- 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.
1. Identification: Include the following Project identification on the schedule of values:
 - a. Project name and location.
 - b. Name of Architect.
 - c. Architect's project number.
 - d. Contractor's name and address.
 - e. Date of submittal.
 2. Arrange schedule of values consistent with format of AIA Document G703.
 3. Arrange the schedule of values in tabular form with separate columns to indicate the following for each item listed:
 - a. Related Specification Section or Division.
 - b. Description of the Work.
 - c. Name of subcontractor.
 - d. Name of manufacturer or fabricator.
 - e. Name of supplier.
 - f. Change Orders (numbers) that affect value.
 - g. Dollar value of the following, as a percentage of the Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent.
 - 1) Labor.
 - 2) Materials.
 - 3) Equipment.
 4. 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 Manual table of contents. Provide multiple line items for principal subcontract amounts in excess of five percent of Contract Sum.
 - a. Include separate line items under [Contractor and] principal subcontracts for [LEED documentation and other] project closeout requirements in an amount totaling [five] [Insert percentage] percent of the Contract Sum and subcontract amount.
 5. Round amounts to nearest whole dollar; total shall equal the Contract Sum.
 6. Provide a separate line item in the schedule of values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.

- a. Differentiate between items stored on-site and items stored off-site. Include evidence of insurance and photo documentation.
 - 7. Provide separate line items in the schedule of values for initial cost of materials, for each subsequent stage of completion, and for total installed value of that part of the Work.
 - 8. Allowances: Provide a separate line item in the schedule of values for each allowance. Show line-item value of unit-cost allowances, as a product of the unit cost, multiplied by measured quantity. Use information indicated in the Contract Documents to determine quantities.
 - 9. Purchase Contracts: Provide a separate line item in the schedule of values for each purchase contract. Show line-item value of purchase contract. Indicate owner payments or deposits, if any, and balance to be paid by Contractor.
 - 10. Each item in the schedule of values and Applications for Payment shall be complete. Include total cost and proportionate share of general overhead and profit for each item.
 - a. Temporary facilities and other major cost items that are not direct cost of actual work-in-place may be shown either as separate line items in the schedule of values or distributed as general overhead expense, at Contractor's option.
 - 11. Schedule Updating: Update and resubmit the schedule of values before the next Applications for Payment when Change Orders or Construction Change Directives result in a change in the Contract Sum.
- 1.5 APPLICATIONS FOR PAYMENT
- A. Each Application for Payment shall be consistent with previous applications and payments as certified by Architect and paid for by Owner.
 - 1. Initial Application for Payment, Application for Payment at time of Substantial Completion, and final Application for Payment involve additional requirements.
 - B. Payment Application Times: The date for each progress payment is indicated in the Agreement between Owner and Contractor. The period of construction work covered by each Application for Payment is the period indicated in the Agreement.
 - C. Application for Payment Forms: Use AIA Document G702 or other Contractor form as approved by Owner / Architect, and AIA Document G703 as form for Applications for Payment.
 - D. Application for Payment Forms: Use forms acceptable to and Owner for Applications for Payment. Submit forms for approval with initial submittal of schedule of values.
 - E. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. Architect will return incomplete applications without action.
 - 1. Entries shall match data on the schedule of values and Contractor's construction schedule. Use updated schedules if revisions were made.
 - 2. Include amounts for work completed following previous Application for Payment, whether or not payment has been received. Include only amounts for work completed at time of Application for Payment.
 - 3. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.
 - 4. Indicate separate amounts for work being carried out under Owner-requested project acceleration.
 - F. Stored Materials: Include in Application for Payment amounts applied for materials or equipment purchased or fabricated and stored, but not yet installed. Differentiate between items stored on-site and items stored off-site.
 - 1. Provide certificate of insurance, evidence of transfer of title to Owner, and consent of surety to payment, for stored materials.
 - 2. Provide supporting documentation that verifies amount requested, such as paid invoices. Match amount requested with amounts indicated on documentation; do not include overhead and profit on stored materials.
 - 3. Provide summary documentation for stored materials indicating the following:
 - a. Materials previously stored and included in previous Applications for Payment.
 - b. Work completed for this Application utilizing previously stored materials.
 - c. Additional materials stored with this Application.
 - d. Total materials remaining stored, including materials with this Application.
 - G. Transmittal: Submit three signed and notarized original copies of each Application for Payment to by a method ensuring receipt within 24 hours. One copy shall include waivers of lien and similar attachments if required.
 - 1. Transmit each copy with a transmittal form listing attachments and recording appropriate information about application.
 - H. Waivers of Mechanic's Lien: With each Application for Payment, submit waivers of mechanic's lien from entities lawfully entitled to file a mechanic's lien arising out of the Contract and related to the Work covered by the payment.

1. Submit partial waivers on each item for amount requested in previous application, after deduction for retain age, on each item.
 2. When an application shows completion of an item, submit conditional final or full waivers.
 3. Owner reserves the right to designate which entities involved in the Work must submit waivers.
 4. Waiver Forms: Submit waivers of lien on forms, executed in a manner acceptable to Owner.
- I. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:
1. List of subcontractors.
 2. Schedule of values.
 3. Contractor's construction schedule (preliminary if not final).
 4. Combined Contractor's construction schedule (preliminary if not final) incorporating Work of multiple contracts, with indication of acceptance of schedule by each Contractor.
 5. Products list (preliminary if not final).
 6. Schedule of unit prices.
 7. Submittal schedule (preliminary if not final).
 8. List of Contractor's staff assignments.
 9. List of Contractor's principal consultants.
 10. Copies of building permits.
 11. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
 12. Initial progress report.
 13. Report of preconstruction conference.
 14. Certificates of insurance and insurance policies.
 15. Performance and payment bonds.
 16. Data needed to acquire Owner's insurance.
- J. Submit evidence of correction of non-conforming work prior to subsequent application for payment.
- K. Application for Payment at Substantial Completion: After issuing the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion for portion of the Work claimed as substantially complete.
1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.
 2. This application shall reflect Certificates of Partial Substantial Completion issued previously for Owner occupancy of designated portions of the Work.
- L. Final Payment Application: Submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:
1. Evidence of completion of Project closeout requirements.
 2. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
 3. Updated final statement, accounting for final changes to the Contract Sum.
 4. AIA Document G706, "Contractor's Affidavit of Payment of Debts and Claims."
 5. AIA Document G706A, "Contractor's Affidavit of Release of Liens."
 6. AIA Document G707, "Consent of Surety to Final Payment."
 7. Evidence that claims have been settled.
 8. Final meter readings for utilities, a measured record of stored fuel, and similar data as of date of Substantial Completion or when Owner took possession of and assumed responsibility for corresponding elements of the Work.
 9. Final liquidated damages settlement statement.

PART 2 - PRODUCTS (Not Used)**PART 3 - EXECUTION (Not Used)****END OF SECTION**

SECTION 013100
PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

- 1.1 RELATED DOCUMENTS
- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.
- 1.2 SUMMARY
- A. Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:
1. General project coordination procedures.
 2. Administrative and supervisory personnel.
 3. Coordination drawings.
 4. Requests for Information (RFIs).
 5. Project Web site.
 6. Project meetings.
- B. Each contractor shall participate in coordination requirements. Certain areas of responsibility are assigned to a specific contractor.
- 1.3 DEFINITIONS
- A. RFI: Request from Owner, Architect, or Contractor seeking information from each other during construction.
- 1.4 COORDINATION
- A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations, included in different Sections that depend on each other for proper installation, connection, and operation.
1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
 2. Coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair.
 3. Make adequate provisions to accommodate items scheduled for later installation.
- B. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.
1. Prepare similar memoranda for Owner and separate contractors if coordination of their Work is required.
- C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities [and activities of other contractors] to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
1. Preparation of Contractor's construction schedule.
 2. Preparation of the schedule of values.
 3. Installation and removal of temporary facilities and controls.
 4. Delivery and processing of submittals.
 5. Progress meetings.
 6. Pre-Installation conferences.
 7. Project closeout activities.
 8. Startup and adjustment of systems.
 9. Project closeout activities.
- 1.5 COORDINATION DRAWINGS
- A. Coordination Drawings, General: Prepare coordination drawings in accordance with requirements in individual Sections, where installation is not completely shown on Shop Drawings, where limited space availability necessitates coordination, or if coordination is required to facilitate integration of products and materials fabricated or installed by more than one entity.
1. Content: Project-specific information, drawn accurately to a scale large enough to indicate and resolve conflicts. Do not base coordination drawings on standard printed data. Include the following information, as applicable:

- a. Use applicable Drawings as a basis for preparation of coordination drawings. Prepare sections, elevations, and details as needed to describe relationship of various systems and components.
 - b. Coordinate the addition of trade-specific information to the coordination drawings by multiple contractors in a sequence that best provides for coordination of the information and resolution of conflicts between installed components before submitting for review.
 - c. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
 - d. Indicate space requirements for routine maintenance and for anticipated replacement of components during the life of the installation.
 - e. Show location and size of access doors required for access to concealed dampers, valves, and other controls.
 - f. Indicate required installation sequences.
 - g. Indicate dimensions shown on the Drawings. Specifically note dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternate sketches to Architect indicating proposed resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.
- B. Coordination Drawing Organization: Organize coordination drawings as follows:
1. Floor Plans and Reflected Ceiling Plans: Show architectural and structural elements, and mechanical, plumbing, fire protection, fire alarm, and electrical Work. Show locations of visible ceiling-mounted devices relative to acoustical ceiling grid. Supplement plan drawings with section drawings where required to adequately represent the Work.
 2. Plenum Space: Indicate subframing for support of ceiling and wall systems, mechanical and electrical equipment, and related Work. Locate components within ceiling plenum to accommodate layout of light fixtures indicated on Drawings. Indicate areas of conflict between light fixtures and other components.
 3. Mechanical Rooms: Provide coordination drawings for mechanical rooms showing plans and elevations of mechanical, plumbing, fire protection, fire alarm, and electrical equipment.
 4. Structural Penetrations: Indicate penetrations and openings required for all disciplines.
 5. Slab Edge and Embedded Items: Indicate slab edge locations and sizes and locations of embedded items for metal fabrications, sleeves, anchor bolts, bearing plates, angles, door floor closers, slab depressions for floor finishes, curbs and housekeeping pads, and similar items.
 6. Mechanical and Plumbing Work: Show the following:
 - a. Sizes and bottom elevations of ductwork, piping, and conduit runs, including insulation, bracing, flanges, and support systems.
 - b. Dimensions of major components, such as dampers, valves, diffusers, access doors, cleanouts and electrical distribution equipment.
 - c. Fire-rated enclosures around ductwork.
 7. Electrical Work: Show the following:
 - a. Runs of vertical and horizontal conduit 1-1/4 inch diameter and larger.
 - b. Light fixture, exit light, emergency battery pack, smoke detector, and other fire alarm locations.
 - c. Panel board, switch board, switchgear, transformer, busway, generator, and motor control center locations.
 - d. Location of pull boxes and junction boxes dimensioned from column center lines.
 8. Fire Protection System: Show the following:
 - a. Locations of standpipes, mains piping, branch lines, pipe drops, and sprinkler heads.
 9. Review: Architect will review coordination drawings to confirm that the Work is being coordinated, but not for the details of the coordination, which are the Contractor's responsibility. If the Architect determines that the coordination drawings are not being prepared in sufficient scope or detail, or are otherwise deficient, the Architect will so inform the Contractor, who shall make changes as directed and resubmit.
 10. Coordination Drawing Prints: Prepare coordination drawing prints in accordance with requirements of Division 01 Section "Submittal Procedures."
- C. Coordination Digital Data Files: Prepare coordination digital data files in accordance with the following requirements:
1. File Preparation Format: Same digital data software program, version, and operating system as the original Drawings.
 2. File Preparation Format: DWG, Version, operating in Microsoft Windows operating system.
 3. File Submittal Format: Submit or post coordination drawing files using [format same as file preparation format] [Portable Data File (PDF) format].
 4. Architect will furnish Contractor one set of digital data files of the Drawings for use in preparing coordination digital data files.

- a. Architect makes no representations as to the accuracy or completeness of digital data files as they relate to the Drawings.
- b. Digital Data Software Program: The Drawings are available in [AutoCAD 2004] (.dwg) [Revit 2012 (.rvt)].
- c. Contractor shall execute a data licensing agreement in the form of [Agreement included in this Project Manual]

1.6 KEY PERSONNEL

- A. Key Personnel Names: Within 15 days of starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses and telephone numbers, including home, office, and cellular telephone numbers and email addresses. Provide names, addresses, and telephone numbers of individuals assigned as standbys in the absence of individuals assigned to Project.
 1. Post copies of list in project meeting room, in temporary field office, and by each temporary telephone. Keep list current at all times.

1.7 REQUESTS FOR INFORMATION (RFIs)

- A. General: Immediately on discovery of the need for additional information or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI. All RFIs should be sent directly to the Architect via email or posted to project collaboration site (if one is being utilized). The Architect will redistribute to the appropriate reviewer.
 1. Architect will return RFIs submitted to Architect by other entities controlled by Contractor with no response.
 2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.
- B. Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:
 1. Project name.
 2. Project number.
 3. Date.
 4. Name of Contractor.
 5. Name of Architect.
 6. RFI number, numbered sequentially.
 7. RFI subject.
 8. RFI Question
 9. Specification Section number and title and related paragraphs, as appropriate.
 10. Drawing number and detail references, as appropriate.
 11. Field dimensions and conditions, as appropriate.
 12. Contractor's suggested resolution. If Contractor's solution(s) impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
 13. Contractor's signature.
 14. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.
 - a. Include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments on attached sketches.
- C. RFI Forms: Software-generated form with substantially the same content as indicated above, acceptable to Architect. RFIs should be emailed to Architect with the following format standards: 1) RFI should include RFI # in subject line of email along with brief description; 2) Body of email should include question or description of RFI and suggestion. Sketches or other necessary documents should be attached to email in PDF format.
- D. Architect's Action: Architect will review each RFI, determine action required, and respond. Allow 7 business days for Architect's response for each RFI. RFIs received by Architect after 1:00 p.m. will be considered as received the following working day.
 1. The following RFIs will be returned without action:
 - a. Requests for approval of submittals.
 - b. Requests for approval of substitutions.
 - c. Requests for coordination information already indicated in the Contract Documents.
 - d. Requests for adjustments in the Contract Time or the Contract Sum.
 - e. Requests for interpretation of Architect's actions on submittals.
 - f. Incomplete RFIs or inaccurately prepared RFIs.
 2. Architect's action may include a request for additional information, in which case Architect's time for response will date from time of receipt of additional information.

3. Architect's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Division 01 Section "Contract Modification Procedures."
 - a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect in writing within 10 days of receipt of the RFI response.
- E. On receipt of Architect's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Architect within seven days if Contractor disagrees with response.
- F. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log weekly. Submit log with not less than the following:
 1. RFI Log Date
 2. Project name.
 3. Name and address of Contractor.
 4. Name and address of Architect and Construction Manager.
 5. RFI number including RFIs that were dropped and not submitted.
 6. RFI description.
 7. Date the RFI was submitted.
 8. Request Date
 9. Date Architect's and Construction Manager's response was received.
 10. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.
 11. Identification of related Field Order, Work Change Directive, and Proposal Request, as appropriate.

1.8 PROJECT MEETINGS

- A. General: Schedule and conduct meetings and conferences at Project site, unless otherwise indicated.
 1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Architect of scheduled meeting dates and times.
 2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
 3. Minutes: Entity responsible for conducting meeting will record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner and Architect, within three days of the meeting.
- B. Pre-construction Conference: Schedule and conduct a pre-construction conference before starting construction, at a time convenient to Owner and Architect, but no later than 15 days after execution of the Agreement.
 1. Conduct the conference to review responsibilities and personnel assignments.
 2. Attendees: Authorized representatives of Owner, Owner's Commissioning Authority, Construction 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.
 3. Agenda: Discuss items of significance that could affect progress, including the following:
 - a. Tentative construction schedule.
 - b. Phasing.
 - c. Critical work sequencing and long-lead items.
 - d. Designation of key personnel and their duties.
 - e. Lines of communications.
 - f. Procedures for processing field decisions and Change Orders.
 - g. Procedures for RFIs.
 - h. Procedures for testing and inspecting.
 - i. Procedures for processing Applications for Payment.
 - j. Distribution of the Contract Documents.
 - k. Submittal procedures.
 - l. Sustainable design requirements.
 - m. Preparation of record documents.
 - n. Use of the premises [and existing building].
 - o. Work restrictions.
 - p. Working hours.
 - q. Owner's occupancy requirements.
 - r. Responsibility for temporary facilities and controls.
 - s. Procedures for moisture and mold control.
 - t. Procedures for disruptions and shutdowns.
 - u. Construction waste management and recycling.
 - v. Parking availability.
 - w. Office, work, and storage areas.
 - x. Equipment deliveries and priorities.

- y. First aid.
- z. Security.
- aa. Progress cleaning.
- 4. Minutes: Entity responsible for conducting meeting will record and distribute meeting minutes.
- C. Pre-Installation Conferences: Conduct a pre-installation conference at Project site before each construction activity that requires coordination with other construction.
 - 1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Architect of scheduled meeting dates.
 - 2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:
 - a. Contract Documents.
 - b. Options.
 - c. Related RFIs.
 - d. Related Change Orders.
 - e. Purchases.
 - f. Deliveries.
 - g. Submittals.
 - h. Review of mockups.
 - i. Possible conflicts.
 - j. Compatibility problems.
 - k. Time schedules.
 - l. Weather limitations.
 - m. Manufacturer's written recommendations.
 - n. Warranty requirements.
 - o. Compatibility of materials.
 - p. Acceptability of substrates.
 - q. Temporary facilities and controls.
 - r. Space and access limitations.
 - s. Regulations of authorities having jurisdiction.
 - t. Testing and inspecting requirements.
 - u. Installation procedures.
 - v. Coordination with other work.
 - w. Required performance results.
 - x. Protection of adjacent work.
 - y. Protection of construction and personnel.
 - 3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
 - 4. Reporting: Distribute minutes of the meeting to each party present and to other parties requiring information.
 - 5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.
- D. Project Closeout Conference: Schedule and conduct Project closeout conference, at a time convenient to Owner and Architect, but no later than 90 days prior to the scheduled date of Substantial Completion.
 - 1. Conduct the conference to review requirements and responsibilities related to Project closeout.
 - 2. Attendees: Authorized representatives of Owner, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the meeting. Participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
 - 3. Agenda: Discuss items of significance that could affect or delay Project closeout, including the following:
 - a. Preparation of record documents.
 - b. Procedures required prior to inspection for Substantial Completion and for final inspection for acceptance.
 - c. Submittal of written warranties.
 - d. Requirements for preparing sustainable design documentation.
 - e. Requirements for preparing operations and maintenance data.
 - f. Requirements for demonstration and training.
 - g. Preparation of Contractor's punch list.
 - h. Procedures for processing Applications for Payment at Substantial Completion and for final payment.
 - i. Submittal procedures.

- j. Coordination of separate contracts.
 - k. Owner's partial occupancy requirements.
 - l. Installation of Owner's furniture, fixtures, and equipment.
 - m. Responsibility for removing temporary facilities and controls.
4. Minutes: Entity conducting meeting will record and distribute meeting minutes.
- E. Progress Meetings: Conduct progress meetings at agreed upon intervals.
1. Coordinate dates of meetings with preparation of payment requests.
 2. Attendees: In addition to representatives of Owner, Owner's Commissioning Authority, Construction Manager, and Architect, each contractor, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
 3. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
 - a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
 - 1) Review schedule for next period.
 - b. Review present and future needs of each entity present, including the following:
 - 1) Interface requirements.
 - 2) Sequence of operations.
 - 3) Status of submittals.
 - 4) Deliveries.
 - 5) Off-site fabrication.
 - 6) Access.
 - 7) Site utilization.
 - 8) Temporary facilities and controls.
 - 9) Progress cleaning.
 - 10) Quality and work standards.
 - 11) Status of correction of deficient items.
 - 12) Field observations.
 - 13) Status of RFIs.
 - 14) Status of proposal requests.
 - 15) Pending changes.
 - 16) Status of Change Orders.
 - 17) Pending claims and disputes.
 - 18) Documentation of information for payment requests.
 4. Minutes: Entity responsible for conducting the meeting will record and distribute the meeting minutes to each party present and to parties requiring information.
 - a. Schedule Updating: Revise Contractor's construction schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.
- F. Coordination Meetings: Conduct Project coordination meetings at regular intervals. Project coordination meetings are in addition to specific meetings held for other purposes, such as progress meetings and pre-installation conferences.
1. Attendees: In addition to representatives of Owner and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meetings shall be familiar with Project and authorized to conclude matters relating to the Work.
 2. Agenda: Review and correct or approve minutes of the previous coordination meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
 - a. Combined Contractor's Construction Schedule: Review progress since the last coordination meeting. Determine whether each contract is on time, ahead of schedule, or behind schedule, in relation to combined Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
 - b. Schedule Updating: Revise combined Contractor's construction schedule after each

- coordination meeting where revisions to the schedule have been made or recognized.
Issue revised schedule concurrently with report of each meeting.
- c. Review present and future needs of each contractor present, including the following:
 - 1) Interface requirements.
 - 2) Sequence of operations.
 - 3) Status of submittals.
 - 4) Deliveries.
 - 5) Off-site fabrication.
 - 6) Access.
 - 7) Site utilization.
 - 8) Temporary facilities and controls.
 - 9) Work hours.
 - 10) Hazards and risks.
 - 11) Progress cleaning.
 - 12) Quality and work standards.
 - 13) Change Orders.
 - 3. Reporting: Record meeting results and distribute copies to everyone in attendance and to others affected by decisions or actions resulting from each meeting.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 013200
CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:
1. Contractor's construction schedule.
 2. Daily construction reports.
 3. Material location reports.
 4. Field condition reports.
 5. Special reports.

1.3 DEFINITIONS

- A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction project. Activities included in a construction schedule consume time and resources.
1. Critical Activity: An activity on the critical path that must start and finish on the planned early start and finish times.
 2. Predecessor Activity: An activity that precedes another activity in the network.
 3. Successor Activity: An activity that follows another activity in the network.
- B. CPM: Critical path method, which is a method of planning and scheduling a construction project where activities are arranged based on activity relationships. Network calculations determine when activities can be performed and the critical path of the Project.
- C. Critical Path: The longest connected chain of interdependent activities through the network schedule that establishes the minimum overall Project duration and contains no float.
- D. Event: The starting or ending point of an activity.
- E. Float: The measure of leeway in starting and completing an activity.
1. Float time is not for the exclusive use or benefit of either Owner or Contractor, but is a jointly owned, expiring Project resource available to both parties as needed to meet schedule milestones and Contract completion date.
 2. Free float is the amount of time an activity can be delayed without adversely affecting the early start of the successor activity.
 3. Total float is the measure of leeway in starting or completing an activity without adversely affecting the planned Project completion date.
- F. Resource Loading: The allocation of manpower and equipment necessary for the completion of an activity as scheduled.

1.4 INFORMATIONAL SUBMITTALS

- A. Format for Submittals: Submit required submittals in the following format:
1. PDF electronic file.
- B. Contractor's Construction Schedule: Initial schedule, of size required to display entire schedule for entire construction period.
1. Submit a working electronic copy of schedule, using software indicated, and labeled to comply with requirements for submittals. Include type of schedule (initial or updated) and date on label.
- C. CPM Reports: Concurrent with CPM schedule, submit each of the following reports. Format for each activity in reports shall contain activity number, activity description, cost and resource loading, original duration, remaining duration, early start date, early finish date, late start date, late finish date, and total float in calendar days.
1. Activity Report: List of all activities sorted by activity number and then early start date, or actual start date if known.
 2. Logic Report: List of preceding and succeeding activities for all activities, sorted in ascending order by activity number and then early start date, or actual start date if known.
 3. Total Float Report: List of all activities sorted in ascending order of total float.
 4. Earnings Report: Compilation of Contractor's total earnings from commencement of the Work until most recent Application for Payment.

- D. Material Location Reports: Submit at prior to application for payment. .
 - E. Field Condition Reports: Submit at time of discovery of differing conditions.
 - F. Special Reports: Submit at time of unusual event.
- 1.5 QUALITY ASSURANCE
- A. Scheduling Consultant Qualifications: An experienced specialist in CPM scheduling and reporting, with capability of producing CPM reports and diagrams within 24 hours of Architect's request.
- 1.6 COORDINATION
- A. Coordinate preparation and processing of schedules and reports with performance of construction activities and with scheduling and reporting of separate contractors.
 - B. Coordinate Contractor's construction schedule with the schedule of values, submittal schedule, progress reports, payment requests, and other required schedules and reports.
 - 1. Secure time commitments for performing critical elements of the Work from entities involved.
 - 2. Coordinate each construction activity in the network with other activities and schedule them in proper sequence.

PART 2 - PRODUCTS

- 2.1 CONTRACTOR'S CONSTRUCTION SCHEDULE, GENERAL
- A. Time Frame: Extend schedule from date established for commencement of the Work to date of Substantial Completion.
 - 1. Contract completion date shall not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by Change Order.
 - B. Activities: Treat each story or separate area as a separate numbered activity for each principal element of the Work. Comply with the following:
 - 1. Procurement Activities: Include procurement process activities for long lead items (as identified by Contractor) and major items, requiring a cycle of more than 60 days, as separate activities in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.
 - 2. Submittal Review Time: Include review and resubmittal times indicated in Division 01 Section "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor's construction schedule with submittal schedule.
 - 3. Startup and Testing Time: Include not less than 15 days for startup and testing.
 - 4. Substantial Completion: Indicate completion in advance of date established for Substantial Completion, and allow time for Architect's administrative procedures necessary for certification of Substantial Completion.
 - 5. Punch List and Final Completion: Include not more than 30 days for punch list and final completion.
 - C. Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule, and show how the sequence of the Work is affected.
 - 1. Phasing: Arrange list of activities on schedule by phase.
 - 2. Work under More Than One Contract: Include a separate activity for each contract.
 - 3. Work by Owner: Include a separate activity for each portion of the Work performed by Owner.
 - 4. Products Ordered in Advance: Include a separate activity for each product. Include delivery date indicated in Division 01 Section "Summary." Delivery dates indicated stipulate the earliest possible delivery date.
 - 5. Owner-Furnished Products: Include a separate activity for each product. Include delivery date indicated in Division 01 Section "Summary." Delivery dates indicated stipulate the earliest possible delivery date.
 - 6. Work Restrictions: Show the effect of the following items on the schedule:
 - a. Coordination with existing construction.
 - b. Limitations of continued occupancies.
 - c. Uninterruptible services.
 - d. Partial occupancy before Substantial Completion.
 - e. Use of premises restrictions.
 - f. Provisions for future construction.
 - g. Seasonal variations.
 - h. Environmental control.
 - 7. Work Stages: Indicate important stages of construction for each major portion of the Work, including, but not limited to, the following:
 - a. Subcontract awards.
 - b. Submittals.

- c. Purchases.
 - d. Mockups.
 - e. Fabrication.
 - f. Sample testing.
 - g. Deliveries.
 - h. Installation.
 - i. Tests and inspections.
 - j. Adjusting.
 - k. Curing.
 - l. Startup and placement into final use and operation.
8. Construction Areas: Identify each major area of construction for each major portion of the Work. Indicate where each construction activity within a major area must be sequenced or integrated with other construction activities to provide for the following:
- a. Structural completion.
 - b. Permanent space enclosure.
 - c. Completion of mechanical installation.
 - d. Completion of electrical installation.
 - e. Substantial Completion.
- D. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, Substantial Completion, and final completion.
- E. Cost Correlation: At the head of schedule, provide a cost correlation line, indicating planned and actual costs. On the line, show dollar volume of the Work performed as of dates used for preparation of payment requests.
- 1. Refer to Division 01 Section "Payment Procedures" for cost reporting and payment procedures.
- F. Upcoming Work Summary: Prepare summary report indicating activities scheduled to occur or commence prior to submittal of next schedule update. Summarize the following issues:
- 1. Unresolved issues.
 - 2. Unanswered RFIs.
 - 3. Rejected or unreturned submittals.
 - 4. Notations on returned submittals.
- G. Recovery Schedule: When periodic update indicates the Work is 14 or more calendar days behind the current approved schedule, submit a separate recovery schedule indicating means by which Contractor intends to regain compliance with the schedule. Indicate changes to working hours, working days, crew sizes, and equipment required achieving compliance, and dating by which recovery will be accomplished.
- H. Computer Scheduling Software: Prepare schedules using current version of a program that has been developed specifically to manage construction schedules.

2.2 CONTRACTOR'S CONSTRUCTION SCHEDULE (CPM SCHEDULE)

- A. General: Prepare network diagrams using AON (activity-on-node) format.
- B. Start-up Network Diagram: Submit diagram within 14 days of date established for commencement of the Work. Outline significant construction activities for the first 90 days of construction. Include skeleton diagram for the remainder of the Work and a cash requirement prediction based on indicated activities.
- C. CPM Schedule: Prepare Contractor's construction schedule using a cost- and resource-loaded, time-scaled CPM network analysis diagram for the Work.
- 1. Develop network diagram in sufficient time to submit CPM schedule so it can be accepted for use no later than 60 days after date established for commencement of the Work.
 - a. Failure to include any work item required for performance of this Contract shall not excuse Contractor from completing all work within applicable completion dates, regardless of Architect's approval of the schedule.
 - 2. Conduct educational workshops to train and inform key Project personnel, including subcontractors' personnel, in proper methods of providing data and using CPM schedule information.
 - 3. Establish procedures for monitoring and updating CPM schedule and for reporting progress. Coordinate procedures with progress meeting and payment request dates.
 - 4. Use "one workday" as the unit of time for individual activities. Indicate nonworking days and holidays incorporated into the schedule in order to correlate with Contract Time.
- D. CPM Schedule Preparation: Prepare a list of all activities required to complete the Work. Using the start-up network diagram, prepare a skeleton network to identify probable critical paths.
- 1. Activities: Indicate the estimated time duration, sequence requirements, and relationship of each activity in relation to other activities. Include estimated time frames for the following activities:
 - a. Preparation and processing of submittals.
 - b. Mobilization and demobilization.
 - c. Purchase of materials.
 - d. Delivery.

- e. Fabrication.
 - f. Utility interruptions.
 - g. Installation.
 - h. Work by Owner that may affect or be affected by Contractor's activities.
 - i. Testing [and commissioning].
 - j. Punch list and final completion.
 - k. Activities occurring following final completion.
2. Critical Path Activities: Identify critical path activities, including those for interim completion dates. Scheduled start and completion dates shall be consistent with Contract milestone dates.
 3. Processing: Process data to produce output data on a computer-drawn, time-scaled network. Revise data, reorganize activity sequences, and reproduce as often as necessary to produce the CPM schedule within the limitations of the Contract Time.
 4. Format: Mark the critical path. Locate the critical path near center of network; locate paths with most float near the edges.
 - a. Sub-networks on separate sheets are permissible for activities clearly off the critical path.
 5. Cost- and Resource-Loading of CPM Schedule: Assign cost to construction activities on the CPM schedule. Do not assign costs to submittal activities. Obtain Architect's approval prior to assigning costs to fabrication and delivery activities. Assign costs under principal subcontracts for testing and commissioning activities, operation and maintenance manuals, punch list activities, Project record documents, [LEED documentation,] and demonstration and training (if applicable), in the amount of [5] [Insert percentage] percent of the Contract Sum.
 - a. Each activity cost shall reflect an appropriate value subject to approval by Architect.
 - b. Total cost assigned to activities shall equal the total Contract Sum.
- E. Contract Modifications: For each proposed contract modification and concurrent with its submission, prepare a time-impact analysis using a network fragment to demonstrate the effect of the proposed change on the overall project schedule.
- F. Initial Issue of Schedule: Prepare initial network diagram from a sorted activity list indicating straight "early start-total float." Identify critical activities. Prepare tabulated reports showing the following:
1. Contractor or subcontractor and the Work or activity.
 2. Description of activity.
 3. Principal events of activity.
 4. Immediate preceding and succeeding activities.
 5. Early and late start dates.
 6. Early and late finish dates.
 7. Activity duration in workdays.
 8. Total float or slack time.
 9. Average size of workforce.
 10. Dollar value of activity (coordinated with the schedule of values).
- G. Schedule Updating: Concurrent with making revisions to schedule, prepare tabulated reports showing the following:
1. Identification of activities that have changed.
 2. Changes in early and late start dates.
 3. Changes in early and late finish dates.
 4. Changes in activity durations in workdays.
 5. Changes in the critical path.
 6. Changes in total float or slack time.
 7. Changes in the Contract Time.
- H. Value Summaries: Prepare two cumulative value lists, sorted by finish dates.
1. In first list, tabulate activity number, early finish date, dollar value, and cumulative dollar value.
 2. In second list, tabulate activity number, late finish date, dollar value, and cumulative dollar value.
 3. In subsequent issues of both lists, substitute actual finish dates for activities completed as of list date.
 4. Prepare list for ease of comparison with payment requests; coordinate timing with progress meetings.
 - a. In both value summary lists, tabulate "actual percent complete" and "cumulative value completed" with total at bottom.
 - b. Submit value summary printouts one week before each regularly scheduled progress meeting.
- 2.3 REPORTS
- A. Daily Construction Reports: Prepare a daily construction report recording the following information concerning events at Project site:
1. List of subcontractors at Project site.

2. List of separate contractors at Project site.
 3. Approximate count of personnel at Project site.
 4. Equipment at Project site.
 5. Material deliveries.
 6. High and low temperatures and general weather conditions, including presence of rain or snow.
 7. Accidents.
 8. Meetings and significant decisions.
 9. Unusual events (refer to special reports).
 10. Stoppages, delays, shortages, and losses.
 11. Meter readings and similar recordings.
 12. Emergency procedures.
 13. Orders and requests of authorities having jurisdiction.
 14. Change Orders received and implemented.
 15. Construction Change Directives received and implemented.
 16. Services connected and disconnected.
 17. Equipment or system tests and startups.
 18. Partial completions and occupancies.
 19. Substantial Completions authorized.
- B. Material Location Reports: prepare and submit a comprehensive list of materials delivered to and stored at Project site. Include with list a statement of progress on and delivery dates for materials or items of equipment fabricated or stored away from Project site.
- C. Field Condition Reports: Immediately on discovery of a difference between field conditions and the Contract Documents, prepare and submit a detailed report. Submit with a Request for Information. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

2.4 SPECIAL REPORTS

- A. General: Submit special reports directly to Owner within one day(s) of an occurrence. Distribute copies of report to parties affected by the occurrence.
- B. Reporting Unusual Events: When an event of an unusual and significant nature occurs at Project site, whether or not related directly to the Work, prepare and submit a special report. List chain of events, persons participating, response by Contractor's personnel, evaluation of results or effects, and similar pertinent information. Advise Owner in advance when these events are known or predictable.

PART 3 - EXECUTION

3.1 CONTRACTOR'S CONSTRUCTION SCHEDULE

- A. Scheduling Consultant: Engage a consultant to provide planning, evaluation, and reporting using CPM scheduling.
1. In-House Option: Owner may waive the requirement to retain a consultant if Contractor employs skilled personnel with experience in CPM scheduling and reporting techniques. Submit qualifications.
 2. Meetings: Scheduling consultant shall attend all meetings related to Project progress, alleged delays, and time impact.
- B. Contractor's Construction Schedule Updating: At monthly intervals, update schedule to reflect actual construction progress and activities. Issue schedule one week before each regularly scheduled progress meeting.
1. Revise schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting.
 2. Include a report with updated schedule that indicates every change, including, but not limited to, changes in logic, durations, actual starts and finishes, and activity durations.
 3. As the Work progresses, indicate final completion percentage for each activity.
- C. Distribution: Distribute copies of approved schedule to Architect Owner, separate contractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.
1. Post copies in Project meeting rooms and temporary field offices.
 2. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.

END OF SECTION

SECTION 013300
SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes requirements for the submittal schedule and administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.

1.3 DEFINITIONS

- A. Action Submittals: Written and graphic information and physical samples that require Architect's responsive action. Action submittals are those submittals indicated in individual Specification Sections as action submittals.
- B. Informational Submittals: Written and graphic information and physical samples that do not require Architect's responsive action. Submittals may be rejected for not complying with requirements. Informational submittals are those submittals indicated in individual Specification Sections as informational submittals.
- C. File Transfer Protocol (FTP): Communications protocol that enables transfer of files to and from another computer over a network and that serves as the basis for standard Internet protocols. An FTP site is a portion of a network located outside of network firewalls within which internal and external users are able to access files.
- D. Portable Document Format (PDF): An open standard file format licensed by Adobe Systems used for representing documents in a device-independent and display resolution-independent fixed-layout document format.

1.4 ACTION SUBMITTALS

- A. Submittal Schedule: Submit a schedule of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or modifications to submittals noted by the Architect and additional time for handling and reviewing submittals required by those corrections.
1. Coordinate submittal schedule with list of subcontracts, the schedule of values, and Contractor's construction schedule.
 2. Initial Submittal: Submit concurrently with start-up construction schedule. Include submittals required during the first 60 days of construction. List those submittals required to maintain orderly progress of the Work and those required early because of long lead-time for manufacture or fabrication.
 3. Final Submittal: Submit concurrently with the first complete submittal of Contractor's construction schedule.
Submit revised submittal schedule to reflect changes in current status and timing for submittals.
 4. Format: Arrange the following information in a tabular format:
 - a. Scheduled date for first submittal.
 - b. Specification Section number and title.
 - c. Submittal category: Action, informational.
 - d. Name of subcontractor.
 - e. Description of the Work covered.
 - f. Scheduled date for Architect's final release or approval.
 - g. Scheduled dates for purchasing.
 - h. Scheduled dates for installation.
 - i. Activity or event number.

1.5 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

- A. Architect's Digital Data Files: Electronic copies of CAD Drawings will be provided by Architect for Contractor's use in preparing coordination submittals.
1. Architect will furnish Contractor one set of drawing files for use in preparing Shop Drawings and Project record drawings.

2. Architect makes no representations as to the accuracy or completeness of digital data drawing files as they relate to the Contract Drawings.
 3. Digital Drawing Software Program: The Contract Drawings are available in AutoCAD 2004 (.dwg).
 4. Contractor shall execute a data licensing agreement in the form of Agreement included in Project Manual.
 5. The following CAD files will be furnished for each appropriate discipline: AE floor, finish, reflected ceiling and site plans.
- B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.
1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
 2. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are approved by Architect.
 3. Submit action submittals and informational submittals required by the same Specification Section as separate packages under separate transmittals.
 4. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.
 5. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.
- C. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals. Submittals received after 1:00 pm will be considered to have been received the following day.
1. Allow 10 business days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination. Allow 4-week review time for large or complex submittals will require additional review time. The following are examples but not limited to such submittals, Millwork, Curtain Wall, Structural Steel, Doors Frames Hardware (total opening).
 2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
 3. Resubmittal Review: Allow 10 business days for review of each resubmittal.
 4. Sequential Review: Where sequential review of submittals by Architect's consultants, Owner, or other parties is indicated, allow 20 business days for initial review of each submittal.
- D. Identification and Information: Place a permanent label or title block on each copy submittal item for identification.
1. On large format Shop Drawings, Contractor shall stamp each individual page as well as the reviewer's stamp.
 2. Indicate name of firm or entity that prepared each submittal on label or title block.
 3. Provide a space approximately 6 by 8 inches on label or beside title block to record Contractor's review and approval markings and action taken by Architect.
 4. Include the following information for processing and recording action taken:
 - a. Project name.
 - b. Date.
 - c. Name of Architect.
 - d. Name of Contractor.
 - e. Name of subcontractor.
 - f. Name of supplier.
 - g. Name of manufacturer.
 - h. Submittal number or other unique identifier, including revision identifier.
 - 1) Submittal number shall use Specification Section number followed by a decimal point and then a sequential number (e.g., 061000.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., 061000.01.A).
 - i. Number and title of appropriate Specification Section.
 - j. Drawing number and detail references, as appropriate.
 - k. Location(s) where product is to be installed, as appropriate.
 - l. Other necessary identification.
- E. Identification and Information: Identify and incorporate information in each electronic submittal file as follows:
1. Assemble complete submittal package into a single indexed file with links enabling navigation to each item.
 2. Name file with submittal number or other unique identifier, including revision identifier.

- a. For typical projects that do not require separate submittals for different buildings or sub the submittal file name shall use Specification Section number followed by a dash and then a sequential number. Resubmittals shall include a numerical suffix after another dash. Include brief description of submittal after sequential number or resubmittal suffix. (e.g., 061000-001-0 Rough Carpentry).
 - b. For complex projects that require project identifier for separate buildings within a project or require individual submittals to be submitted by multiple subcontractors, the submittal file name shall follow the following. Specification Section number followed by a decimal point and then a sequential number. Resubmittals shall include an alphabetic suffix after another decimal point. Project Identifier should follow in parentheses (e.g., 061000-001-0 (LNHS) Rough Carpentry).
- 3. Provide means for insertion to permanently record Contractor's review and approval markings and action taken by Architect.
- 4. Include the following information on an inserted cover sheet:
 - a. Project name.
 - b. Date.
 - c. Name and address of Architect.
 - d. Name of Contractor.
 - e. Name of firm or entity that prepared submittal.
 - f. Name of subcontractor.
 - g. Name of supplier.
 - h. Name of manufacturer.
 - i. Number and title of appropriate Specification Section.
 - j. Drawing number and detail references, as appropriate.
 - k. Location(s) where product is to be installed, as appropriate.
 - l. Related physical samples submitted directly.
 - m. Other necessary identification.
- 5. Include the following information as keywords in the electronic file metadata:
 - a. Project name.
 - b. Number and title of appropriate Specification Section.
 - c. Manufacturer name.
 - d. Product name.
- F. Options: Identify options requiring selection by the Architect.
- G. Deviations: Identify deviations from the Contract Documents on submittals.
- H. Additional Paper Copies: Unless additional copies are required for final submittal, and unless Architect observes noncompliance with provisions in the Contract Documents, initial submittal may serve as final submittal.
 - a. Submit one copy of submittal to concurrent reviewer in addition to specified number of copies to Architect.
- I. Transmittal: Assemble each submittal individually and appropriately for transmittal and handling. Transmit each submittal using a transmittal form. Architect will return submittals, without review, received from sources other than Contractor.
 - 1. Transmittal Form: Use standard contractor form as approved by Architect Owner.
 - 2. On an attached separate sheet, prepared on Contractor's letterhead, record relevant information, requests for data, revisions other than those requested by Architect on previous submittals, and deviations from requirements in the Contract Documents, including minor variations and limitations. Include same identification information as related submittal.
- J. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.
 - 1. Note date and content of previous submittal.
 - 2. Note date and content of revision in label or title block and clearly indicate extent of revision.
 - 3. Include all submitted information from previous submittal in resubmittal, to form a comprehensive document for Architect's review.
 - 4. Resubmit submittals until they are marked with 'Reviewed', 'Furnish as Corrected' notation from Architect's action stamp, or with approval notation from alternate reviewer
- K. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, and installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.
- L. Use for Construction: Use only final submittals that are marked with 'Reviewed', 'Furnish as Corrected' notation from Architect's action stamp, or with approval notation from alternate reviewer.

PART 2 - PRODUCTS**2.1 SUBMITTAL PROCEDURES**

- A. General Submittal Procedure Requirements: Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.
1. Email or upload electronic submittals as PDF electronic files directly to Architect's Info Exchange Folder (Newforma) specifically established for Project.
 - a. Architect will return annotated file. Annotate and retain one copy of file as an electronic Project record document file.
 2. Action Submittals: For large format drawings and submittals (larger than 11 x 17), submit PDF file plus 2 hard copies. For smaller format drawings and submittals (11x17 or less), provide only PDF file. Architect will return only the marked-up PDF.
 3. Informational Submittals: Submit two paper copies of each submittal, unless otherwise indicated. Architect will not return copies.
 4. Closeout Submittals and Maintenance Material Submittals: Comply with requirements specified in Division 01 Section "Closeout Procedures."
 5. Certificates and Certifications Submittals: Provide a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.
 - a. Provide a digital signature with digital certificate on electronically-submitted certificates and certifications where indicated.
 - b. Provide a notarized statement on original paper copy certificates and certifications where indicated.
 6. Test and Inspection Reports Submittals: Comply with requirements specified in Division 01 Section "Quality Requirements."
- B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.
1. If information must be specially prepared for submittal because standard published data are not suitable for use, submit as Shop Drawings, not as Product Data.
 2. Mark each copy of each submittal to show which products and options are applicable.
 3. Include the following information, as applicable:
 - a. Manufacturer's catalog cuts.
 - b. Manufacturer's product specifications.
 - c. Standard color charts.
 - d. Statement of compliance with specified referenced standards.
 - e. Testing by recognized testing agency.
 - f. Application of testing agency labels and seals.
 - g. Notation of coordination requirements.
 - h. Availability and delivery time information.
 4. For equipment, include the following in addition to the above, as applicable:
 - a. Wiring diagrams showing factory-installed wiring.
 - b. Printed performance curves.
 - c. Operational range diagrams.
 - d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.
 5. Submit Product Data before or concurrent with Samples.
 6. Submit Product Data in the following format:
 - a. PDF electronic file.
- C. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.
1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
 - a. Identification of products.
 - b. Schedules.
 - c. Compliance with specified standards.
 - d. Notation of coordination requirements.
 - e. Notation of dimensions established by field measurement.
 - f. Relationship and attachment to adjoining construction clearly indicated.
 - g. Seal and signature of professional engineer if specified.
 2. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches but no larger than 30 by 42 inches.
 3. Submit Shop Drawings in the following format:

4. For large format drawings and submittals (larger than 11 x 17), submit PDF file plus 2 hard copies. For smaller format drawings and submittals (11x17 or less), provide only PDF file. Architect will return only the marked-up PDF.
- D. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed.
1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
 2. Identification: Attach label on unexposed side of Samples that includes the following:
 - a. Generic description of Sample.
 - b. Product name and name of manufacturer.
 - c. Sample source.
 - d. Number and title of applicable Specification Section.
 3. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.
 - a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.
 - b. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.
 4. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.
 - a. Number of Samples: Submit three full set(s) of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect will return submittal with options selected.
 5. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.
 - a. Number of Samples: Submit sets of Samples. Architect will retain one sample set; remainder will be returned. Mark up and retain one returned Sample set as a Project record sample.
 - 1) Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
 - 2) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least three sets of paired units that show approximate limits of variations.
- E. Product Schedule: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:
1. Type of product. Include unique identifier for each product indicated in the Contract Documents.
 2. Manufacturer and product name, and model number if applicable.
 3. Number and name of room or space.
 4. Location within room or space.
 5. Submit product schedule in the following format:
 - a. PDF electronic file.
- F. Contractor's Construction Schedule: Comply with requirements specified in Division 01 Section "Construction Progress Documentation."
- G. Application for Payment: Comply with requirements specified in Division 01 Section "Payment Procedures."
- H. Schedule of Values: Comply with requirements specified in Division 01 Section "Payment Procedures."
- I. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Use CSI Form 1.5A. Include the following information in tabular form:
1. Name, address, and telephone number of entity performing subcontract or supplying products.
 2. Number and title of related Specification Section(s) covered by subcontract.
 3. Drawing number and detail references, as appropriate, covered by subcontract.
 4. Submit subcontract list in the following format:
 - a. PDF electronic file.

- J. Coordination Drawings: Comply with requirements specified in Division 01 Section "Project Management and Coordination."
 - K. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of architects and owners, and other information specified.
 - L. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification and Procedure Qualification Record on American Welding Society (AWS) forms. Include names of firms and personnel certified.
 - M. Installer Certificates: Submit written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.
 - N. Manufacturer Certificates: Submit written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.
 - O. Product Certificates: Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.
 - P. Material Certificates: Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.
 - Q. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.
 - R. Product Test Reports: Submit written reports indicating current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.
 - S. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:
 1. Name of evaluation organization.
 2. Date of evaluation.
 3. Time period when report is in effect.
 4. Product and manufacturers' names.
 5. Description of product.
 6. Test procedures and results.
 7. Limitations of use.
 - T. Schedule of Tests and Inspections: Comply with requirements specified in Division 01 Section "Quality Requirements."
 - U. Pre-construction Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.
 - V. Compatibility Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.
 - W. Field Test Reports: Submit reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.
 - X. Maintenance Data: Comply with requirements specified in Division 01 Section "Operation and Maintenance Data."
 - Y. Design Data: Prepare and submit written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.
- 2.2 DELEGATED-DESIGN SERVICES
- A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.
 1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect.
 - B. Delegated-Design Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit digitally-signed PDF electronic file and three paper copies of certificate, signed and

sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.

1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.

PART 3 - EXECUTION

3.1 CONTRACTOR'S REVIEW

- A. Action and Informational Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect.
- B. Project Closeout and Maintenance/Material Submittals: Refer to requirements in Division 01 Section "Closeout Procedures."
- C. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

3.2 ARCHITECT'S ACTION

- A. General: Architect will not review submittals that do not bear Contractor's approval stamp and will return them without action.
- B. Action Submittals: Architect will review each submittal, make marks to indicate corrections or modifications required, and return it. Architect will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action, as follows:
 1. Reviewed
 2. Revise and Resubmit
 3. Rejected
 4. Furnish as Corrected
 5. No Action Taken.
- C. Informational Submittals: Architect will review each submittal and will not return it, or will return it if it does not comply with requirements. Architect will forward each submittal to appropriate party.
- D. Partial submittals prepared for a portion of the Work will be reviewed when use of partial submittals has received prior approval from Architect.
- E. Incomplete submittals are not acceptable, will be considered non-responsive, and will be returned without review.
- F. Submittals not required by the Contract Documents may not be reviewed and may be discarded.

END OF SECTION

SECTION 014000**QUALITY REQUIREMENTS****PART 1 - GENERAL**

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for quality assurance and quality control.
- B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.
 - 1. Specific quality-assurance and -control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.
 - 2. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and -control procedures that facilitate compliance with the Contract Document requirements.
 - 3. Requirements for Contractor to provide quality-assurance and -control services required by Architect, Owner, or authorities having jurisdiction are not limited by provisions of this Section.
- C. Related Sections:
 - 1. Divisions 02 through 49 Sections for specific test and inspection requirements.

1.3 DEFINITIONS

- A. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.
- B. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Services do not include contract enforcement activities performed by Architect.
- C. Mockups: Full size physical assemblies that are constructed on-site. Mockups are constructed to verify selections made under sample submittals; to demonstrate aesthetic effects and, where indicated, qualities of materials and execution; to review coordination, testing, or operation; to show interface between dissimilar materials; and to demonstrate compliance with specified installation tolerances. Mockups are not Samples. Unless otherwise indicated, approved mockups establish the standard by which the Work will be judged.
 - 1. Laboratory Mockups: Full-size, physical assemblies constructed at testing facility to verify performance characteristics.
 - 2. Integrated Exterior Mockups: Mockups of the exterior envelope erected separately from the building but on the project site, consisting of multiple products, assemblies and subassemblies.
 - 3. Room Mockups: Mockups of typical interior spaces complete with wall, floor, and ceiling finishes, doors, windows, millwork, casework, specialties, furnishings and equipment, and lighting.
- D. Pre-construction Testing: Tests and inspections performed specifically for the Project before products and materials are incorporated into the Work to verify performance or compliance with specified criteria.
- E. Product Testing: Tests and inspections that are performed by an NRTL, an NVLAP, or a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.
- F. Source Quality-Control Testing: Tests and inspections that are performed at the source, i.e., plant, mill, factory, or shop.
- G. Field Quality-Control Testing: Tests and inspections that are performed on-site for installation of the Work and for completed Work.
- H. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.
- I. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations.
 - 1. Use of trade-specific terminology in referring to a trade or entity does not require that certain construction activities be performed by accredited or unionized individuals, or that requirements specified apply exclusively to specific trade or trades.

- J. Experienced: When used with an entity or individual, "experienced" means having successfully completed a minimum of five previous projects similar in nature, size, and extent to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.
- 1.4 CONFLICTING REQUIREMENTS
- A. Referenced Standards: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer conflicting requirements that are different, but apparently equal, to Architect for a decision before proceeding.
- B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Architect for a decision before proceeding.
- 1.5 ACTION SUBMITTALS
- A. Shop Drawings: For integrated exterior mockups, provide plans, sections, and elevations, indicating materials and size of mockup construction.
1. Indicate manufacturer and model number of individual components.
 2. Provide axonometric drawings for conditions difficult to illustrate in two dimensions.
- 1.6 INFORMATIONAL SUBMITTALS
- A. Contractor's Quality-Control Plan: For quality-assurance and quality-control activities and responsibilities.
- B. Contractor's Quality-Control Manager Qualifications: For supervisory personnel.
- C. Testing Agency Qualifications: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.
- D. Schedule of Tests and Inspections: Prepare in tabular form and include the following:
1. Specification Section number and title.
 2. Entity responsible for performing tests and inspections.
 3. Description of test and inspection.
 4. Identification of applicable standards.
 5. Identification of test and inspection methods.
 6. Number of tests and inspections required.
 7. Time schedule or time span for tests and inspections.
 8. Requirements for obtaining samples.
 9. Unique characteristics of each quality-control service.
- 1.7 CONTRACTOR'S QUALITY-CONTROL PLAN
- A. Quality-Control Plan, General: Submit quality-control plan within 10 days of Notice to Proceed, and not less than five days prior to pre-construction conference. Submit in format acceptable to Architect. Identify personnel, procedures, controls, instructions, tests, records, and forms to be used to carry out Contractor's quality-assurance and quality-control responsibilities. Coordinate with Contractor's construction schedule.
- B. Quality-Control Personnel Qualifications: Engage qualified full-time personnel trained and experienced in managing and executing quality-assurance and quality-control procedures similar in nature and extent to those required for Project.
1. Project quality-control manager may also serve as Project superintendent.
- C. Submittal Procedure: Describe procedures for ensuring compliance with requirements through review and management of submittal process. Indicate qualifications of personnel responsible for submittal review.
- D. Testing and Inspection: Include in quality-control plan a comprehensive schedule of Work requiring testing or inspection, including the following:
1. Contractor-performed tests and inspections including subcontractor-performed tests and inspections. Include required tests and inspections and Contractor-elected tests and inspections.
 2. Special inspections required by authorities having jurisdiction and indicated on the "Statement of Special Inspections."
 3. Owner-performed tests and inspections indicated in the Contract Documents [, including tests and inspections indicated to be performed by the Commissioning Authority].
- E. Continuous Inspection of Workmanship: Describe process for continuous inspection during construction to identify and correct deficiencies in workmanship in addition to testing and inspection specified. Indicate types of corrective actions to be required to bring work into compliance with standards of workmanship established by Contract requirements and approved mockups.
- F. Monitoring and Documentation: Maintain testing and inspection reports including log of approved and

rejected results. Include work Architect has indicated as nonconforming or defective. Indicate corrective actions taken to bring nonconforming work into compliance with requirements. Comply with requirements of authorities having jurisdiction.

1.8 REPORTS AND DOCUMENTS

- A. Test and Inspection Reports: Prepare and submit certified written reports specified in other Sections. Include the following:
1. Date of issue.
 2. Project title and number.
 3. Name, address, and telephone number of testing agency.
 4. Dates and locations of samples and tests or inspections.
 5. Names of individuals making tests and inspections.
 6. Description of the Work and test and inspection method.
 7. Identification of product and Specification Section.
 8. Complete test or inspection data.
 9. Test and inspection results and an interpretation of test results.
 10. Record of temperature and weather conditions at time of sample taking and testing and inspecting.
 11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
 12. Name and signature of laboratory inspector.
 13. Recommendations on retesting and re-inspecting.
- B. Manufacturer's Technical Representative's Field Reports: Prepare written information documenting manufacturer's technical representative's tests and inspections specified in other Sections. Include the following:
1. Name, address, and telephone number of technical representative making report.
 2. Statement on condition of substrates and their acceptability for installation of product.
 3. Statement that products at Project site comply with requirements.
 4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
 5. Results of operational and other tests and a statement of whether observed performance complies with requirements.
 6. Statement whether conditions, products, and installation will affect warranty.
 7. Other required items indicated in individual Specification Sections.
- C. Factory-Authorized Service Representative's Reports: Prepare written information documenting manufacturer's factory-authorized service representative's tests and inspections specified in other Sections. Include the following:
1. Name, address, and telephone number of factory-authorized service representative making report.
 2. Statement that equipment complies with requirements.
 3. Results of operational and other tests and a statement of whether observed performance complies with requirements.
 4. Statement whether conditions, products, and installation will affect warranty.
 5. Other required items indicated in individual Specification Sections.
- D. Permits, Licenses, and Certificates: For Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.

1.9 QUALITY ASSURANCE

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

- F. Specialists: Certain Specification Sections require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged for the activities indicated.
 - 1. Requirements of authorities having jurisdiction shall supersede requirements for specialists.
 - G. Testing Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, as documented according to ASTM E 329; and with additional qualifications specified in individual Sections; and where required by authorities having jurisdiction, that is acceptable to authorities.
 - 1. NRTL: A nationally recognized testing laboratory according to 29 CFR 1910.7.
 - 2. NVLAP: A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.
 - H. Manufacturer's Technical Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to observe and inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.
 - I. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.
 - J. Pre-construction Testing: Where testing agency is indicated to perform pre-construction 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; 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.
 - K. Mockups: Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:
 - 1. Build mockups in location and of size indicated or, if not indicated, as directed by Architect.
 - 2. Notify Architect 7 days in advance of dates and times when mockups will be constructed.
 - 3. Employ supervisory personnel who will oversee mockup construction. Employ workers that will be employed during the construction at the Project.
 - 4. Demonstrate the proposed range of aesthetic effects and workmanship.
 - 5. Obtain Architect's approval of mockups before starting work, fabrication, or construction.
 - a. Allow seven days for initial review and each re-review of each mockup.
 - 6. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
 - 7. Demolish and remove mockups when directed, unless otherwise indicated.
 - L. Integrated Exterior Mockups: Construct integrated exterior mockup in accordance with approved Shop Drawings. Coordinate installation of exterior envelope materials and products for which mockups are required in individual specification sections, along with supporting materials.
 - M. Room Mockups: Construct room mockups incorporating required materials and assemblies, finished in accordance with requirements. Provide required lighting and additional lighting where required to enable Architect to evaluate quality of the Work. Provide room mockups of the following rooms:
 - 1. [Insert room name or description].
 - N. Laboratory Mockups: Comply with requirements of pre-construction testing and those specified in individual Specification Sections in Divisions 02 through 49.
- 1.10 QUALITY CONTROL
- A. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.
 - 1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspecting they are engaged to perform.

2. Costs for retesting and re-inspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to Contractor, and the Contract Sum will be adjusted by Change Order.
 - B. Contractor Responsibilities: Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Perform additional quality-control activities required to verify that the Work complies with requirements, whether specified or not.
 1. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.
 2. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform these quality-control services.
 - a. Contractor shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.
 3. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspecting will be performed.
 4. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
 5. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
 6. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.
 - C. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Division 01 Section "Submittal Procedures."
 - D. Manufacturer's Technical Services: Where indicated, engage a manufacturer's technical representative to observe and inspect the Work. Manufacturer's technical representative's services include participation in pre-installation conferences, examination of substrates and conditions, verification of materials, observation of Installer activities, inspection of completed portions of the Work, and submittal of written reports.
 - E. Re-testing/Re-inspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and re-inspecting, for construction that replaced Work that failed to comply with the Contract Documents.
 - F. 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 approve or accept any portion of the Work.
 6. Do not perform any duties of Contractor.
 - G. Associated Services: Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:
 1. Access to the Work.
 2. Incidental labor and facilities necessary to facilitate tests and inspections.
 3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
 4. Facilities for storage and field curing of test samples.
 5. Delivery of samples to testing agencies.
 6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
 7. Security and protection for samples and for testing and inspecting equipment at Project site.
 - H. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and -control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.
 1. Schedule times for tests, inspections, obtaining samples, and similar activities.
- 1.11 SPECIAL TESTS AND INSPECTIONS
- A. Special Tests and Inspections: Conducted by a qualified testing agency as required by authorities having

jurisdiction, as indicated in individual Specification Sections, and as follows:

1. Verifying that manufacturer maintains detailed fabrication and quality-control procedures and reviewing the completeness and adequacy of those procedures to perform the Work.
2. Notifying Architect and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.
3. Submitting a certified written report of each test, inspection, and similar quality-control service to Architect with copy to Contractor and to authorities having jurisdiction.
4. Submitting a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.
5. Interpreting tests and inspections and stating in each report whether tested and inspected work complies with or deviates from the Contract Documents.
6. Retesting and re-inspecting corrected work.

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 or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible. Comply with the Contract Document requirements for cutting and patching in Division 01 Section "Execution."
- B. Protect construction exposed by or for quality-control service activities.
- C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION

SECTION 014200**REFERENCES****PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

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

1.2 DEFINITIONS

- A. General: Basic Contract definitions are included in the Conditions of the Contract.
- B. "Approved": When used to convey Architect's action on Contractor's submittals, applications, and requests, "approved" is limited to Architect's duties and responsibilities as stated in the Conditions of the Contract.
- C. "Directed": A command or instruction by Architect. Other terms including "requested," "authorized," "selected," "required," and "permitted" have the same meaning as "directed."
- D. "Indicated": Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including "shown," "noted," "scheduled," and "specified" have the same meaning as "indicated."
- E. "Regulations": Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.
- F. "Furnish": Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.
- G. "Install": Operations at Project site including unloading, temporarily storing, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.
- H. "Provide": Furnish and install, complete and ready for the intended use.
- I. "Project Site": Space available for performing construction activities. The extent of Project site is shown on Drawings and may or may not be identical with the description of the land on which Project is to be built.

1.3 INDUSTRY STANDARDS

- A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.
- B. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.
- C. Copies of Standards: Each entity engaged in construction on Project should be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.
 - 1. Where copies of standards are needed to perform a required construction activity, obtain copies directly from publication source.

1.4 ABBREVIATIONS AND ACRONYMS

- A. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities indicated in Gale's "Encyclopedia of Associations" or in Columbia Books' "National Trade & Professional Associations of the United States."

END OF SECTION

SECTION 015300**MOLD PREVENTION MEASURES****PART 1 - GENERAL**

- 1.1 RELATED DOCUMENTS
- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.
- 1.2 SUMMARY
- A. Section includes: Administrative and procedural requirements to help prevent mold contamination in construction.
- 1.3 SUBMITTALS
- A. Reports: Submit reports required in this Section, including but not limited to the following:
1. Sightings of existing mold.
 2. Window and storefront testing.
 3. Moisture contents of materials.
 4. Exterior sealant cracks, damage, and deterioration.
- 1.4 QUALITY ASSURANCE
- A. Pre-construction Meeting: Review requirements of this Section at Pre-construction Meeting.
- 1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING
- A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft. Comply with manufacturer's written instructions.
- B. Do not bring finish materials into building until building is in a conditioned state. Protect finish materials stored within building. Stage materials off the floor and cover with waterproof covering. Examples of these materials include, but are not limited to, insulation, gypsum products, wall coverings, carpet, ceiling tile, wood products, etc.
- C. Remove from Project site damaged materials or materials that have become wet. Do not install such materials.
- 1.6 PROJECT CONDITIONS
- A. Perform daily visual inspections of existing building for existing mold. Report sightings of mold to Architect.
- B. Remove water found within building during construction immediately.
1. Energize lift stations and sump pumps as early in Project as possible. Use temporary pumps if necessary to get water out of building and drain lines.
- C. Ventilation:
1. Verify that existing HVAC system is providing positive pressure in building.
 2. Provide adequate air circulation and ventilation during demolition phase(s).
 3. Seal off return air ducts and diffusers to prevent construction dust and moisture from entering occupied areas and HVAC system.
 4. Provide temporary outside air ventilation as building becomes enclosed.
- D. Maintain clean project site, free from hazards, garbage, and debris.
- E. Eating, drinking, and smoking are not permitted within building.
- F. Slope perimeter grades, both temporary and final grades, away from building structure.
- G. Verify that condensate pans drain properly beginning with initial installation.
- H. Flash roof penetrations immediately. Do not allow water to penetrate to floor below.
- I. Seal window openings prior to window installation with plastic to prevent moisture entry.
- J. Sprayed-on Fireproofing: Keep air moving throughout building when using sprayed-on fireproofing.
- K. Cover stored and installed ductwork and installed duct openings with plastic to prevent dust, debris, and moisture from entering ductwork. Repair damaged plastic barrier.
- L. Do not operate air handling equipment below 60 degrees F supply air temperature until building is 100 percent enclosed.
- M. Monitor humidity and temperature for conformance to installation requirements defined by material and equipment manufacturers.
- N. Check moisture content of gypsum board prior to applying finishes. Record findings.

PART 2 - PRODUCTS (Not Used)**PART 3 - EXECUTION**3.1 **INSTALLATION**

- A. Roof Drains: Connect roof drains to risers and storm drainage lines as soon as possible.
- B. Floor Drains: Connect floor drains as soon as possible. Do not cover floor drains with tape or other obstructions during construction. Clean out floor drain lines to mains prior to Substantial Completion.
- C. Wall Assemblies:
 - 1. Install exterior wall insulation, vapor retarder, and gypsum board only after building is enclosed.
 - 2. Keep bottom of installed gypsum board off floor 1/2 inch.
- D. Cavity Conditions: Clean and inspect cavity conditions prior to covering, sealing, or restricting access. Vacuum clean cavity spaces prior to covering or enclosing.
- E. Sprayed-On Fireproofing: Remove sprayed-on fireproofing overspray immediately.
- F. Plumbing: Pressure test plumbing piping identified as insulated on Project prior to installation of insulation.
- G. Roof Mounted Equipment: Inspect rooftop units and other roof-mounted equipment for signs of rain leaks immediately after first rain. Water test with hose immediately after installation. Seal leaks immediately.
- H. Windows and Storefront: Water test windows to manufacturer's and Project Manual's specifications. Record findings and forward to Architect.
- I. Sealants: Inspect exterior sealants for cracks, damage, or deterioration. Record findings and forward to Architect.
- J. HVAC Equipment (Permanent HVAC Equipment Used for Temporary Conditioning of Building During Construction Phases): Change filters and clean ductwork interior to remove dirt, dust, debris, and moisture buildup prior to turning Project over to Owner.

3.2 **ADJUSTING**

- A. Remove damaged materials or materials that have become wet. Replace with new materials.

3.3 **DEMONSTRATION**

- A. Train and educate Owner's maintenance personnel on use of building systems. Explain how improper operation and shutting down systems during off periods can create mold problems.
- B. Schedule with Owner a review of building for mold problems at 1 year warranty walk-through. Inspect exterior sealants and masonry joints for cracks and other damage or deterioration where water can penetrate building envelope.
- C. Explain to Owner the need for Owner to establish annual building review for mold.

END OF SECTION

SECTION 016000**PRODUCT REQUIREMENTS****PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

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

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; and comparable products.

1.3 DEFINITIONS

- A. Products: Items obtained for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.
 - 1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature, that is current as of date of the Contract Documents.
 - 2. New Products: Items that have not previously been incorporated into another project or facility. Products salvaged from other projects are not considered new products.
 - 3. Comparable Product: Product that is demonstrated and approved through submittal process to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.
- B. Basis-of-Design Product Specification: A specification in which a specific manufacturer's product is named and accompanied by the words "basis-of-design product," including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of additional manufacturers named in the specification.

1.4 ACTION SUBMITTALS

- A. Comparable Product Requests: Submit request for consideration of each comparable product. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
 - 1. Include data to indicate compliance with the requirements specified in "Comparable Products" Article.
 - 2. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within one week of receipt of a comparable product request. Architect will notify Contractor of approval or rejection of proposed comparable product request within 15 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.
 - a. Form of Approval: As specified in Division 01 Section "Submittal Procedures."
 - b. Use product specified if Architect does not issue a decision on use of a comparable product request within time allocated.
- B. Basis-of-Design Product Specification Submittal: Comply with requirements in Division 01 Section "Submittal Procedures." Show compliance with requirements.

1.5 QUALITY ASSURANCE

- A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, select product compatible with products previously selected, even if previously selected products were also options.

1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft and vandalism. Comply with manufacturer's written instructions.
- B. Delivery and Handling:
 - 1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
 - 2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
 - 3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
 - 4. Inspect products on delivery to determine compliance with the Contract Documents and to determine that products are undamaged and properly protected.
- C. Storage:
 - 1. Store products to allow for inspection and measurement of quantity or counting of units.
 - 2. Store materials in a manner that will not endanger Project structure.
 - 3. Store products that are subject to damage by the elements, under cover in a weather-tight enclosure above ground, with ventilation adequate to prevent condensation.
 - 4. Store foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
 - 5. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
 - 6. Protect stored products from damage and liquids from freezing.
 - 7. Provide a secure location and enclosure at Project site for storage of materials and equipment by Owner's construction forces. Coordinate location with Owner.

1.7 PRODUCT WARRANTIES

- A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.
 - 1. Manufacturer's Warranty: Written warranty furnished by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.
 - 2. Special Warranty: Written warranty required by the Contract Documents to provide specific rights for Owner.
- B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution.
 - 1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
 - 2. Specified Form: When specified forms are included with the Specifications, prepare a written document using indicated form properly executed.
 - 3. Refer to Divisions 02 through 49. Sections for specific content requirements and particular requirements for submitting special warranties.
- C. Submittal Time: Comply with requirements in Division 01 Section "Closeout Procedures."

PART 2 - PRODUCTS**2.1 PRODUCT SELECTION PROCEDURES**

- A. General Product Requirements: Provide products that comply with the Contract Documents, are undamaged and, unless otherwise indicated, are new at time of installation.
 - 1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
 - 2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
 - 3. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
 - 4. Where products are accompanied by the term "as selected," Architect will make selection.
 - 5. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.
 - 6. Or Equal: For products specified by name and accompanied by the term "or equal," or "or approved equal," or "or approved," comply with requirements in "Comparable Products" Article to obtain approval for use of an unnamed product.

7. Where all other criteria are met, contractor shall give preference to products that:
 - a. Are extracted, harvested and/or manufactured closer to the project location.
 - b. Have longer warranted life span under normal use.
 - c. Result in less construction waste
 - d. Have recycled content
 8. Do not use the following products:
 - a. Products containing CFCs or HCFCs.
 - b. Composite wood products containing added urea formaldehyde.
 - c. Wood products harvested from old growth timber.
 - d. Paints, coatings, adhesives and sealants for use on the building interior that do not comply with LEED NC 2009 EQc4.1 and 4.2 requirements. See Section 01-61-16.
- B. Product Selection Procedures:
1. Product: Where Specifications name a single manufacturer and product, provide the named product that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
 2. Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
 3. Products:
 - a. Restricted List: Where Specifications include a list of names of both manufacturers and products, provide one of the products listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will be considered, unless otherwise indicated.
 - b. Non-restricted List: Where Specifications include a list of names of both available manufacturers and products, provide one of the products listed, or an unnamed product, that complies with requirements. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product.
 4. Manufacturers:
 - a. Restricted List: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will be considered, unless otherwise indicated.
 - b. Non-restricted List: Where Specifications include a list of available manufacturers, provide a product by one of the manufacturers listed, or a product by an unnamed manufacturer, that complies with requirements. Comply with requirements in "Comparable Products" Article for consideration of an unnamed manufacturer's product.
 5. Basis-of-Design Product: Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product by one of the other named manufacturers.
- C. Visual Matching Specification: Where Specifications require "match Architect's sample", provide a product that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches.
1. If no product available within specified category matches and complies with other specified requirements, comply with requirements in Division 01 Section "Substitution Procedures" for proposal of product.
- D. Visual Selection Specification: Where Specifications include the phrase "as selected by Architect from manufacturer's full range" or similar phrase, select a product that complies with requirements. Architect will select color, gloss, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.
- 2.2 COMPARABLE PRODUCTS
- A. Conditions for Consideration: Architect will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Architect may return requests without action, except to record noncompliance with these requirements:
1. Evidence that the proposed product does not require revisions to the Contract Documents, that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.
 2. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability,

- LEED requirements, visual effect, and specific features and requirements indicated.
3. Evidence that proposed product provides specified warranty.
 4. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners, if requested.
 5. Samples, if requested.

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 017300**EXECUTION****PART 1 - GENERAL**

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes general administrative and procedural requirements governing execution of the Work including, but not limited to, the following:

1. Construction layout.
2. Field engineering and surveying.
3. Installation of the Work.
4. Cutting and patching.
5. Coordination of Owner-installed products.
6. Progress cleaning.
7. Starting and adjusting.
8. Protection of installed construction.
9. Correction of the Work.

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 construction to original conditions after installation of other work.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For land surveyor.
- B. Certificates: Submit certificate signed by land surveyor certifying that location and elevation of improvements comply with requirements.
- C. Certified Surveys: Submit two copies signed by land surveyor.
- D. Final Property Survey: Submit 10 copies showing the Work performed and record survey data.

1.5 QUALITY ASSURANCE

- A. Land Surveyor Qualifications: A professional land surveyor who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing land-surveying services of the kind indicated.
- B. Cutting and Patching: Comply with requirements for and limitations on cutting and patching of construction elements.
 1. Structural Elements: When cutting and patching structural elements, notify Architect of locations and details of cutting and await directions from the Architect before proceeding. Shore, brace, and support structural element during cutting and patching. Do not cut and patch structural elements in a manner that could change their load-carrying capacity or increase deflection
 - a. [Insert list of structural elements].
 2. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety. Operational elements include the following:
 - a. Primary operational systems and equipment.
 - b. Fire separation assemblies.
 - c. Air or smoke barriers.
 - d. Fire-suppression systems.
 - e. Mechanical systems piping and ducts.
 - f. Control systems.
 - g. Communication systems.
 - h. Conveying systems.
 - i. Electrical wiring systems.
 - j. Operating systems of special construction.
 - k. [Insert operating system].

3. Other Construction Elements: Do not cut and patch other construction elements or components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety. Other construction elements include but are not limited to the following:
 - a. Water, moisture, or vapor barriers.
 - b. Membranes and flashings.
 - c. Exterior curtain-wall construction.
 - d. Equipment supports.
 - e. Piping, ductwork, vessels, and equipment.
 - f. Noise- and vibration-control elements and systems.
 - g. [Insert miscellaneous element].
 4. Visual Elements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch exposed construction in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.
- C. Cutting and Patching Conference: Before proceeding, meet at Project site with parties involved in cutting and patching, including mechanical and electrical trades. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.
- D. Manufacturer's Installation Instructions: Obtain and maintain on-site manufacturer's written recommendations and instructions for installation of products and equipment.
- 1.6 WARRANTY
- A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during installation or cutting and patching operations, by methods and with materials so as not to void existing warranties.

PART 2 - PRODUCTS

- 2.1 MATERIALS
- A. General: Comply with requirements specified in other Sections.
1. For projects requiring compliance with sustainable design and construction practices and procedures, utilize products for patching that comply with requirements of Division 01 Section "Sustainable Design Requirements."
- B. In-Place Materials: Use materials for patching identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.
1. If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to the Architect for the visual and functional performance of in-place materials.

PART 3 - EXECUTION

- 3.1 EXAMINATION
- A. Existing Conditions: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities,[mechanical and electrical systems,] and other construction affecting the Work.
1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping; underground electrical services, and other utilities.
 2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.
- B. Examination and Acceptance of Conditions: Before proceeding with each component of the Work, examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.
1. Written Report: Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:
 - a. Description of the Work.
 - b. List of detrimental conditions, including substrates.
 - c. List of unacceptable installation tolerances.
 - d. Recommended corrections.
 2. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.

3. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
4. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
5. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Existing Utility Information: Furnish information to [local utility] [Owner] that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.
- B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
- C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.
- D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents caused by differing field conditions outside the control of the Contractor, submit a request for information to Architect according to requirements in Division 01 Section "Project Management and Coordination."

3.3 CONSTRUCTION LAYOUT

- A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks. If discrepancies are discovered, notify Architect promptly.
- B. General: Engage a land surveyor to lay out the Work using accepted surveying practices.
 1. Establish benchmarks and control points to set lines and levels at each story of construction and elsewhere as needed to locate each element of Project.
 2. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
 3. Inform installers of lines and levels to which they must comply.
 4. Check the location, level and plumb, of every major element as the Work progresses.
 5. Notify Architect when deviations from required lines and levels exceed allowable tolerances.
 6. Close site surveys with an error of closure equal to or less than the standard established by authorities having jurisdiction.
- C. Site Improvements: Locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and rim and invert elevations.
- D. Building Lines and Levels: Locate and lay out control lines and levels for structures, building foundations, column grids, and floor levels, including those required for mechanical and electrical work. Transfer survey markings and elevations for use with control lines and levels. Level foundations and piers from two or more locations.
- E. Record Log: Maintain a log of layout control work. Record deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used. Make the log available for reference by Architect.

3.4 FIELD ENGINEERING

- A. Identification: Owner will identify existing benchmarks, control points, and property corners.
- B. Reference Points: Locate existing permanent benchmarks, control points, and similar reference points before beginning the Work. Preserve and protect permanent benchmarks and control points during construction operations.
 1. Do not change or relocate existing benchmarks or control points without prior written approval of Architect. Report lost or destroyed permanent benchmarks or control points promptly. Report the need to relocate permanent benchmarks or control points to Architect before proceeding.
 2. Replace lost or destroyed permanent benchmarks and control points promptly. Base replacements on the original survey control points.
- C. Benchmarks: Establish and maintain a minimum of two permanent benchmarks on Project site, referenced to data established by survey control points. Comply with authorities having jurisdiction for type and size of benchmark.
 1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.
 2. Where the actual location or elevation of layout points cannot be marked, provide temporary

- reference points sufficient to locate the Work.
- 3. Remove temporary reference points when no longer needed. Restore marked construction to its original condition.
- D. Certified Survey: On completion of foundation walls, major site improvements, and other work requiring field-engineering services, prepare a certified survey showing dimensions, locations, angles, and elevations of construction and sitework.
- E. Final Property Survey: Engage a land surveyor to prepare a final property survey showing significant features (real property) for Project. Include on the survey a certification, signed by land surveyor, that principal metes, bounds, lines, and levels of Project are accurately positioned as shown on the survey.
 - 1. Show boundary lines, monuments, streets, site improvements and utilities, existing improvements and significant vegetation, adjoining properties, acreage, grade contours, and the distance and bearing from a site corner to a legal point.
 - 2. Recording: At Substantial Completion, have the final property survey recorded by or with authorities having jurisdiction as the official "property survey."

3.5 INSTALLATION

- A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.
 - 1. Make vertical work plumb and make horizontal work level.
 - 2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
 - 3. Conceal pipes, ducts, and wiring in finished areas, unless otherwise indicated.
- B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.
- C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.
- D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.
- E. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.
- F. Templates: Obtain and distribute to the parties involved templates for work specified to be factory prepared and field installed. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.
- G. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions.
 - 1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
 - 2. Allow for building movement, including thermal expansion and contraction.
 - 3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.
- H. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.
- I. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

3.6 CUTTING AND PATCHING

- A. Cutting and Patching, General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.
 - 1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.
- B. Temporary Support: Provide temporary support of work to be cut.
- C. 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.
- D. Adjacent Occupied Areas: Where interference with use of adjoining areas or interruption of free passage to adjoining areas is unavoidable, coordinate cutting and patching in accordance with requirements of Division 01 Section "Summary."
- E. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to [minimize]

- [prevent] interruption to occupied areas.
- F. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.
1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots neatly to minimum size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
 2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
 3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
 4. Excavating and Backfilling: Comply with requirements in applicable Division 31 Sections where required by cutting and patching operations.
 5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
 6. Proceed with patching after construction operations requiring cutting are complete.
- G. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other work. Patch with durable seams that are as invisible as practicable. Provide materials and comply with installation requirements specified in other Sections, where applicable.
1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate physical integrity of installation.
 2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will minimize evidence of patching and refinishing.
 - a. Clean piping, conduit, and similar features before applying paint or other finishing materials.
 - b. Restore damaged pipe covering to its original condition.
 3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
 - a. Where patching occurs in a painted surface, prepare substrate and apply primer and intermediate paint coats appropriate for substrate over the patch, and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.
 4. Ceilings: Patch, repair, or re-hang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
 5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weather-tight condition.
- H. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.
- 3.7 OWNER-INSTALLED PRODUCTS
- A. Site Access: Provide access to Project site for Owner's construction personnel.
- B. Coordination: Coordinate construction and operations of the Work with work performed by Owner's construction personnel.
1. Construction Schedule: Inform Owner of Contractor's preferred construction schedule for Owner's portion of the Work. Adjust construction schedule based on a mutually agreeable timetable. Notify Owner if changes to schedule are required due to differences in actual construction progress.
 2. Pre-installation Conferences: Include Owner's construction personnel at pre-installation conferences covering portions of the Work that are to receive Owner's work. Attend pre-installation conferences conducted by Owner's construction personnel if portions of the Work depend on Owner's construction.
- 3.8 PROGRESS CLEANING
- A. General: Clean Project site and work areas daily, including common areas. Enforce requirements strictly. Dispose of materials lawfully.
1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
 2. Do not hold waste materials more than seven days during normal weather or three days if the temperature is expected to rise above 80 deg F.
 3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.
 - a. Utilize containers intended for holding waste materials of type to be stored.

4. Coordinate progress cleaning for joint-use areas where more than one installer has worked.
 - B. Site: Maintain Project site free of waste materials and debris.
 - C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.
 1. Remove liquid spills promptly.
 2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.
 - D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.
 - E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.
 - F. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.
 - G. Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways. Comply with waste disposal requirements in Division 01 Section "Temporary Facilities and Controls." Division 01 Section "Construction Waste Management and Disposal."
 - H. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.
 - I. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.
 - J. Limiting Exposures: Supervise construction operations to assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.
- 3.9 STARTING AND ADJUSTING
- A. Coordinate startup and adjusting of equipment and operating components with requirements in Division 01 Section "General Commissioning Requirements."
 - B. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.
 - C. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.
 - D. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 - E. Manufacturer's Field Service: Comply with qualification requirements in Division 01 Section "Quality Requirements."
- 3.10 PROTECTION OF INSTALLED CONSTRUCTION
- A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.
 - B. Comply with manufacturer's written instructions for temperature and relative humidity.
- 3.11 CORRECTION OF THE WORK
- A. Repair or remove and replace defective construction. Restore damaged substrates and finishes.
 1. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment.
 - B. Restore permanent facilities used during construction to their specified condition.
 - C. Remove and replace damaged surfaces that are exposed to view if surfaces cannot be repaired without visible evidence of repair.
 - D. Repair components that do not operate properly. Remove and replace operating components that cannot be repaired.
 - E. Remove and replace chipped, scratched, and broken glass or reflective surfaces.

END OF SECTION

SECTION 017700**CLOSEOUT PROCEDURES****PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

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

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:
1. Substantial Completion procedures.
 2. Final completion procedures.
 3. Warranties.
 4. Final cleaning.

1.3 SUBSTANTIAL COMPLETION

- A. Preliminary Procedures: Before requesting inspection for determining date of Substantial Completion, complete the following. List items below that are incomplete with request.
1. Prepare a list of items to be completed and corrected (punch list), the value of items on the list, and reasons why the Work is not complete.
 2. Advise Owner of pending insurance changeover requirements.
 3. Submit specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
 4. Obtain and submit releases permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
 5. Prepare and submit Project Record Documents, operation and maintenance manuals, final completion construction photographic documentation, damage or settlement surveys, property surveys, and similar final record information.
 6. Deliver tools, spare parts, extra materials, and similar items to location designated by Owner. Label with manufacturer's name and model number where applicable.
 7. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
 8. Complete startup testing of systems.
 9. Submit test/adjust/balance records.
 10. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
 11. Advise Owner of changeover in heat and other utilities.
 12. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.
 13. Complete final cleaning requirements, including touchup painting.
 14. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.
- B. Inspection: Submit a written request for inspection for Substantial Completion. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.
1. Re-inspection: Request re-inspection when the Work identified in previous inspections as incomplete is completed or corrected.
 2. Results of completed inspection will form the basis of requirements for final completion.

1.4 FINAL COMPLETION

- A. Preliminary Procedures: Before requesting final inspection for determining final completion, complete the following:
1. Submit a final Application for Payment according to Division 01 Section "Payment Procedures."
 2. Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. The certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
 3. Submit evidence of final, continuing insurance coverage complying with insurance requirements.

4. Submit pest-control final inspection report and warranty.
 5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems.
- B. Inspection: Submit a written request for final inspection for acceptance. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.
1. Re-inspection: Request re-inspection when the Work identified in previous inspections as incomplete is completed or corrected. Include cost for re-inspection based on incomplete work of the Contractor.
- 1.5 LIST OF INCOMPLETE ITEMS (PUNCH LIST)
- A. Organization of List: Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction. Use CSI Form 14.1A attached or form provide by Contractor and approved by Architect.
1. Organize list of spaces in sequential order, starting with exterior areas first.
 2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
 3. Include the following information at the top of each page:
 - a. Project name.
 - b. Date.
 - c. Name of Architect.
 - d. Name of Contractor.
 - e. Page number.
 4. Submit list of incomplete items in the following format:
 - a. PDF electronic file.
 - b. [Insert number] paper copies of product schedule or list, unless otherwise indicated. Architect will return [two] copies.
- 1.6 WARRANTIES
- A. Submittal Time: Submit written warranties on request of Architect for designated portions of the Work where commencement of warranties other than date of Substantial Completion is indicated.
- B. Partial Occupancy: Submit properly executed warranties within 15 days of completion of designated portions of the Work that are completed and occupied or used by Owner during construction period by separate agreement with Contractor.
- C. Organize warranty documents into an orderly sequence based on the table of contents of the Project Manual.
1. Bind warranties and bonds in heavy-duty, three-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch paper.
 2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
 3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.
 4. Scan warranties and bonds and assemble complete warranty and bond submittal package into a single indexed electronic PDF file with links enabling navigation to each item. Provide table of contents at beginning of document.
- D. Provide additional copies of each warranty to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.
1. Use cleaning products that meet Green Seal GS-37, or if GS-37 is not applicable, use products that comply with the California Code of Regulations maximum allowable VOC levels.

PART 3 - EXECUTION

3.1 FINAL CLEANING

- A. General: Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.
- B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.
 - 1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a portion of Project:
 - a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
 - b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
 - c. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
 - d. Remove tools, construction equipment, machinery, and surplus material from Project site.
 - e. Remove snow and ice to provide safe access to building.
 - f. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
 - g. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
 - h. Sweep concrete floors broom clean in unoccupied spaces.
 - i. Vacuum carpet and similar soft surfaces, removing debris and excess nap; shampoo if visible soil or stains remain.
 - j. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials. Polish mirrors and glass, taking care not to scratch surfaces.
 - k. Remove labels that are not permanent.
 - l. Touch up and otherwise repair and restore marred, exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily repaired or restored or that already show evidence of repair or restoration.
 - 1) Do not paint over "UL" and other required labels and identification, including mechanical and electrical nameplates.
 - m. Wipe surfaces of mechanical and electrical equipment, elevator equipment, and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
 - n. Replace parts subject to operating conditions during construction that may impede operation or reduce longevity.
 - o. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
 - p. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
 - q. Clean ducts, blowers, and coils if units were operated without filters during construction or that display contamination with particulate matter upon inspection.
 - 1) Clean HVAC system in compliance with NADCA Standard 1992-01. Provide written report upon completion of cleaning.
 - r. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency. Replace burned-out bulbs, and those noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.
 - s. Leave Project clean and ready for occupancy.
- C. Pest Control: Engage an experienced, licensed exterminator to make a final inspection and rid Project of rodents, insects, and other pests. Prepare a report.
- D. [Construction Waste Disposal: Comply with waste disposal requirements in Division 01 Section "Construction Waste Management and Disposal."]

END OF SECTION



Project: _____

To (Contractor): _____

From (A/E): _____
Site Visit Date: _____
A/E Project Number: _____
Contract For: _____

The following items require the attention of the Contractor for completion or correction. This list may not be all-inclusive, and the failure to include any items on this list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents.

Item Number	Room Number	Location (Area)	Description	Correction/Completion Date	Verification A/E Check
-------------	-------------	-----------------	-------------	----------------------------	------------------------

Attachments

Signed by: _____ Date: _____

Copies: Owner Consultants _____ _____ _____ _____ _____ _____ _____ File

SECTION 017823**OPERATION AND MAINTENANCE DATA****PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

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

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:
 - 1. Operation and maintenance documentation directory.
 - 2. Emergency manuals.
 - 3. Operation manuals for systems, subsystems, and equipment.
 - 4. Product maintenance manuals.
 - 5. Systems and equipment maintenance manuals.

1.3 DEFINITIONS

- A. System: An organized collection of parts, equipment, or subsystems united by regular interaction.
- B. Subsystem: A portion of a system with characteristics similar to a system.

1.4 CLOSEOUT SUBMITTALS

- A. Manual Content: Operations and maintenance manual content is specified in individual specification sections to be reviewed at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.
 - 1. Where applicable, clarify and update reviewed manual content to correspond to modifications and field conditions.
- B. Format: Submit operations and maintenance manuals in the following format:
 - 1. PDF electronic file. Assemble each manual into a composite electronically-indexed file. Submit on digital media acceptable to Architect.
 - a. Name each indexed document file in composite electronic index with applicable item name. Include a complete electronically-linked operation and maintenance directory.
 - b. Enable inserted reviewer comments on draft submittals.
 - 2. One paper copy. Include a complete operation and maintenance directory. Enclose title pages and directories in clear plastic sleeves. Architect will return.
- C. Initial Manual Submittal: Submit draft copy of each manual at least 30 days before commencing demonstration and training. Architect [and Commissioning Agent] will comment on whether general scope and content of manual are acceptable.
- D. Final Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion and at least 15 days before commencing demonstration and training. Architect [and Commissioning Agent] will return copy with comments.
 - 1. Correct or modify each manual to comply with Architect's [and Commissioning Agent's] comments. Submit copies of each corrected manual within 15 days of receipt of Architect's [and Commissioning Agent's] comments and prior to commencing demonstration and training.

PART 2 - PRODUCTS**2.1 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY**

- A. Organization: Include a section in the directory for each of the following:
 - 1. List of documents.
 - 2. List of systems.
 - 3. List of equipment.
 - 4. Table of contents.
- B. List of Systems and Subsystems: List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.
- C. List of Equipment: List equipment for each system, organized alphabetically by system. For pieces of equipment not part of system, list alphabetically in separate list.
- D. Tables of Contents: Include a table of contents for each emergency, operation, and maintenance manual.

- E. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with same designation used in the Contract Documents. If no designation exists, assign a designation according to ASHRAE Guideline 4, "Preparation of Operating and Maintenance Documentation for Building Systems."
- 2.2 REQUIREMENTS FOR EMERGENCY, OPERATION, AND MAINTENANCE MANUALS
- A. Organization: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:
1. Title page.
 2. Table of contents.
 3. Manual contents.
- B. Title Page: Include the following information:
1. Subject matter included in manual.
 2. Name and address of Project.
 3. Name and address of Owner.
 4. Date of submittal.
 5. Name and contact information for Contractor.
 6. Name and contact information for Construction Manager.
 7. Name and contact information for Architect.
 8. Name and contact information for Commissioning Agent.
 9. Names and contact information for major consultants to the Architect that designed the systems contained in the manuals.
 10. Cross-reference to related systems in other operation and maintenance manuals.
- C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.
1. If operation or maintenance documentation requires more than one volume to accommodate data, include comprehensive table of contents for all volumes in each volume of the set.
- D. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.
- E. Manuals, Electronic Files: Submit manuals in the form of a multiple file composite electronic PDF file for each manual type required.
1. Electronic Files: Use electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size.
 2. File Names and Bookmarks: Enable bookmarking of individual documents based upon file names. Name document files to correspond to system, subsystem, and equipment names used in manual directory and table of contents. Group documents for each system and subsystem into individual composite bookmarked files, then create composite manual, so that resulting bookmarks reflect the system, subsystem, and equipment names in a readily navigated file tree. Configure electronic manual to display bookmark panel upon opening file.
- F. Manuals, Paper Copy: Submit manuals in the form of hard copy, bound and labeled volumes.
1. Binders: Heavy-duty, three-ring, vinyl-covered, [loose-leaf] [post-type] binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.
 - a. If two or more binders are necessary to accommodate data of a system, organize data in each binder into groupings by subsystem and related components. Cross-reference other binders if necessary to provide essential information for proper operation or maintenance of equipment or system.
 - b. Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, [and] subject matter of contents [, and indicate Specification Section number on bottom of spine]. Indicate volume number for multiple-volume sets.
 2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section of the manual. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual.
 3. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software storage media for computerized electronic equipment.
 4. Supplementary Text: Prepared on 8-1/2-by-11-inch white bond paper.
 5. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.

- a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.
- b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.

2.3 EMERGENCY MANUALS

- A. Content: Organize manual into a separate section for each of the following:
 - 1. Type of emergency.
 - 2. Emergency instructions.
 - 3. Emergency procedures.
- B. Type of Emergency: Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component:
 - 1. Fire.
 - 2. Flood.
 - 3. Gas leak.
 - 4. Water leak.
 - 5. Power failure.
 - 6. Water outage.
 - 7. System, subsystem, or equipment failure.
 - 8. Chemical release or spill.
- C. Emergency Instructions: Describe and explain warnings, trouble indications, error messages, and similar codes and signals. Include responsibilities of Owner's operating personnel for notification of Installer, supplier, and manufacturer to maintain warranties.
- D. Emergency Procedures: Include the following, as applicable:
 - 1. Instructions on stopping.
 - 2. Shutdown instructions for each type of emergency.
 - 3. Operating instructions for conditions outside normal operating limits.
 - 4. Required sequences for electric or electronic systems.
 - 5. Special operating instructions and procedures.

2.4 OPERATION MANUALS

- A. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:
 - 1. System, subsystem, and equipment descriptions. Use designations for systems and equipment indicated on Contract Documents.
 - 2. Performance and design criteria if Contractor is delegated design responsibility.
 - 3. Operating standards.
 - 4. Operating procedures.
 - 5. Operating logs.
 - 6. Wiring diagrams.
 - 7. Control diagrams.
 - 8. Piped system diagrams.
 - 9. Precautions against improper use.
 - 10. License requirements including inspection and renewal dates.
- B. Descriptions: Include the following:
 - 1. Product name and model number. Use designations for products indicated on Contract Documents.
 - 2. Manufacturer's name.
 - 3. Equipment identification with serial number of each component.
 - 4. Equipment function.
 - 5. Operating characteristics.
 - 6. Limiting conditions.
 - 7. Performance curves.
 - 8. Engineering data and tests.
 - 9. Complete nomenclature and number of replacement parts.
- C. Operating Procedures: Include the following, as applicable:
 - 1. Startup procedures.
 - 2. Equipment or system break-in procedures.
 - 3. Routine and normal operating instructions.
 - 4. Regulation and control procedures.
 - 5. Instructions on stopping.

- 6. Normal shutdown instructions.
 - 7. Seasonal and weekend operating instructions.
 - 8. Required sequences for electric or electronic systems.
 - 9. Special operating instructions and procedures.
 - D. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.
 - E. Piped Systems: Diagram piping as installed, and identify color-coding where required for identification.
- 2.5 PRODUCT MAINTENANCE MANUALS
- A. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.
 - B. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.
 - C. Product Information: Include the following, as applicable:
 - 1. Product name and model number.
 - 2. Manufacturer's name.
 - 3. Color, pattern, and texture.
 - 4. Material and chemical composition.
 - 5. Reordering information for specially manufactured products.
 - D. Maintenance Procedures: Include manufacturer's written recommendations and the following:
 - 1. Inspection procedures.
 - 2. Types of cleaning agents to be used and methods of cleaning.
 - 3. List of cleaning agents and methods of cleaning detrimental to product.
 - 4. Schedule for routine cleaning and maintenance.
 - 5. Repair instructions.
 - E. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.
 - F. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
 - 1. Include procedures to follow and required notifications for warranty claims.
- 2.6 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS
- A. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranty and bond information, as described below.
 - B. Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.
 - C. Manufacturers' Maintenance Documentation: Manufacturers' maintenance documentation including the following information for each component part or piece of equipment:
 - 1. Standard maintenance instructions and bulletins.
 - 2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
 - 3. Identification and nomenclature of parts and components.
 - 4. List of items recommended to be stocked as spare parts.
 - D. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:
 - 1. Test and inspection instructions.
 - 2. Troubleshooting guide.
 - 3. Precautions against improper maintenance.
 - 4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
 - 5. Aligning, adjusting, and checking instructions.
 - 6. Demonstration and training video recording, if available.
 - E. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.
 - 1. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly,

- 2. semiannual, and annual frequencies.
- 2. Maintenance and Service Record: Include manufacturers' forms for recording maintenance.
- F. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.
- G. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.
- H. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
 - 1. Include procedures to follow and required notifications for warranty claims.

PART 3 - EXECUTION

3.1 MANUAL PREPARATION AND DELIVERY

- A. Operation and Maintenance Documentation Directory: Prepare a separate manual that provides an organized reference to emergency, operation, and maintenance manuals.
- B. Emergency Manual: Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by Owner's operating personnel for types of emergencies indicated.
- C. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.
- D. Operation and Maintenance Manuals: Assemble a complete set of operation and maintenance data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.
 - 1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
 - 2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.
- E. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.
 - 1. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.
- F. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in record Drawings to ensure correct illustration of completed installation.
 - 1. Do not use original project record documents as part of operation and maintenance manuals.
 - 2. Comply with requirements of newly prepared record Drawings in Division 01 Section "Project Record Documents."
- G. Comply with Division 01 Section "Closeout Procedures" for schedule for submitting operation and maintenance documentation.
- H. Include transmittal with all deliveries to Owner. Request receipt confirmation.

END OF SECTION

SECTION 017839**PROJECT RECORD DOCUMENTS****PART 1 - GENERAL**

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for project record documents, including the following:
 - 1. Record Drawings.
 - 2. Record Specifications.
 - 3. Record Product Data.
 - 4. Miscellaneous record submittals.

1.3 CLOSEOUT SUBMITTALS

- A. Record Drawings: Comply with the following:
 - 1. Number of Copies: Submit copies of record Drawings as follows:
 - a. Initial Submittal: Submit one paper copy and PDF electronic files of marked-up record prints and one set(s) of plots from corrected record digital data files. Architect will indicate whether general scope of changes, additional information recorded, and quality of drafting are acceptable.
 - b. Final Submittal: Submit one paper copy and PDF electronic files of marked-up record prints. Print each Drawing, whether or not changes and additional information were recorded.
 - c. Final Submittal: Submit one paper copy and PDF electronic files of marked-up record prints, one set(s) of record digital data files, and three set(s) of record digital data file plots. Plot each drawing file, whether or not changes and additional information were recorded.
- B. Record Specifications: Submit one paper copy and one PDF copy of Project's Specifications, including addenda and contract modifications.
- C. Record Product Data: Submit one paper copy and one PDF copy of each submittal.
 - 1. Where record Product Data are required as part of operation and maintenance manuals, submit duplicate marked-up Product Data as a component of manual.
- D. Miscellaneous Record Submittals: Refer to other Specification Sections for miscellaneous record-keeping requirements and submittals in connection with various construction activities. Submit one paper copy of each submittal.
- E. Reports: Submit written report indicating items incorporated in Project record documents concurrent with progress of the Work, including modifications, concealed conditions, field changes, product selections, and other notations incorporated.

PART 2 - PRODUCTS

2.1 RECORD DRAWINGS

- A. Record Prints: Maintain one set of marked-up paper copies of the Contract Drawings and Shop Drawings.
 - 1. Preparation: Mark record prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked-up record prints.
 - a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
 - b. Accurately record information in an acceptable drawing technique.
 - c. Record data as soon as possible after obtaining it.
 - d. Record and check the markup before enclosing concealed installations.
 - e. Cross-reference record prints to corresponding archive photographic documentation.
 - 2. Content: Types of items requiring marking include, but are not limited to, the following:
 - a. Dimensional changes to Drawings.
 - b. Revisions to details shown on Drawings.

- c. Depths of foundations below first floor.
 - d. Locations and depths of underground utilities.
 - e. Revisions to routing of piping and conduits.
 - f. Revisions to electrical circuitry.
 - g. Actual equipment locations.
 - h. Duct size and routing.
 - i. Locations of concealed internal utilities.
 - j. Changes made by Change Order or Construction Change Directive.
 - k. Changes made following Architect's written orders.
 - l. Details not on the original Contract Drawings.
 - m. Field records for variable and concealed conditions.
 - n. Record information on the Work that is shown only schematically.
3. Mark the Contract Drawings and Shop Drawings completely and accurately. Utilize personnel proficient at recording graphic information in production of marked-up record prints.
 4. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
 5. Mark important additional information that was either shown schematically or omitted from original Drawings.
 6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.
- B. Record Digital Data Files: Immediately before inspection for Certificate of Substantial Completion, review marked-up record prints with Architect. When authorized, prepare a full set of corrected digital data files of the Contract Drawings, as follows:
1. Format: Same digital data software program, version, and operating system as the original Contract Drawings.
 2. Format: DWG [DXF] [DGN], Version [Insert designation], operating in Microsoft Windows Apple Macintosh operating system.
 3. Format: Annotated PDF electronic file with comment function enabled.
 4. Incorporate changes and additional information previously marked on record prints. Delete, redraw, and add details and notations where applicable.
 5. Refer instances of uncertainty to Architect through Construction Manager for resolution.
- C. Newly Prepared Record Drawings: Prepare new Drawings instead of preparing record Drawings where Architect determines that neither the original Contract Drawings nor Shop Drawings are suitable to show actual installation.
1. New Drawings may be required when a Change Order is issued as a result of accepting an alternate, substitution, or other modification.
 2. Consult Architect and Construction Manager for proper scale and scope of detailing and notations required to record the actual physical installation and its relation to other construction. Integrate newly prepared record Drawings into record Drawing sets; comply with procedures for formatting, organizing, copying, binding, and submitting.
- D. Format: Identify and date each record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.
1. Record Prints: Organize record prints and newly prepared record Drawings into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
 2. Format: Annotated PDF electronic file with comment function enabled.
 3. Record Digital Data Files: Organize digital data information into separate electronic files that correspond to each sheet of the Contract Drawings. Name each file with the sheet identification. Include identification in each digital data file.
 4. Identification: As follows:
 - a. Project name.
 - b. Date.
 - c. Designation "PROJECT RECORD DRAWINGS."
 - d. Name of Architect and Construction Manager.
 - e. Name of Contractor.
- 2.2 RECORD SPECIFICATIONS
- A. Preparation: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.
1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
 2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.

3. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.
 4. For each principal product, indicate whether record Product Data has been submitted in operation and maintenance manuals instead of submitted as record Product Data.
 5. Note related Change Orders, record Product Data, and record Drawings where applicable.
- B. Format: Submit record Specifications as annotated PDF electronic file paper copy scanned PDF electronic file(s) of marked up paper copy of Specifications.

2.3 RECORD PRODUCT DATA

- A. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.
1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
 2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
 3. Note related Change Orders, record Specifications, and record Drawings where applicable.
- B. Format: Submit record Product Data as annotated PDF electronic file paper copy scanned PDF electronic file(s) of marked up paper copy of Product Data.
1. Include record Product Data directory organized by specification section number and title, electronically linked to each item of record Product Data.

2.4 MISCELLANEOUS RECORD SUBMITTALS

- A. Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.
- B. Format: Submit miscellaneous record submittals as PDF electronic file paper copy scanned PDF electronic file(s) of marked up miscellaneous record submittals.
1. Include miscellaneous record submittals directory organized by specification section number and title, electronically linked to each item of miscellaneous record submittals.

PART 3 - EXECUTION

3.1 RECORDING AND MAINTENANCE

- A. Recording: Maintain one copy of each submittal during the construction period for project record document purposes. Post changes and modifications to project record documents as they occur; do not wait until the end of Project.
- B. Maintenance of Record Documents and Samples: Store record documents and Samples in the field office apart from the Contract Documents used for construction. Do not use project record documents for construction purposes. Maintain record documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to project record documents for Architect's and Construction Manager's reference during normal working hours.

END OF SECTION

SECTION 017900**DEMONSTRATION AND TRAINING****PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

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

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for instructing Owner's personnel, including the following:
 - 1. Demonstration of operation of systems, subsystems, and equipment.
 - 2. Training in operation and maintenance of systems, subsystems, and equipment.
- B. Related Sections:
 - 1. Divisions 02 through 49 Sections for specific requirements for demonstration and training for products in those Sections.

1.3 INFORMATIONAL SUBMITTALS

- A. Instruction Program: Submit outline of instructional program for demonstration and training, including a list of training modules and a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module.
 - 1. Indicate proposed training modules utilizing manufacturer-produced demonstration and training video recordings for systems, equipment, and products in lieu of video recording of live instructional module.
- B. Qualification Data: For facilitator.
- C. Attendance Record: For each training module, submit list of participants and length of instruction time.
- D. Evaluations: For each participant and for each training module, submit results and documentation of performance-based test.

1.4 QUALITY ASSURANCE

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

1.5 COORDINATION

- A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations.
- B. Coordinate instructors, including providing notification of dates, times, length of instruction time, and course content.
- C. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data has been reviewed and approved by Architect.

PART 2 - PRODUCTS**2.1 INSTRUCTION PROGRAM**

- A. Program Structure: Develop an instruction program that includes individual training modules for each system and for equipment not part of a system, as required by individual Specification Sections.
- B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following as applicable to the system, equipment, or component:
 - 1. Basis of System Design, Operational Requirements, and Criteria: Include the following:
 - a. System, subsystem, and equipment descriptions.
 - b. Performance and design criteria if Contractor is delegated design responsibility.
 - c. Operating standards.
 - d. Regulatory requirements.
 - e. Equipment function.
 - f. Operating characteristics.
 - g. Limiting conditions.
 - h. Performance curves.
 - 2. Documentation: Review the following items in detail:
 - a. Emergency manuals.
 - b. Operations manuals.
 - c. Maintenance manuals.
 - d. Project record documents.
 - e. Identification systems.
 - f. Warranties and bonds.
 - g. Maintenance service agreements and similar continuing commitments.
 - 3. Emergencies: Include the following, as applicable:
 - a. Instructions on meaning of warnings, trouble indications, and error messages.
 - b. Instructions on stopping.
 - c. Shutdown instructions for each type of emergency.
 - d. Operating instructions for conditions outside of normal operating limits.
 - e. Sequences for electric or electronic systems.
 - f. Special operating instructions and procedures.
 - 4. Operations: Include the following, as applicable:
 - a. Startup procedures.
 - b. Equipment or system break-in procedures.
 - c. Routine and normal operating instructions.
 - d. Regulation and control procedures.
 - e. Control sequences.
 - f. Safety procedures.
 - g. Instructions on stopping.
 - h. Normal shutdown instructions.
 - i. Operating procedures for emergencies.
 - j. Operating procedures for system, subsystem, or equipment failure.
 - k. Seasonal and weekend operating instructions.
 - l. Required sequences for electric or electronic systems.
 - m. Special operating instructions and procedures.
 - 5. Adjustments: Include the following:
 - a. Alignments.
 - b. Checking adjustments.
 - c. Noise and vibration adjustments.
 - d. Economy and efficiency adjustments.
 - 6. Troubleshooting: Include the following:
 - a. Diagnostic instructions.
 - b. Test and inspection procedures.
 - 7. Maintenance: Include the following:
 - a. Inspection procedures.
 - b. Types of cleaning agents to be used and methods of cleaning.
 - c. List of cleaning agents and methods of cleaning detrimental to product.
 - d. Procedures for routine cleaning
 - e. Procedures for preventive maintenance.
 - f. Procedures for routine maintenance.
 - g. Instruction on use of special tools.

8. Repairs: Include the following:
 - a. Diagnosis instructions.
 - b. Repair instructions.
 - c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
 - d. Instructions for identifying parts and components.
 - e. Review of spare parts needed for operation and maintenance.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a training manual organized in coordination with requirements in Division 01 Section "Operations and Maintenance Data."
- B. Set up instructional equipment at instruction location.

3.2 INSTRUCTION

- A. Facilitator: Engage a qualified facilitator to prepare instruction program and training modules, to coordinate instructors, and to coordinate between Contractor and Owner for number of participants, instruction times, and location.
- B. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.
- C. Scheduling: Provide instruction at mutually agreed on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.
 1. Schedule training with Owner, through Construction Manager, with at least seven days' advance notice.
- D. Evaluation: At conclusion of each training module, assess and document each participant's mastery of module by use of a demonstration performance-based test.
- E. Cleanup: Collect used and leftover educational materials and give to Owner. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

END OF SECTION

SECTION 018113**SUSTAINABLE DESIGN REQUIREMENTS****PART 1 - GENERAL**

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes general requirements and procedures for compliance with Architect's sustainable design and construction requirements
- B. Related Sections:
 1. Divisions 01 through 33 Sections for requirements specific to the work of each of these Sections.
 2. Division 1 Section "Construction Waste Management."
 3. Division 1 Section "Indoor Air Quality During Construction."

1.3 SUBMITTALS

- A. Provide Waste management plan complying with Division 01 Section "Construction Waste Management and Disposal".

PART 2 - PRODUCTS

2.1 LOW-EMITTING MATERIALS

- A. For field applications that are inside the weatherproofing system, use adhesives and sealants that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
 1. Wood Glues: 30 g/L.
 2. Metal-to-Metal Adhesives: 30 g/L.
 3. Adhesives for Porous Materials (Except Wood): 50 g/L.
 4. Subfloor Adhesives: 50 g/L.
 5. Plastic Foam Adhesives: 50 g/L.
 6. Carpet Adhesives: 50 g/L.
 7. Carpet Pad Adhesives: 50 g/L.
 8. VCT and Asphalt Tile Adhesives: 50 g/L.
 9. Cove Base Adhesives: 50 g/L.
 10. Gypsum Board and Panel Adhesives: 50 g/L.
 11. Rubber Floor Adhesives: 60 g/L.
 12. Ceramic Tile Adhesives: 65 g/L.
 13. Multipurpose Construction Adhesives: 70 g/L.
 14. Fiberglass Adhesives: 80 g/L.
 15. Contact Adhesive: 80 g/L.
 16. Structural Glazing Adhesives: 100 g/L.
 17. Wood Flooring Adhesive: 100 g/L.
 18. Structural Wood Member Adhesive: 140 g/L.
 19. Special Purpose Contact Adhesive (contact adhesive that is used to bond melamine covered board, metal, unsupported vinyl, Teflon, ultra-high molecular weight polyethylene, rubber or wood veneer 1/16 inch or less in thickness to any surface): 250 g/L.
 20. Top and Trim Adhesive: 250 g/L.
 21. Plastic Cement Welding Compounds: 250 g/L.
 22. ABS Welding Compounds: 250 g/L.
 23. CPVC Welding Compounds: 490 g/L.
 24. PVC Welding Compounds: 510 g/L.
 25. Adhesive Primer for Plastic: 550 g/L.
 26. Sheet Applied Rubber Lining Adhesive: 850 g/L.
 27. Aerosol Adhesive, General Purpose Mist Spray: 65 percent by weight.
 28. Aerosol Adhesive, General Purpose Web Spray: 55 percent by weight.
 29. Special Purpose Aerosol Adhesive (All Types): 70 percent by weight.
 30. Other Adhesives: 250 g/L.
 31. Architectural Sealants: 250 g/L.
 32. Non-membrane Roof Sealants: 300 g/L.

- 33. Single-Ply Roof Membrane Sealants: 450 g/L.
 - 34. Other Sealants: 420 g/L.
 - 35. Sealant Primers for Nonporous Substrates: 250 g/L.
 - 36. Sealant Primers for Porous Substrates: 775 g/L.
 - 37. Modified Bituminous Sealant Primers: 500 g/L.
 - 38. Other Sealant Primers: 750 g/L.
- B. For field applications that are inside the weatherproofing system, use paints and coatings that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24) and the following chemical restrictions:
- 1. Flat Paints, Coatings, and Primers: VOC not more than 50 g/L.
 - 2. Nonflat Paints, Coatings, and Primers: VOC not more than 100 g/L for HC and 150 g/L for all others.
 - 3. High Gloss Coatings and Primers: VOC not more than 150 g/L for HC.
 - 4. Dry-Fog Coatings: VOC not more than 400 g/L.
 - 5. Primers, Sealers, and Undercoaters: VOC not more than 100 g/L. for HC and 200 g/L for others.
 - 6. Anticorrosive and Antirust Paints Applied to Ferrous Metals: VOC not more than 250 g/L.
 - 7. Zinc-Rich Industrial Maintenance Primers: VOC not more than 340 g/L.
 - 8. Pretreatment Wash Primers: VOC not more than 420 g/L.
 - 9. Clear Wood Finishes, Varnishes: VOC not more than 350 g/L.
 - 10. Clear Wood Finishes, Lacquers: VOC not more than 550 g/L.
 - 11. Floor Coatings: VOC not more than 100 g/L.
 - 12. Shellacs, Clear: VOC not more than 730 g/L.
 - 13. Shellacs, Pigmented: VOC not more than 550 g/L.
 - 14. Stains: VOC not more than 250 g/L.
- C. Urea Formaldehyde Prohibition: Do not use composite wood or agrifiber products or adhesives that contain urea-formaldehyde resin.
- D. FloorScore Certification: Use FloorScore-certified hard surface flooring. An acceptable alternative to FloorScore certified flooring is the use of flooring that meets 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, including 2004 Addenda.
- 2.2 RECYCLED CONTENT OF MATERIALS
- A. Provide not less than 20 percent of building materials in Divisions 3-10, 31, and 32 (by cost) that are recycled materials.
 - B. Recycled material value is determined by multiplying the percentage (by weight) of post-consumer recycled content plus one-half of pre-consumer recycled content in the item by the total material cost of the item. Do not include mechanical or electrical components in the calculation.
- 2.3 REGIONAL MATERIALS
- A. Provide no less than 20 percent of building materials in Divisions 3-10, 31, and 32 (by cost) that are regionally harvested, extracted, or recovered and regionally manufactured materials.
 - B. Regional material value is determined by multiplying the percentage of the material (by weight) that has had its raw material extraction, harvest, or recovery, as well as its manufacturing, take place within 500 miles of Project site.

PART 3 - EXECUTION

- 3.1 CONSTRUCTION WASTE MANAGEMENT
- A. Comply with Division 01 Section "Construction Waste Management and Disposal."
- 3.2 CONSTRUCTION INDOOR-AIR-QUALITY MANAGEMENT
- A. Comply with SMACNA's "SMACNA IAQ Guideline for Occupied Buildings under Construction."
If Owner authorizes use of permanent heating, cooling, and ventilating systems during construction period as specified in Division 01 Section "Temporary Facilities and Controls," install filter media having a MERV 8 according to ASHRAE 52.2 at each return-air inlet for the air-handling system used during construction.
- 3.3 INDOOR AIR QUALITY PRIOR TO OCCUPANCY
- A. Conduct either air quality testing or a building flush out consistent with the requirements of LEED credit IEQ 3.2: Construction Indoor Air Quality Management Plan—Before Occupancy.
 - 1. Air-Quality Testing:
 - a. Conduct baseline indoor-air-quality 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 BD+C 2009 Reference Guide."
- b. Demonstrate that the contaminant maximum concentrations listed below are not exceeded:
 - 1) Formaldehyde: 27 ppb.
 - 2) Particulates (PM10): 50 micrograms/cu. m.
 - 3) Total Volatile Organic Compounds (TVOC): 500 micrograms/cu. m.
 - 4) 4-Phenylcyclohexene (4-PH): 6.5 micrograms/cu. m.
 - 5) Carbon Monoxide: 9 ppm and no greater than 2 ppm above outdoor levels.
 - c. For each sampling point where the maximum concentration limits are exceeded, conduct additional flush-out with outside air and retest the specific parameter(s) exceeded to indicate the requirements are achieved. Repeat procedure until all requirements have been met. When retesting non-complying building areas, take samples from same locations as in the first test.
 - d. Air-sample testing shall be conducted as follows:
 - 1) 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.
 - 2) Building shall have all interior finishes installed including, but not limited to, millwork, doors, paint, carpet, and acoustic tiles. Non-fixed furnishings such as workstations and partitions are encouraged, but not required, to be in place for the testing.
 - 3) Number of sampling locations will vary 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 25,000 sq. ft. or for each contiguous floor area, whichever is larger, and shall include areas with the least ventilation and greatest presumed source strength.
 - 4) 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.
2. Conduct an unoccupied or occupied building flush out meeting the requirements of LEED credit IEQ 3.2:
- a. Unoccupied flush-out shall be conducted as follows:
 - 1) Unoccupied flush-out shall take place after construction ends, prior to occupancy, and with all interior finishes installed.
 - 2) New filtration media shall be installed and a flush-out performed by supplying a total air volume of 14,000 cubic feet of outdoor air per square foot of floor area while maintaining an internal temperature of at least 60° F and relative humidity of no higher than 60%.
 - b. Occupied flush-out shall be conducted as follows:
 - 1) Before the building is occupied, deliver a minimum of 3,500 cubic feet of outdoor air per square foot of floor area.
 - 2) Once the space is occupied, ventilate at a minimum rate that is the greater of either 0.30 cubic feet per minute per square foot of outside air or the design minimum outside air rate determined by ASHRAE 62.1-2007, sections 4 through 7 for mechanically ventilated spaces or paragraph 5.1 for naturally ventilated spaces.
 - 3) During each day of the flush-out period, ventilation must begin a minimum of 3 hours prior to occupancy and continue during occupancy. These conditions must be maintained until a total of 14,000 cubic feet per square foot of outside air has been delivered to the space.

END OF SECTION

SECTION 024113**SELECTIVE SITE DEMOLITION****PART 1 - GENERAL****1.1 SUMMARY**

- A. Section includes the following:
 - 1. Demolition and removal of selected site elements and building remnants.
 - 2. Demolition and removal of existing paving, curbs, sidewalks, and adjacent landscape work to limits indicated on Drawings.
- B. Items of interest or value to Owner that may be encountered during selective demolition shall remain Owner's property. Carefully remove and salvage each item or object in a manner to prevent damage and deliver promptly to Owner.

1.2 REFERENCES

- A. American National Standard Institute (ANSI):
 - 1. ANSI A 10.6 "Demolition, Safety Requirements"
- B. National Fire Protection Association (NFPA)
 - 1. NFPA 241 "Standard for Safeguarding Construction, Alteration, and Demolition Operations"

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. 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 INFORMATIONAL SUBMITTALS

- A. General: Submit the following under provisions of Section 013300.
- B. Schedule of Selective Demolition Activities: Indicate the following:
 - 1. Interruption of utility services. Indicate how long utility services will be interrupted.
 - 2. Coordination for shut-off, capping, and continuation of utility services as required.
 - 3. Owner's On-Site Operations: Provide a detailed sequence of demolition and removal work to ensure uninterrupted progress of Owner's off-site operations.
 - 4. Means of protection for items to remain and items in path of waste removal from site.
- C. Qualification Data: Qualification data for firms and persons specified in "Quality Assurance" article to demonstrate their capabilities and experience. Include list of completed projects with project name, addresses, names of Architects and Owners, and other information specified.
- D. Pre-demolition Photographs or Videotapes: 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 Section "Photographic Documentation." Submit before Work begins.
- E. Landfill Records: Indicate receipt and acceptance of hazardous wastes by a landfill facility licensed to accept hazardous wastes.
- F. Closeout Submittals: Record documents, indicating locations of encountered items, whether currently in use or abandoned in place.

1.5 QUALITY ASSURANCE

- A. Qualifications:
 - 1. Contractor: Contractor is responsible for quality control of the Work.
 - 2. Demolition Firm: A firm experienced in successfully demolition and removal of work similar to that indicated for this Project, with a record of successful performance, and with sufficient capacity to provide demolition, removal, and legal disposal of debris without causing delay in the Work.
- B. Regulatory Requirements: Comply with all applicable requirements of the laws, codes, ordinances and regulations of Federal, State and Municipal authorities having jurisdiction. Obtain necessary approvals from all such authorities.
 - 1. Comply with governing EPA notification regulations before beginning demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.
 - 2. Comply with ANSI A 10.6 and NFPA 241.

- C. Pre-demolition Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination." Review methods and procedures related to selective demolition.
- 1.6 PROJECT CONDITIONS OR SITE CONDITIONS
- A. Environmental Requirements: Proceed with the Work in accordance with governmental requirements.
 - B. Condition of Site Elements: Owner assumes no responsibility for actual condition of site elements to be demolished.
 - 1. Conditions existing at time of inspection for bidding purpose will be maintained by Owner insofar as practicable. However, variations may occur by Owner's removal and salvage operations prior to start of demolition work.
 - C. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.
 - D. Recycled Materials: Items of recycled value to Contractor may be removed from structure as work progresses. Recycled items shall be transported from site as they are removed. Comply with governing regulations pertaining to environmental protection.
 - E. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.
 - 1. Hazardous Materials: If materials suspected of containing hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Hazardous materials will be removed by Owner under a separate contract.
 - F. Explosives: Use of explosives will not be permitted.
 - G. Traffic: Conduct demolition operations and removal of debris to ensure minimum interference with roads, streets, walks, and other adjacent occupied or used facilities.
 - H. Do not close or obstruct streets, walks or other occupied or used facilities without permission from authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by governing regulations.
 - I. Protections: Ensure safe passage of persons around areas of demolition. Conduct operations to prevent injury to adjacent buildings, structures, other facilities, and persons.
 - 1. Erect temporary covered passageways as required by authorities having jurisdiction.
 - 2. Provide shoring, bracing, or support to prevent movement, settlement or collapse of structures to be demolished and adjacent facilities to remain.
 - J. Damages: Promptly repair damages caused to adjacent facilities by demolition operations at no cost to Owner.
 - K. Utility Services: Maintain existing utilities indicated to remain, keep in service, and protect against damage during demolition operations.
 - 1. Do not interrupt existing utilities serving adjacent facilities, except when authorized in writing by authorities having jurisdiction. Provide temporary services during interruptions to existing utilities, as acceptable to governing authorities.

PART 2 - PRODUCTS (Not Used)

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. Survey of Existing Conditions: Record existing conditions by use of preconstruction photographs and preconstruction videotapes.
 - 1. Comply with requirements specified in Division 01 Section "Photographic Documentation."
- 3.2 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS
 - A. Existing Services/Systems: Maintain services/systems indicated to remain and protect them against damage during selective demolition operations.
 - 1. Comply with requirements for existing services/systems interruptions specified in Division 01 Section "Summary of Work."

- B. 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. Owner will arrange to shut off indicated services/systems when requested by Contractor.
 - 2. If services/systems are required to be removed, relocated, or abandoned, 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.
- 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 Division 01 Section "Temporary Facilities and Controls."
 - B. Temporary Facilities: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
 - 1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of existing adjacent buildings.
 - C. Temporary Shoring: Provide and maintain interior and exterior shoring, bracing, or structural support to preserve stability and prevent unexpected movement or collapse of construction being demolished.
 - 1. Strengthen or add new supports when required during progress of demolition.
 - D. Pollution Controls: Use water sprinkling, temporary enclosures, and other suitable methods to limit dust and dirt rising and scattering in air to lowest practical level. Comply with governing regulations pertaining to environmental protection.
 - 1. Do not use water when it may create hazardous or objectionable conditions such as ice, flooding, and pollution.
- 3.4 DEMOLITION
- 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 demolition in systematic manner, from top of structure to ground. Complete demolition work above each floor or tier before disturbing supporting members on lower levels.
 - 2. Demolish concrete and masonry in small sections.
 - 3. Break up and remove concrete slabs-on-grade, unless otherwise shown to remain.
 - B. Below-Grade Construction:
 - 1. Demolish and remove below-grade construction and concrete slabs on grade.
 - 2. Filling Basements and Voids: Completely fill below-grade areas and voids resulting from demolition of structures.
 - 3. Use satisfactory soil materials consisting of stone, gravel, and sand, free from debris, trash, frozen materials, roots and other organic matter.
 - 4. Prior to placement of fill materials, ensure that areas to be filled are free of standing water, frost, frozen material, trash and debris.
 - 5. Place fill materials in horizontal layers not exceeding 6" in loose depth. Compact each layer at optimum moisture content of fill material to a density equal to original adjacent ground, unless subsequent excavation for new work is required.
 - 6. After fill placement and compaction, grade surface to meet adjacent contours and to provide flow to surface drainage structures.
- 3.5 DISPOSAL OF DEMOLISHED MATERIALS
- A. General: Except for items or materials indicated to be reused, salvaged, reinstalled, or otherwise indicated to remain Owner's property, remove demolished materials from Project site and legally dispose of them in an EPA-approved landfill.
 - 1. Do not allow demolished materials to accumulate on-site.
 - 2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
 - B. At the end of each workday, remove unused materials, debris and containers from the site.
 - C. Burning of removed materials from demolished structures will not be permitted on site.
 - D. Disposal: Transport demolished materials off Owner's property and legally dispose of them.
 - E. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

END OF SECTION

SECTION 03 1000

CONCRETE FORMWORK

PART 1 - GENERAL

1.1 SYSTEM DESCRIPTION

- A. Design, engineer, and construct formwork, shoring, and bracing to meet design and code requirements, so that resultant concrete conforms to required shapes, lines, and dimensions.

1.2 QUALITY ASSURANCE

- A. Construct and erect concrete formwork in accordance with ACI 301 and 347.

PART 2 - PRODUCTS

2.1 WOOD FORM MATERIALS

- A. Plywood: Solid one side grade; sound, undamaged sheets with clean, true edges.
- B. Lumber: No. 2 or better grade; with grade stamp clearly visible.

2.2 FORMWORK ACCESSORIES

- A. Form Ties: Snap-off metal of adjustable length; cone type; 1 inch break back dimension; free of defects that will leave holes no larger than 1-1/4 inches diameter in concrete surface.
- B. Form Release Agent: Colorless material which will not stain concrete, absorb moisture or affect bond of subsequent surface finish, or impair natural bonding or color characteristics of coating intended for use on concrete;
- C. Fillets for Chamfered Corners and other justifications: Wood strips, sizes and configurations as detailed.
- D. Formed Construction Joints: Galvanized steel, tongue and groove type, knock-out holes spaced at 6 inches on center, with anchors.

PART 3 - EXECUTION

3.1 EARTH FORMS

- A. Earth forms not permitted, except for footings where soil is conducive and approval is received from authorities having jurisdiction and structural engineer.

3.2 ERECTION

- A. Minimize form joints. Symmetrically align joints and make watertight to prevent leakage of mortar.
- B. Arrange and assemble formwork to permit stripping, so that concrete is not damaged during its removal.
- C. Arrange forms to allow stripping without removal of principal shores, where required to remain in place.

- D. Provide bracing to ensure stability of formwork. Strengthen formwork liable to be overstressed by construction loads.
- E. Provide chamfer strips on external corners of beams, and columns where they will be exposed to view after completion of construction.
- F. Do not displace or damage vapor barrier placed by Section 03300.
- G. Construct formwork to maintain tolerances in accordance with ACI 301.
- H. Construct form full depth of concrete to be placed.

3.3 APPLICATION OF FORM RELEASE AGENT

- A. Apply form release agent on formwork in accordance with manufacturer's instructions. Apply prior to placing reinforcing steel, anchoring devices, and embedded items.

3.4 INSERTS, EMBEDDED PARTS, AND OPENINGS

- A. Provide formed openings where required for work embedded in or passing through concrete.
- B. Locate and set in place items which will be cast directly into concrete.
- C. Coordinate work of other Sections in forming and setting openings, slots, recesses, chases, sleeves, bolts, anchors, and other inserts.
- D. Install accessories in accordance with manufacturer's instructions, level and plumb. Ensure items are not disturbed during concrete placement.
- E. Install construction joint device in coordination with floor slab pattern placement sequence. Set top to required elevations. Secure to resist movement by wet concrete.

3.5 FORMWORK TOLERANCES

- A. Construct formwork to maintain tolerances required by ACI 301.
- B. Camber slabs and beams as indicated in Drawings and in accordance with ACI 301.

3.6 FORM REMOVAL

- A. Do not remove forms, shoring and bracing until concrete has sufficient strength to support its own weight, and construction and design loads which may be imposed upon it.
- B. Do not damage concrete surfaces during form removal.
- C. Do not place wood forms which cannot be retrieved after concrete placement. Use steel forms.

END OF SECTION

SECTION 03 2000
CONCRETE REINFORCEMENT

PART 1 GENERAL

1.1 QUALITY ASSURANCE

- A. Perform concrete reinforcement work in accordance with CRSI Manual of Standard Practice, Documents 63 and 65.
- B. Conform to ACI 301 and 318.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Reinforcing Steel: ASTM A 615, grade billet-steel deformed bars, uncoated, 60 KSI yield grade; ASTM A 706, grade 40 weldable for bars welded to steel members.
- B. Welded Steel Wire Fabric: ANSI/ASTM A 185 plain type; in flat sheets; uncoated finish.
- C. Contractor's Option: Glass fiber reinforcement, ASTM C 948 collated, fibrillated, polypropylene fibers.
 - 1. Acceptable Products:
 - a. Forta CR by Forta Corporation.
 - b. "Fibermesh" by Fibermesh, Inc.

2.2 ACCESSORY MATERIALS

- A. Tie Wire: Minimum 16 gage annealed type.
- B. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for strength and support of reinforcement during installation and placement of concrete including load bearing pad on bottom to prevent vapor barrier puncture.

2.3 FABRICATION

- A. Fabricate in accordance with ACI SP-66, providing concrete cover specified in Section 03 3000.
- B. Locate reinforcing splices not indicated on Drawings at points of minimum stress. Indicate location of splices on shop drawings.
- C. Weld reinforcing bars in accordance with ANSI/AWS D1.4.
- D. Provide sufficient lap of splicing of reinforcement, where required, to permit transfer of stress in accordance with requirements of this specification. Splice wall vertical reinforcement at location of horizontal construction joints.
- E. Unless otherwise noted on the drawings to be more, lap reinforcement 36 bar diameters (class "A" lap) at splices or have dowels of same bar section and spacing as the bars to be

spliced. Lap bars at least 36 diameters (class "A" lap) at corners and at abrupt changes in direction of walls. Stagger splices in adjacent bars.

PART 3 EXECUTION

3.1 PREPARATION

- A. Before placing concrete, clean reinforcement of foreign particles or coatings.

3.2 PLACING

- A. Place reinforcement in accordance with CRSI "Placing Reinforcing Bars" and ACI 318, with provisions of ACI 318 governing.
- B. Move bars as necessary to avoid interference with other reinforcing steel, conduits, or embedded items.
- C. If bars are moved more than one bar diameter or enough to exceed tolerances, submit resulting arrangement of bars to Owner's Representative for review.
- D. Place, support, and secure reinforcement against displacement. Do not deviate from alignment or measurement. Place in accordance with approved shop drawings and CRSI recommendations. Do not heat, cut or bend bars without Owner's Representative's approval.
- E. Do not displace or damage vapor barrier required by Section 03 3000.
- F. Refer to Section 03 3000 for minimum coverage of concrete unless noted otherwise on the Drawings.
- G. Place reinforcement, at time of concrete placing, free of mud, oil, or other materials that adversely affect or reduce bond.
- H. Reinforcement with Rust, Mill Scale, or Both: Considered satisfactory, provided minimum dimensions, including height of deformation, and weight of hand-wire-brushed test specimen are not less than ASTM A 615 requirements.
- I. Support reinforcement and fasten together to prevent displacement by construction loads of placing concrete. Use No. 16 gage black annealed wire at joints and crosses to accurately position reinforcing in place.
- J. Over formwork, use metal or plastic bar chairs and spacers to support reinforcement.
- K. Where concrete surface will be exposed to weather in finished structure, use non-corrosive or corrosion protected accessories within 1/2 inch of concrete surface.
- L. Bars having splices not shown on shop drawings will be subject to rejection.
- M. Do not bend reinforcement after being embedded in hardened concrete.
- N. Do not allow bars to be in contact with dissimilar materials.

END OF SECTION

SECTION 03 3000

CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.1 QUALITY ASSURANCE

- A. Perform work in accordance with ACI 301, 304, 305, 306, 309, and 318.
- B. Obtain materials from same source throughout the Work.

1.2 REGULATORY REQUIREMENTS

- A. Conform to applicable building code.

1.3 COORDINATION

- A. Notify responsible trades of schedules of concrete pours so as to allow adequate time for installation of their work.
- B. Obtain anchor bolts and other miscellaneous steel items to be cast into concrete from material supplier.
- C. Coordinate size and location of mechanical equipment concrete pads with applicable trades.

1.4 DELIVERY, STORAGE AND HANDLING

- A. Mix and deliver concrete to project ready-mixed in accordance with ASTM C 94.
- B. Schedule delivery so that continuity of any pour will not be interrupted for over 15 minutes.
- C. Place concrete on site within 90 minutes after proportioning materials at batch plant.

PART 2 PRODUCTS

2.1 CONCRETE MATERIALS

- A. Cement: ASTM C 150, Normal - Type II; air entrained where exposed to the freeze-thaw cycle; gray color.
- B. Fine Aggregate: ASTM C 33 clean, hard, durable, natural sand free from silt, loam or clay.
- C. Coarse Aggregate: ASTM C 33, hard, durable, uncoated, crushed limestone or other approved aggregate.
- D. Water: Clean and not detrimental to concrete.

2.2 ADMIXTURES

- A. Air Entrainment: ASTM C 260
 - 1. Acceptable Manufacturers: Subject to compliance with requirements herein, provide products from one of the following:

- a. W.R. Grace.
- b. Master Builders.
- c. Sika.

- B. Chemical Admixtures: ASTM C 494. Depending upon weather conditions at time of placing, cement-dispersing agent may be supplemented by a set- retarding or set-accelerating agent to improve control of setting and, in the case of hot weather, to minimize surface checking. Introduce admixtures in quantities and according to methods recommended by manufacturers of materials approved for use. Introduce admixtures only after receiving written approval from testing laboratory and Structural Engineer.

2.3 ACCESSORIES

- A. Sheet Vapor Barrier:

1. Type: 15 mil film meeting requirements of ASTM E 1745, Class A and B.
2. Water Vapor Transmittance: Maximum 0.006 grams per square foot per hour.
3. Tensile Strength: Minimum 54.2 pounds at 1139 percent strain/MD per ASTM D 638.
4. Tear Resistance: 7.40 pounds per foot MD per ASTM D 1004.
5. Acceptable Products:
 - a. Stego Wrap Vapor Barrier by Stego Industries, Ilc, San Juan Capistrano, CA.
 - b. Comparable products by Reef Industries, Raven Industries, and WR Meadows.
6. Accessories: Rubber based pressure sensitive adhesive polyethylene tape.
 - a. Acceptable Product: Stego Wrap Red Polyethylene Tape.

2.4 CONCRETE MIX

- A. Mix concrete in accordance with ASTM C 94, Alternative No. 2, or ACI 304.
- B. Deliver concrete in accordance with ASTM C 94.
- C. Select proportions for normal weight concrete in accordance with ACI 301 Method 1. Mix not less than one minute after materials are in mixer.
- D. Do not transport or use concrete after the following time has expired from time of initial mixing:
1. 90 minutes when ambient temperatures are below 80 degrees F.
 2. 75 minutes when ambient temperatures are between 80 and 90 degrees F.
 3. 60 minutes when ambient temperatures are over 90 degrees F. Verify supplier of transit-mixed concrete has a plant of sufficient capacity, and adequate transportation facilities to assure continuous delivery at required rate. Frequency of deliveries to project site shall be such as to provide for continuous concrete placement throughout any one pour.
- E. Use of calcium chloride is strictly prohibited.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify anchors, seats, plates, reinforcement, and other items to be cast into concrete are accurately placed, held securely, and will not cause hardship in placing concrete.
- B. Correct unsatisfactory work prior to placing concrete.
- C. Remove rubbish from formwork immediately prior to placing concrete.
- D. Remove ice and excess water from excavations and formwork.

3.2 PREPARATION

- A. Install vapor barrier under interior slabs-on-fill and over sand leveling bed, if present. Lap joints minimum 12 inches and seal with special tape of same permeance as vapor barrier. Do not disturb or damage vapor barrier while placing concrete. Repair damaged vapor barrier.

3.3 PLACING CONCRETE

- A. Notify testing laboratory a minimum of 24 hours prior to commencement of concrete operations.
- B. Place concrete in accordance with ACI 301 and as specified below.
 - 1. Unless protection is provided, do not place concrete in rain, sleet, or snow.
 - 2. Regulate rate of placement so concrete remains plastic and flows into position.
 - 3. Deposit concrete continuously until panel or section is completed. Place as near as possible to its final location; do not rehandle.
 - 4. Consolidation
 - a. Comply with requirements of ACI 309.
 - b. Use mechanical vibrating equipment for consolidation.
 - c. Do not use vibrators to transport concrete in forms.
 - d. Thoroughly consolidate concrete and work around reinforcement, embedded items and into corners of forms. Thoroughly consolidate layers of concrete with previous layers.
 - 5. Cold Weather Placement: Do not place concrete when temperature is below 40 degrees F unless cold weather concrete procedures are followed as specified in ACI 306. Calcium chloride shall not be used.
 - 6. Hot Weather Placement: Exercise special care to prevent high temperature in fresh concrete during hot weather in accordance with ACI 305. Use water reducing set-retarding admixtures in such quantities as especially recommended by manufacturer to assure that concrete remains workable and lift lines will not be visible.
- C. Ensure reinforcement, inserts, embedded parts, and formed joints are not disturbed during concrete placement.
- D. Unless noted otherwise on the Drawings, maintain concrete cover around reinforcing in accordance with ACI 318.
- E. Place concrete continuously between predetermined construction and control joints.

- F. Place floor slabs on fill in pattern indicated on Drawings.
- G. Separate exterior slabs on fill from vertical surfaces with joint filler. Extend joint filler from bottom of slab to within 1/4 inch of finished slab surface.
- H. Excessive honeycomb or embedded debris in concrete is not acceptable. Notify Owner's Representative upon discovery.
- I. Maintain record of concrete placement. Record date, location, quantity, air temperature and test samples taken.

3.4 CONCRETE CURING AND PROTECTION

- A. General: Protect freshly placed formed concrete from premature drying and excessive cold or hot temperatures. Start initial curing as soon as free water has disappeared from concrete surface after placing and finishing. Weather permitting, keep continuously moist for not less than 7 days.
- B. Curing Methods: Perform curing of formed concrete by moist curing, or by moisture-retaining cover curing, as herein specified.
- C. Curing Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces, by moist curing with forms in place for full curing period or until forms are removed. If forms are removed, continue curing by moisture cover curing method.
- D. Curing Unformed Surfaces: Cure unformed surfaces, including slabs and other flat surfaces, in accordance with Section 03355.

3.5 PATCHING CONCRETE SURFACES

- A. It is the intent of these Specifications to provide for grade beams of such quality as to require a minimum of pointing.
- B. Exercise care in forming, mixing and placing of concrete to ensure reasonably uniform dense surfaces, free from blemishes, voids, or honeycombs.
- C. Repair and patch defective areas with cement mortar and bonding agent mixture immediately after removal of forms, when acceptable to Owner's Representative.
 - 1. Cut out honeycomb, rock pockets, voids over 1/4 inch in any dimension, and holes left by tie rods and bolts, down to solid concrete but in no case to a depth of less than 1 inch. Make edges of cuts perpendicular to the concrete surface. Thoroughly clean, dampen with water, and brush-coat the area to be patched with specified bonding agent. Place patching mortar before bonding compound has dried.

3.6 FIELD QUALITY CONTROL

- A. Field inspection and testing will be performed under provisions of Section 01 4000.
- B. Maintain records of placed concrete items. Record date, location of pour, quantity, air temperature, and test samples taken.
- C. Cast-in-Place Concrete

1. Test Cylinders: Make at least one test of each day's pouring or each 50 cubic yards, whichever comes first, on each different portion or section of the work. Mold and cure specimens in accordance with ASTM C 31, and test in accordance with ASTM C 39. Test cylinders shall be made and tested by the laboratory in accordance with ASTM C 172. Footings, walls, and floor systems constitute different sections. Each test shall consist of 5 specimens, 2 of which shall be broken at 7 days, 2 at 28 days and one held in reserve. Determine temperature and air content for each set of test cylinders in accordance with ASTM C 231.
2. Field Quality Control
 - a. Determine slump for each strength test and whenever consistency of concrete appears to vary, in accordance with ASTM C 143.
 - b. Monitor addition of water to concrete and length of time concrete is allowed to remain in truck.
 - c. Certify delivery tickets indicating class of concrete, amount of water added during initial batching, and time initial batching occurred.
 - d. Monitor work being performed in accordance with ACI recommendations as a standard of quality.

3.7 PROTECTION

- A. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, rain or running water and mechanical injury.
- B. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.

3.8 SCHEDULE OF MIXES

- A. Refer to Drawings.

END OF SECTION

SECTION 03 3500

CONCRETE FLOOR FINISHING AND CURING

PART 1- GENERAL

1.1 QUALITY ASSURANCE

- A. Conform to ACI 301.

1.2 ENVIRONMENTAL REQUIREMENTS

- A. Maintain ambient temperature during curing period above 70 degrees F for 3 days or above 50 degrees F for 5 days.
- B. Protect from rain or running water.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers: Subject to compliance with requirements indicated, provide products of one of the following:
 - 1. Sonneborn Building Products
 - 2. L & M Construction Chemicals
 - 3. Secure, Inc.
 - 4. Dayton Superior
 - 5. Burke

2.2 MATERIALS

- A. Sodium Silicate Compounds: Zero-VOC water-based sodium silicate compound in solution. Clear. Non-membrane forming. Compounds in suspension not permitted.
 - 1. Compatible with subsequent coatings and toppings without stripping.
 - 2. Acceptable Products:
 - a. Sinak S-102, Sinak Corp., San Diego, CA
 - b. L&M Cure, L&M Construction Chemicals, Omaha, NE.
 - c. Eucosil, Euclid Chemical Company, Cleveland, OH.
 - d. Ashford Formula, Crecrete Distribution Inc.

PART 3- EXECUTION

3.1 INSPECTION

- A. Verify floor surfaces are acceptable for application of this work.
- B. Ensure floor surfaces are depressed to accommodate finish materials.
- C. Beginning of installation means acceptance of surfaces.

3.2 FLOOR FINISHING

- A. Finish concrete floor surfaces in accordance with ACI 301.
- B. Uniformly spread, screed, and float concrete. Do not use grate tampers or mesh rollers. Do not spread concrete by vibration.
- C. Manually float surfaces which will receive ceramic tile with full bed setting system.
- D. Steel trowel surfaces to receive carpeting, resilient flooring, seamless flooring, thin set ceramic tile, and surfaces to be left exposed.
- E. Apply hardener/sealer in accordance with manufacturers instructions on scheduled floor surfaces.

3.3 TOLERANCES.

- A. Maintain surface flatness to ACI 302 of Ff30 and levelness of FI25 for floors to receive carpet, resilient surfaces, thin set tile, and surfaces to be left exposed; maintain flatness to Ff15 and levelness to FI13 for recessed sub-slabs. Test flatness and levelness in accordance with ASTM E 1155.
- B. In areas of floor drains, maintain floor level at walls and slope surface uniformly to drains at 1/8 to 1/4 inch per foot.

3.4 CONCRETE CURING AND PROTECTION

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. In hot, dry, and windy weather, protect concrete from rapid moisture loss before and during finishing operations with an evaporation-control material. Apply in accordance with manufacturer's instructions after screeding and bull floating, but before power floating and troweling.
- B. Start initial curing as soon as free water has disappeared from concrete surface after placing and finishing. Weather permitting, keep continuously moist for not less than 7 days.
- C. Curing Methods: Perform curing of concrete by curing and sealing compound, or by moisture-retaining cover curing, and by combinations thereof, as herein specified.
 - 1. Provide moisture curing by the following Method 1:
 - a. Keep concrete surface continuously wet by covering with water.
 - b. Use continuous water-fog spray.
 - 2. Provide moisture-cover curing by the following Method 2:
 - a. Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width with sides and ends lapped at least 3 inches and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
 - 3. Provide curing compound to exposed interior slabs and to exterior slabs, walks, and curbs as follows:

- a. Apply specified curing compound to concrete slabs as soon as final finishing operations are complete, within 2 hours and after surface water sheen has disappeared. Apply uniformly in continuous operation by power spray or roller in accordance with manufacturer's directions. Recoat areas subjected to heavy rainfall within 3 hours after initial application. Maintain continuity of coating and repair damage during curing period.
- b. Use membrane curing compounds that will not affect surfaces to be covered with finish materials applied directly to concrete.
- c. Apply in accordance with manufacturer's instructions and ACI 301.
- d. Do not apply curing compound on surfaces to receive applied coatings and finishes. Use other methods specified herein.

END OF SECTION

SECTION 035416**HYDRAULIC CEMENT UNDERLAYMENT****PART 1 - GENERAL**

- 1.1 RELATED DOCUMENTS
- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- 1.2 SUMMARY
- A. Section includes hydraulic-cement-based, polymer-modified, self-leveling underlayment for application below interior floor coverings.
- 1.3 QUALITY ASSURANCE
- A. Installer Qualifications: Installer who is approved by manufacturer for application of underlayment products required for this Project.
- B. Product Compatibility: Manufacturers of underlayment and floor-covering systems certify in writing that products are compatible.
- C. Fire-Resistance Ratings: Where indicated, provide hydraulic-cement underlayment systems 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.
- D. Sound Transmission Characteristics: Where indicated, provide hydraulic-cement underlayment systems identical to those of assemblies tested for STC and IIC ratings per ASTM E 90 and ASTM E 492 by a qualified testing agency.
- 1.4 DELIVERY, STORAGE, AND HANDLING
- A. Store materials to comply with manufacturer's written instructions to prevent deterioration from moisture or other detrimental effects.
- 1.5 PROJECT CONDITIONS
- A. Environmental Limitations: Comply with manufacturer's written instructions for substrate temperature, ventilation, ambient temperature and humidity, and other conditions affecting underlayment performance.
1. Place hydraulic-cement-based underlayments only when ambient temperature and temperature of substrates are between 50 and 80 deg F.
- 1.6 COORDINATION
- A. Coordinate application of underlayment with requirements of floor-covering products and adhesives, specified in Division 09 Sections, to ensure compatibility of products.

PART 2 - PRODUCTS

- 2.1 HYDRAULIC-CEMENT-BASED UNDERLAYMENTS
- A. Underlayment: Hydraulic-cement-based, polymer-modified, self-leveling product that can be applied in minimum uniform thickness of 1/4 inch and that can be feathered at edges to match adjacent floor elevations.
1. Products: Subject to compliance with requirements, provide one of the following:
- a. Ardex; K-15 Self-Leveling Underlayment Concrete.
- b. Dayton Superior Corporation; EconoLevel.
- c. Euclid Chemical Company (The); Super Flo-Top Level Magic TAMMS SLU.
- d. L&M Construction Chemicals, Inc.; Levelex.
- e. MAPEI Corporation; Novoplan Easy.
2. Cement Binder: ASTM C 150, portland cement, or hydraulic or blended hydraulic cement as defined by ASTM C 219.
3. Compressive Strength: Not less than 4000 psi at 28 days when tested according to ASTM C 109.
4. Underlayment Additive: Resilient-emulsion product of underlayment manufacturer, formulated for use with underlayment when applied to substrate and conditions indicated.
- B. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch; or coarse sand as recommended by

underlayment manufacturer.

1. Provide aggregate when recommended in writing by underlayment manufacturer for underlayment thickness required.
- C. Water: Potable and at a temperature of not more than 70 deg F.
- D. Primer: Product of underlayment manufacturer recommended in writing for substrate, conditions, and application indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, with Installer present, for conditions affecting performance.
1. Proceed with application only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. General: Prepare and clean substrate according to manufacturer's written instructions.
1. Treat nonmoving substrate cracks according to manufacturer's written instructions to prevent cracks from telegraphing (reflecting) through underlayment.
 2. Fill substrate voids to prevent underlayment from leaking.
- B. Concrete Substrates: Mechanically remove, according to manufacturer's written instructions, laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, and other contaminants that might impair underlayment bond.

3.3 APPLICATION

- A. General: Mix and apply underlayment components according to manufacturer's written instructions.
1. Close areas to traffic during underlayment application and for time period after application recommended in writing by manufacturer.
 2. Coordinate application of components to provide optimum underlayment-to-substrate and intercoat adhesion.
- B. Apply primer over prepared substrate at manufacturer's recommended spreading rate.
- C. Apply underlayment to produce uniform, level surface.
1. Apply a final layer without aggregate to product surface.
 2. Feather edges to match adjacent floor elevations.
- D. Cure underlayment according to manufacturer's written instructions. Prevent contamination during application and curing processes.
- E. Do not install floor coverings over underlayment until after time period recommended in writing by underlayment manufacturer.
- F. Remove and replace underlayment areas that evidence lack of bond with substrate, including areas that emit a "hollow" sound when tapped.

3.4 PROTECTION

- A. Protect underlayment from concentrated and rolling loads for remainder of construction period.

END OF SECTION

SECTION 04 2200
CONCRETE UNIT MASONRY

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Concrete masonry units and accessories indicated, specified, or required for installation.

1.2 DEFINITIONS

- A. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells for loadbearing assemblies designed by Structural Engineer to support axial (gravity) loads and lateral (wind/seismic) loads.
- B. Masonry Terminology: Refer to NCMA TEK 1-4 and other referenced quality standards.

1.3 ACTION SUBMITTALS

- A. Product Data: Manufacturers technical literature for each type of product indicated, specified, or required.

1.4 QUALITY ASSURANCE

- A. Masonry Installer Qualifications:
1. Experience: Installer with minimum of 10 years specialized experience installing Work similar to scope of Project and having record of successful in-service performance.
 2. Supervision: Installer shall maintain a competent supervisor who is on job site during times specified Work is in progress and who has minimum 10 years experience in installing systems similar to type and scope required for Project.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Delivery: 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.
- B. Storage:
1. Masonry Units: Store 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.
 2. Cementitious Materials: Store on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
 3. Aggregates: Store where grading and other required characteristics can be maintained and contamination avoided.
 4. Accessories: Store to prevent corrosion and accumulation of dirt and oil.

1.6 PROJECT CONDITIONS

- A. Protection During Work: Prevent excess moisture from entering Work in progress.
 - 1. Cover tops of walls, projections, and sills with water-repellent tarps or heavy plastic sheets at end of each day's Work.
 - 2. Cover partially completed masonry when construction is not in progress.
 - 3. Extend cover minimum of 24 in down both sides and hold cover securely in place.
 - 4. Protect door frames from damage.
- B. Hot and Cold Weather Requirements: Comply with building code or TMS 602/ACI 530.1/ASCE 6 whichever is more stringent, and following:
 - 1. Do not use frozen materials or materials mixed or coated with ice or frost.
 - 2. Do not build on frozen substrates.
 - 3. Remove and replace masonry damaged by frost or freezing conditions.
 - 4. 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.

PART 2 - PRODUCTS

2.1 MASONRY UNITS, GENERAL

- A. 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.
- B. Shapes: Provide shapes indicated and as follows for each form of unit required:
 - 1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.
 - 2. Provide bullnose units for outside corners, unless otherwise indicated.

2.2 PERFORMANCE REQUIREMENTS

- A. Reinforced Masonry:
 - 1. Provide reinforced masonry that develops net-area compressive strengths (f'_m) at 28 days indicated on Structural Drawings.
 - 2. Determine net-area compressive strength (f'_m) of masonry from average net-area compressive strengths of masonry units and mortar types (unit-strength method).

2.3 STANDARD CONCRETE MASONRY UNITS (CMU)

- A. Product Quality Standard: ASTM C 90, with following physical properties:
 - 1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 1900 psi for 3 units and minimum 1700 psi for individual unit.
 - 2. Weight Classification: Lightweight.
 - 3. Size (Width): Manufactured to dimensions 3/8 in less than nominal dimensions.
 - 4. Exposed Faces: Manufacturer's standard.

5. Faces to Receive Direct Bonded Portland Cement Plaster: Provide coarse textured face units made with gap-graded aggregates.

2.4 LINTELS

- A. Masonry Lintels: Prefabricated or built-in-place masonry lintels made from bond beam concrete masonry units with reinforcing bars placed as indicated and filled with coarse grout. Cure precast lintels before handling and installing.

2.5 MORTAR AND GROUT MATERIALS

- A. Portland Cement: ASTM C 150, Type I; except Type III may be used for cold-weather construction.
- B. Hydrated Lime: ASTM C 207, Type S.
- C. Types of Cement Not Acceptable:
 1. ASTM C 91 masonry cement
 2. ASTM C 1329 mortar cement.
- D. Aggregate: ASTM C 144.
- E. Aggregate for Grout: ASTM C 404.
- F. Water: Potable.

2.6 JOINT REINFORCEMENT

- A. Masonry Joint Reinforcement, General:
 1. Product Quality Standard: ASTM A 951.
 2. Interior Walls: Mill galvanized, carbon steel.
 3. Exterior Walls: Hot-dip galvanized, carbon steel.
 4. Wire Size for Side Rods: One of following diameters as indicated on Drawings, required by building code, or required by TMS 602/ACI 530.1/ASCE 6:
 - a. W1.7 or 9 ga (0.148 in).
 - b. W2.8 or 3/16 in (0.188 in).
 5. Wire Size for Cross Rods: One of following diameters as indicated on Drawings, required by building code, or required by TMS 602/ACI 530.1/ASCE 6:
 - a. W1.7 or 9 ga (0.148 in).
 - b. W2.8 or 3/16 in (0.188 in).
 6. Spacing of Cross Rods, Tabs, and Cross Ties: Not more than 16 in on centers.
 7. Lengths: Not less than 10 ft, with prefabricated corner and tee units.
- B. Masonry Joint Reinforcement for Single-Wythe Masonry: Either ladder or truss type with single pair of side rods.

2.7 REINFORCEMENT

- A. Uncoated Steel Reinforcing Bars Product Quality Standard: ASTM A 615 or ASTM A 996, Grade 60.

2.8 MISCELLANEOUS MASONRY ACCESSORIES

- A. Compressible Filler:
 - 1. Product Quality Standard: ASTM D 1056, Grade 2A1.
 - 2. Description: Premolded filler strips formulated from neoprene; compressible up to 35 percent; of width and thickness indicated.
- B. Preformed Control Joint Gaskets:
 - 1. Product Quality Standard: ASTM D 2000, Designation M2AA-805.
 - 2. Description: Formed from styrene-butadiene-rubber compound designed to fit standard sash block to maintain lateral stability in masonry wall; size and configuration as indicated.
- C. Bond Breaker Strips:
 - 1. Product Quality Standard: ASTM D 226, Type I.
 - 2. Description: Asphalt-saturated, organic roofing felt (No. 15 asphalt felt).
- D. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells with loops for holding reinforcing bars in center of cells. Units are formed from 0.142 in steel wire, hot-dip galvanized after fabrication. Provide units with either two loops or four loops as needed for number of bars indicated.

2.9 MORTAR AND GROUT MIXES

- A. General: Mix cementitious materials in a mechanical batch mixer with a sufficient amount of water to produce a workable consistency for minimum 3 minutes to 5 minutes; do not hand mix.
 - 1. Admixture Limitation: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, calcium chloride, or other admixtures, unless otherwise indicated.
 - 2. Cementitious Limitation: Limit cementitious materials in mortar and grout to portland cement and lime.
 - 3. Ingredient Measurement: Measure in a one cubic foot batching box before mixing for component materials not preblended, prepackaged or containerized.
 - 4. Aggregate Moisture Content: Monitor moisture content of aggregates and exercise caution when mixing to avoid over or under-saturation of the mortar.
- B. Mortar Mix:
 - 1. Mix Quality Standard: ASTM C 270, Proportion Specification for portland cement-lime mortars, Types as follows for applications stated unless another type is indicated:
 - a. Non-Reinforced Masonry: Type N.
 - b. Reinforced Masonry: Type S.
 - c. Other Applications: Type N where another type is not indicated.

2. Mortar Color: Standard gray.

C. Grout for Unit Masonry:

1. Product Quality Standard: ASTM C 476.
2. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with Table 1.15.1 in TMS 602/ACI 530.1/ASCE 6 for dimensions of grout spaces and pour height.
3. Use fine grout in grout spaces less than 2 inches in horizontal dimension.
4. Use coarse grout in grout spaces 2 inches or more in least horizontal dimension.
5. Provide grout with a slump of 8 to 11 in as measured according to ASTM C 143.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Acceptance of Surfaces and Conditions: Examine substrates to which masonry will be placed for compliance with requirements, installation tolerances and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with the Contract Documents. Starting Work within a particular area will be construed as acceptance.

3.2 PREPARATION

- A. Substrate Cleaning: Remove construction debris, dust, dirt, mud, oil, and other materials on surfaces that would adversely affect or reduce bond of masonry and mortar.

3.3 INSTALLATION, GENERAL

- A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:
1. TMS 602/ACI 530.1/ASCE 6, unless local building code has jurisdiction.
 2. Applicable portions of NCMA TEK's.
 3. Respective manufacturer's written installation instructions.
 4. Approved submittals.
 5. Contract Documents.
- B. 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.
- C. Chases and Recesses: Build to accommodate items specified in this and other Sections.
- D. Openings: Leave for equipment to be installed before completing masonry. After installing equipment, complete masonry to match the construction immediately adjacent to opening.
- E. Cutting: 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. Install cut units with cut surfaces and, where possible, cut edges concealed.

3.4 LAYING MASONRY WALLS

- A. General: Lay out walls in advance for accurate spacing of surface bond patterns, uniform joint thicknesses, accurate location of openings, movement-type joints, returns, and offsets. Avoid using less than half-size units at corners, jambs, and, where possible at other locations.
- B. Bond Pattern for Exposed Masonry:
 - 1. Concealed Masonry: Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than 4 in lap.
 - 2. Corners: Bond and interlock each course of each wythe at corners. Do not use units with less than nominal 8 in horizontal face dimensions at corners or jambs.
- 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.
- D. Built-in Work:
 - 1. As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.
 - 2. Fill space between steel frames and masonry solidly with mortar, unless otherwise indicated.
 - 3. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath, wire mesh, or plastic mesh in the joint below and rod mortar or grout into core.
- E. Concrete Masonry Cores Under Loads: Fill cores in hollow concrete masonry units with grout 24 in under bearing plates, beams, lintels, posts, and similar items, unless otherwise indicated.

3.5 MORTAR BEDDING AND JOINTING

- A. Mortar Joint Thickness: Minimum 3/8 in wide for head and bed joints.
- B. Hollow Concrete Masonry Units: Lay 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.
- C. Joint Tooling: Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness, unless otherwise indicated.
 - 1. Make mortar joints straight, clean, and uniform in thickness. Tool joints to produce dense surface well bonded to edges.
 - 2. Joints which are not tight at time of tooling shall be raked out, pointed, and then tooled.
 - 3. Tool when mortar is partially set but still sufficiently plastic to bond.
 - 4. Use a tool which compacts mortar, pressing excess mortar out of joint rather than dragging it out.
 - 5. Tool vertical joint first.

- D. Joints at Direct Applied Finishes: Cut joints flush for masonry walls to receive plaster or other direct-applied finishes (other than paint), unless otherwise indicated.

3.6 MASONRY JOINT REINFORCEMENT

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

3.7 CONTROL JOINTS

- A. General: Install control joint materials as masonry progresses. Do not allow materials to span control joints without provision to allow for in-plane wall or partition movement. Maintain joints free and clear of mortar.
- B. Control Joints: Form in concrete masonry using one of following methods:
 - 1. Install preformed control-joint gaskets designed to fit standard sash block.
 - 2. Install temporary foam-plastic filler in head joints and remove filler when unit masonry is complete for application of sealant.
 - 3. At structural bond beams, provide dummy groove or raked joint. Do not extend control joints through bond beams.
- C. Control Joint Spacing: Locate 3/8 in wide control joints as indicated but do not exceed 30 ft on centers.

3.8 LINTELS

- A. Masonry Lintels: Provide lintels where shown and where openings of more than 24 in for block-size units are shown without structural steel or other supporting lintels.
 - 1. Provide built-in-place masonry lintels. Use specially formed bond beam units with reinforcing bars placed and filled with coarse grout. Cure precast lintels before handling and installing.
- B. Minimum Bearing: Provide 8 in at each jamb, unless otherwise indicated.

3.9 REINFORCED MASONRY

- 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 TMS 602/ACI 530.1/ASCE 6.
1. Provide minimum bar lap splice not less than 48 bar diameters unless otherwise indicated.
 2. Provide corner bars of same size and spacing as horizontal bars unless otherwise indicated.
- C. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.
1. Comply with requirements in TMS 602/ACI 530.1/ASCE 6 for cleanouts and for grout placement, including minimum grout space and maximum pour height unless otherwise required by local applicable code.
 2. Place grout only after inspectors have verified compliance of grout spaces and grades, sizes, and locations of reinforcement.
 3. Limit height of vertical grout pours to not more than 60 in.
 4. Fill with grout, vertical cells, bond beams, lintels and other structural members having reinforcement. Secure in place and inspect reinforcing before grouting. Keep mortar droppings out of grout space and puddle or vibrate grout in place.
 5. Provide solid bearing under structural members at least 8 in vertically and at least 16 in horizontally. Bearing may be solid units, or hollow units with grout. Fill cells in units adjacent to openings.
 6. Grout from inside face of masonry and prevent grout from staining masonry face. Protect projecting surfaces from droppings and clean immediately any grout which comes in contact with face of masonry.

3.10 TOLERANCES

- A. Conspicuous Lines:
1. Vertical: For such conditions as external corners, door and window jambs, reveals, and expansion joints, maximum variation of one of following from plumb:
 - a. 1/4 in in 20 ft.
 - b. 1/2 in overall.
 2. Horizontal: For such conditions as exposed lintels, sills, door and window heads, parapets, and reveals, maximum variation of one of following from level:
 - a. 1/4 in in 20 ft.
 - b. 1/2 in overall.
- B. Exposed Head Joints:
1. Vertical Alignment: Maximum variation of one of following from plumb:
 - a. 1/4 in in 10 ft.

- b. 1/2 in from plumb top to bottom of wall.
 - 2. Thickness: Maximum variation from width indicated of plus or minus 1/8 in; maximum variation from adjacent bed joint and head joint thicknesses 1/8 in.
 - C. Flush Alignment: Maximum variation of 1/16 in except due to warpage of masonry units with tolerances specified for warpage of units.
- 3.11 ADJUSTING
- A. Damaged Units: 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 tooling of joints, enlarge voids and holes, except weeps and vents, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.
- 3.12 PROTECTION
- A. Protection of Work: When installed at building interiors, provide protection of lower 96 in portion of [decorative concrete masonry] [pre-faced concrete masonry] in form of rigid panels to prevent damage and to resist staining.
 - B. Cleaning: During cleaning operations, protect surrounding areas, landscaping, adjacent surfaces, and vehicles from contact with cleaning products.
 - 1. Clean surfaces prior to installation of windows and doors.
 - 2. Avoid drifting of spray caused by wind.
- 3.13 CLEANING
- A. In-Progress Cleaning: Clean unit masonry as Work progresses by dry brushing to remove mortar fins and smears before tooling joints.
 - B. Final Cleaning: After mortar is thoroughly set and cured, remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.

END OF SECTION

SECTION 05 1200
STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Structural steel framing members, base plates, plates, and grouting under base plates.

1.2 SUBMITTALS

- A. Shop Drawings: Indicate sizes, spacing, and locations of structural members, openings, connections, cambers, loads, and welded connections.

1.3 QUALITY ASSURANCE

- A. Fabricate structural steel members in accordance with AISC - Specification for the Design, Fabrication and Erection of Structural Steel for Buildings.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Structural Steel Members: ASTM A36.
- B. Structural Tubing: ASTM A501.
- C. Pipe: ASTM A53, Grade B.
- D. Bolts, Nuts, and Washers: ASTM A325, galvanized to ASTM A153 for galvanized members.
- E. Anchor Bolts: ASTM A307.
- F. Welding Materials: AWS D1.1; type required for materials being welded.
- G. Grout: Non-shrink type, pre-mixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing additives, capable of developing a minimum compressive strength of 7,000 psi at 28 days.
- H. Shop and Touch-Up Primer: SSPC 15, Type 1, red oxide.

2.2 FABRICATION

- A. Continuously seal joined members by continuous welds. Grind exposed welds smooth.

2.3 FINISH

- A. Prepare structural component surfaces in accordance with SSPC SP 2.
- B. Shop prime structural steel members. Do not prime surfaces that will be fireproofed, field welded, in contact with concrete, or high strength bolted.

PART 3 - EXECUTION

3.1 EXAMINATION AND PREPARATION

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

3.2 ERECTION

- A. Allow for erection loads. Provide temporary bracing to maintain framing in alignment until completion of erection and installation of permanent bridging and bracing.
- B. Field weld components indicated on Drawings and shop drawings.
- C. Do not field cut or alter structural members without approval of Architect/Engineer.
- D. After erection, prime welds, abrasions, and surfaces not shop primed, except surfaces to be in contact with concrete.
- E. Grout under base plates.

3.3 FIELD QUALITY CONTROL

- A. Field inspection of members, connections, and torquing.

END OF SECTION

SECTION 05 2100

STEEL JOISTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Open web steel joists with bridging, attached seats and anchors.

1.2 SUBMITTALS

- A. Shop Drawings: Indicate configuration, sizes, spacing, locations of joists, joist leg extensions, bridging, connections, attachments, and cambers.

1.3 QUALITY ASSURANCE

- A. Perform Work in accordance with SJI.
- B. Utilize Load Tables, and Weight Tables, including headers and other supplementary framing.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Open Web Joists Members: SJI Type K Open Web, Longspan LH, or Deep Longspan DLH and Joist Girders.
- B. Anchor Bolts, Nuts and Washers: ASTM A307, galvanized to ASTM A153.
- C. Primer: SSPC 15, Type 1, red oxide.
- D. Supplementary Framing: ASTM A36.
- E. Welding Materials: AWS D1.1; type required for materials being welded.

2.2 FABRICATION

- A. Provide bottom and top chord extensions as indicated.
- B. Drill holes in chords necessary for attachment of wood nailers. Weld threaded lugs to chords for attachment of wood nailers.

2.3 FINISH

- A. Shop prime joists. Do not prime surfaces that will be fireproofed, field welded, or in contact with concrete.

PART 3 - EXECUTION

3.1 EXAMINATION AND PREPARATION

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

3.2 ERECTION

- A. Erect and bear joists on supports.
- B. Allow for erection loads. Provide temporary bracing to maintain framing in alignment until completion of erection and installation of permanent bridging and bracing.
- C. After joist alignment, field weld joist seat to bearing surfaces.
- D. Position and field weld joist chord extensions and wall attachments as detailed.
- E. Frame floor/roof openings greater than 18 inches with supplementary framing.
- F. After erection, prime welds, abrasions, and surfaces not shop primed except surfaces to be in contact with concrete.

3.3 FIELD QUALITY CONTROL

- A. Field inspection of members, connections, and torquing.

END OF SECTION

SECTION 05 3100

STEEL DECKING

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Steel deck and accessories; framing for openings up to and including 18 inches; bearing plates and angles.

1.2 SUBMITTALS

- A. Shop Drawings: Indicate decking plan, support locations, projections, openings and reinforcement, pertinent details, and accessories.
- B. Product Data: Deck profile characteristics and dimensions, structural properties, and finishes.

PART 2 - PRODUCTS

2.1 METAL DECK

- A. Deck Type:
 - 1. Type B wide rib deck of carbon steel of specified gage.
- B. Sheet Steel: ASTM A446, Grade B Structural Quality; with G30 galvanized coating conforming to ASTM A525.
- C. Bearing Plates, Angles: ASTM A36 steel.
- D. Welding Materials: AWS D1.1.
- E. Touch-Up Primer: Zinc chromate type.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Erect metal decking in accordance with manufacturer's instructions.
- B. Bear decking on support surfaces with minimum bearing as specified on Drawings. Align and level.
- C. Fasten ribbed deck to steel support members at ends and intermediate supports with fusion welds through weld washers at 12 inches oc maximum, parallel with the deck flute and at each transverse flute.
- D. Weld in accordance with AWS D1.1.
- E. Weld male/female side laps at 18 inches oc maximum.

- F. Reinforce steel deck openings from 6 to 18 inches in size with 2 x 2 x 1/4 inch steel angles. Place angles perpendicular to flutes; extend minimum two flutes beyond each side of opening and fusion weld to deck at each flute.
- G. Install 6 inch minimum wide sheet steel cover plates, of same thickness as decking, where deck changes direction. Fusion weld.
- H. Install wet concrete stops at deck edge upturned to top surface of slab.
- I. Install sheet steel closures and angle flashings to close openings between deck and walls, columns, and openings.
- J. Install single row of foam flute closures above walls and partitions perpendicular to deck flutes.
- K. Position roof sump pans with flange bearing on top surface of deck. Attach at each deck flute.
- L. Place cant strips in position and attach.
- M. Immediately after welding deck and other metal components in position, coat welds, weld blooms, burned areas, and damaged surface coating, with touch-up prime paint.

END OF SECTION

SECTION 05 4000
COLD FORMED METAL FRAMING

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Load bearing formed steel stud framing.
- B. Formed steel joist, purlin, slotted channel framing and bridging.

1.2 SUBMITTALS

- A. Shop Drawings: Indicate component details, framed openings, bearing, anchorage, loading, welds, type and location of fasteners, and accessories or items required of related work.
- B. Indicate stud, floor joist, ceiling joist, roof joist, roof rafter, and roof truss layout.
- C. Product Data: Describe materials and finish, product criteria, and limitations.

PART 2 - PRODUCTS

2.1 FRAMING MATERIALS

- A. As specified on Drawings.

2.2 ACCESSORIES

- A. Bracing, Furring, Bridging, Plates, Gussets, Clips: Formed sheet steel, thickness determined for conditions encountered; same finish as framing members.
- B. Screws: ASTM A90, hot dip galvanized, self-drilling, self-tapping.
- C. Anchorage Devices: Power actuated or Drilled expansion bolts.
- D. Welding: In accordance with AWS D1.1 and AWS D1.3.
- E. Primer: Touch-up for galvanized surfaces.

2.3 FABRICATION

- A. Fabricate assemblies of sizes and profiles required; with framing members fitted, reinforced and braced.
- B. Fit and assemble in largest practical sections for delivery to site, ready for installation.

2.4 FINISHES

- A. Studs and Accessories: Galvanize to G90 coating class.
- B. Joists, Purlins and Accessories: Galvanize to G90 coating class.

PART 3 - EXECUTION

3.1 EXAMINATION AND PREPARATION

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

3.2 ERECTION OF STUDDING

- A. Install components in accordance with manufacturer's instructions.
- B. Align floor and ceiling tracks; locate to layout. Coordinate installation of sealant with floor and ceiling tracks.
- C. Construct corners using minimum three studs. Double stud wall openings, door and window jambs.
- D. Erect load bearing studs one piece full length. Splicing of studs is not permitted.
- E. Allow for deflection, directly below horizontal building framing for non-load bearing framing.
- F. Attach cross studs/furring channels to studs for attachment of fixtures anchored to walls and for attachment of mechanical and electrical items within walls.
- G. Touch-up field welds and damaged prefinished surfaces with primer.

3.3 ERECTION OF JOISTS/PURLINS

- A. Install framing components in accordance with manufacturer's instructions.
- B. Make provisions for erection stresses. Provide temporary alignment and bracing.
- C. Set joists parallel and level, with lateral bracing and bridging.
- D. Locate joist end bearing directly over load bearing studs or provide load distributing member to top of stud track.
- E. Provide web stiffeners at reaction points.
- F. Touch-up field welds and damaged prefinished surfaces with primer.

END OF SECTION

SECTION 055000
METAL FABRICATIONS

PART 1 - GENERAL

- 1.1 RELATED DOCUMENTS
- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- 1.2 SUMMARY
- A. Section Includes:
1. Steel framing and supports for countertops.
 2. Steel framing and supports for mechanical and electrical equipment.
 3. Steel framing and supports for applications where framing and supports are not specified in other Sections.
 4. Metal bollards.
 5. Loose bearing and leveling plates for applications where they are not specified in other Sections.
- B. Products furnished, but not installed, under this Section:
1. Loose steel lintels.
 2. Anchor bolts, steel pipe sleeves, slotted-channel inserts, and wedge-type inserts indicated to be cast into concrete or built into unit masonry.
- 1.3 PERFORMANCE REQUIREMENTS
- A. Delegated Design: Design ladders alternating tread devices, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- 1.4 SUBMITTALS
- A. Product Data: For the following:
1. Paint products.
 2. Grout.
- B. Sustainable Submittals:
1. Product Data indicating percentages by weight of postconsumer and preconsumer recycled content for products having recycled content. Include statement indicating costs for each product having recycled content.
- 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.
- 1.5 QUALITY ASSURANCE
- A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code - Steel."
- B. Welding Qualifications: Qualify procedures and personnel according to the following:
1. AWS D1.1, "Structural Welding Code - Steel."
 2. AWS D1.2, "Structural Welding Code - Aluminum."
- 1.6 PROJECT CONDITIONS
- A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications 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. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

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

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

2.2 FERROUS METALS

- A. Recycled Content of Steel Products: Provide products with average recycled content of steel products so postconsumer recycled content plus one-half of preconsumer recycled content is not less than 10 percent.
- B. Steel Plates, Shapes, and Bars: ASTM A 36.
- C. Steel Pipe: ASTM A 53, standard weight (Schedule 40) unless otherwise indicated.
- D. Slotted Channel Framing: Cold-formed metal box channels (struts) complying with MFMA-4.
 - 1. Size of Channels: 1-5/8 by 1-5/8 inches.
 - 2. Material: Galvanized steel, ASTM A 653, commercial steel, Type B, with G90coating; 0.108-inch nominal thickness.

2.3 FASTENERS

- A. General: Unless otherwise indicated, provide Type 304 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.
 - 1. Provide stainless-steel fasteners for fastening aluminum.
- B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade AASTM F 568M, Property Class 4.6; with hex nuts, ASTM A 563; and, where indicated, flat washers.
- C. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 325, Type 3; with hex nuts, ASTM A 563, Grade C3; and, where indicated, flat washers.
- D. Stainless-Steel Bolts and Nuts: Regular hexagon-head annealed stainless-steel bolts, ASTM F 593; with hex nuts, ASTM F 594; and, where indicated, flat washers; Alloy Group 1.
- E. 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.
- F. Eyebolts: ASTM A 489.
- G. Machine Screws: ASME B18.6.
- H. Lag Screws: ASME B18.2.
- I. Wood Screws: Flat head, ASME B18.6.1.
- J. Plain Washers: Round, ASME B18.22.
- K. Lock Washers: Helical, spring type, ASME B18.21.
- L. Anchors, General: Anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.
- M. Cast-in-Place Anchors in Concrete: Either threaded type or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A 47 malleable iron or ASTM A 27 cast steel. Provide bolts, washers, and shims as needed, all hot-dip galvanized per ASTM F 2329.

2.4 MISCELLANEOUS MATERIALS

- A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
- B. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.
- C. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.
- D. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.
- E. Non-shrink, Metallic Grout: Factory-packaged, ferrous-aggregate grout complying with ASTM C 1107, specifically recommended by manufacturer for heavy-duty loading applications.
- F. Non-shrink, Nonmetallic Grout: Factory-packaged, non-staining, non-corrosive, non-gaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

2.5 FABRICATION, GENERAL

- A. Shop Assembly: Pre-assemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

- B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32-inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
 - C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
 - D. Form exposed work with accurate angles and surfaces and straight edges.
 - E. Weld corners and seams continuously to comply with the following:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
 - F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) fasteners unless otherwise indicated. Locate joints where least conspicuous.
 - G. Fabricate seams and other connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.
 - H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.
 - I. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.
 - 1. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8 by 1-1/2 inches, with a minimum 6-inch embedment and 2-inch hook, not less than 8 inches from ends and corners of units and 24 inches o.c., unless otherwise indicated.
- 2.6 MISCELLANEOUS FRAMING AND SUPPORTS
- A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.
 - B. Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction.
 - 1. Fabricate units from slotted channel framing where indicated.
- 2.7 METAL BOLLARDS
- A. Fabricate metal bollards from Schedule 80 steel pipe.
 - 1. Cap bollards with 1/4-inch- thick steel plate.
 - 2. Where bollards are indicated to receive controls for door operators, provide necessary cutouts for controls and holes for wire.
 - 3. Where bollards are indicated to receive light fixtures, provide necessary cutouts for fixtures and holes for wire.
 - B. Fabricate sleeves for bollard anchorage from steel pipe with 1/4-inch- thick steel plate welded to bottom of sleeve. Make sleeves not less than 8 inches deep and 3/4 inch larger than OD of bollard.
 - C. Prime bollards with zinc-rich primer.
- 2.8 LOOSE BEARING AND LEVELING PLATES
- A. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts and for grouting.
 - B. Galvanize plates.
 - C. Prime plates with zinc-rich primer.
- 2.9 LOOSE STEEL LINTELS
- A. Fabricate loose steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated. Fabricate in single lengths for each opening unless otherwise indicated. Weld adjoining members together to form a single unit where indicated.
 - B. Galvanize loose steel lintels located in exterior walls.
- 2.10 FINISHES, GENERAL
- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
 - B. Finish metal fabrications after assembly.
 - C. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

2.11 STEEL AND IRON FINISHES

- A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A 153 for steel and iron hardware and with ASTM A 123 for other steel and iron products.
 - 1. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.
- B. Shop prime iron and steel items not indicated to be galvanized unless they are to be embedded in concrete, sprayed-on fireproofing, or masonry, or unless otherwise indicated.
 - 1. Shop prime with universal shop primer unless zinc-rich primer is indicated.

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

- A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.
- B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
- C. Field Welding: Comply with the following requirements:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag screws, wood screws, and other connectors.
- E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.
- F. Corrosion Protection: Coat concealed surfaces of aluminum that will come into contact with grout, concrete, masonry, wood, or dissimilar metals with the following:
 - 1. Cast Aluminum: Heavy coat of bituminous paint.
 - 2. Extruded Aluminum: Two coats of clear lacquer.

3.2 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

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

3.3 INSTALLING METAL BOLLARDS

- A. Fill metal-capped bollards solidly with concrete and allow concrete to cure seven days before installing.
- B. Anchor bollards in concrete with pipe sleeves preset and anchored into concrete. Fill annular space around bollard solidly with non-shrink, non-metallic grout; mixed and placed to comply with grout manufacturer's written instructions. Slope grout up approximately 1/8 inch toward bollard.
- C. Fill bollards solidly with concrete, mounding top surface to shed water.
 - 1. Do not fill removable bollards with concrete.

3.4 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 non-shrink grout, either metallic or nonmetallic, in concealed locations where not exposed to moisture; use non-shrink, nonmetallic grout in exposed locations unless otherwise indicated.
 - 2. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.5 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. 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 057000
DECORATIVE METAL

PART 1 - GENERAL

- 1.1 RELATED DOCUMENTS
- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- 1.2 SUMMARY
- A. Section Includes:
1. Decorative metal items for various applications, including:
 - a. Wall base.
- 1.3 SUBMITTALS
- A. Product Data: For each type of product indicated, including finishing materials.
- B. Sustainable Submittals:
1. Product data 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: Show fabrication and installation details for decorative metal.
1. Include plans, elevations, component details, and attachments to other work.
 2. Indicate materials and profiles of each decorative metal member, fittings, joinery, finishes, fasteners, anchorages, and accessory items.
- D. Samples for Initial Selection: For products involving selection of color, texture, or design including mechanical finishes.
- 1.4 QUALITY ASSURANCE
- A. Fabricator Qualifications: A firm experienced in producing decorative metal similar to that indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- B. Installer Qualifications: Fabricator of products.
- 1.5 DELIVERY, STORAGE, AND HANDLING
- A. Store decorative metal in a well-ventilated area, away from uncured concrete and masonry, and protected from weather, moisture, soiling, abrasion, extreme temperatures, and humidity.
- B. Deliver and store cast-metal products in wooden crates surrounded by sufficient packing material to ensure that products will not be cracked or otherwise damaged.
- 1.6 PROJECT CONDITIONS
- A. Field Measurements: Verify actual locations of walls and other construction contiguous with decorative metal by field measurements before fabrication and indicate measurements on Shop Drawings.
- 1.7 COORDINATION
- A. Coordinate installation of anchorages for decorative metal items. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

PART 2 - PRODUCTS

- 2.1 METALS, GENERAL
- A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. Provide materials without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.
- 2.2 STAINLESS STEEL
- A. Sheet, Strip, Plate, and Flat Bar: ASTM A 666, Type 304.
- B. Bars and Shapes: ASTM A 276, Type 304.

2.3 FASTENERS

- A. Fastener Materials: Unless otherwise indicated, provide the following:
 - 1. Stainless-Steel Items: Type 304 stainless-steel fasteners.
- B. Fasteners for Anchoring to Other Construction: Unless otherwise indicated, select fasteners of type, grade, and class required to produce connections suitable for anchoring indicated items to other types of construction indicated.
- C. Provide concealed fasteners for interconnecting components and for attaching decorative metal items to other work unless otherwise indicated.
 - 1. Provide Phillips flat-head machine screws for exposed fasteners unless otherwise indicated.

2.4 MISCELLANEOUS MATERIALS

- A. Shop Primer for Galvanized Steel: Water-based galvanized metal primer complying with MPI#134.
- B. Intermediate Coats and Topcoats for Steel: Provide products that comply with Division 09 painting Sections and Division 09 Section "High-Performance Coatings."

2.5 FABRICATION, GENERAL

- A. Assemble items 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 re-assembly and coordinated installation. Use connections that maintain structural value of joined pieces.
- B. Form decorative metal to required shapes and sizes, true to line and level with true curves and accurate angles and surfaces. Finish exposed surfaces to smooth, sharp, well-defined lines and arris.
- C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing the Work.
- D. Form simple and compound curves in bars, pipe, tubing, and extruded shapes by bending members in jigs to produce uniform curvature for each configuration required; maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces.
- E. 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.
- F. Mill joints to a tight, hairline fit. Cope or miter corner joints. Fabricate connections that will be exposed to weather in a manner to exclude water.
- G. Provide weep holes where water may accumulate. Locate weep holes in inconspicuous locations.
- H. Provide necessary rebates, lugs, and brackets to assemble units and to attach to other work. Cut, reinforce, drill, and tap as needed to receive finish hardware, screws, and similar items unless otherwise indicated.
- I. Comply with AWS for recommended practices in shop welding. Weld behind finished surfaces without distorting or discoloring exposed side. Clean exposed welded joints of flux, and dress exposed and contact surfaces.
 - 1. Where welding cannot be concealed behind finished surfaces, finish joints to comply with NOMMA's "Voluntary Joint Finish Standards" for Type 4 Welds: good quality, uniform undressed weld with minimal splatter.
- J. Provide castings that are sound and free of warp, cracks, blowholes, or other defects that impair strength or appearance. Grind, wire brush, sandblast, and buff castings to remove seams, gate marks, casting flash, and other casting marks.

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 STAINLESS-STEEL FINISHES

- A. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
- B. Directional Satin Finish: No. 4.

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

3.2 INSTALLATION, GENERAL

- A. Perform cutting, drilling, and fitting required to install decorative metal. Set products accurately in location, alignment, and elevation, measured from established lines and levels. Provide temporary bracing or anchors in formwork for items to be built into concrete, masonry, or similar construction.
- B. Fit exposed connections accurately together to form tight, hairline joints or, where indicated, uniform reveals and spaces for sealants and joint fillers. Where cutting, welding, and grinding are required for proper shop fitting and jointing of decorative metal, restore finishes to eliminate evidence of such corrective work.
- C. Do not cut or abrade finishes that cannot be completely restored in the field. Return items with such finishes to the shop for required alterations, followed by complete refinishing, or provide new units as required.
- D. Restore protective coverings that have been damaged during shipment or installation. Remove protective coverings only when there is no possibility of damage from other work yet to be performed at same location.
 - 1. Retain protective coverings intact; remove coverings simultaneously from similarly finished items to preclude non-uniform oxidation and discoloration.

3.3 CLEANING AND PROTECTION

- A. Unless otherwise indicated, clean metals by washing thoroughly with clean water and soap, rinsing with clean water, and drying with soft cloths.
- B. Protect finishes of decorative metal from damage during construction period with temporary protective coverings approved by decorative metal fabricator. Remove protective covering at time of Substantial Completion.
- C. Restore finishes damaged during installation and construction period so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit, or provide new units.

END OF SECTION

SECTION 057300**DECORATIVE RAILINGS****PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Steel decorative 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. Structural capacities: Handrails, guardrails, and their supports must be designed for 50 lbs per linear foot, applied in any direction at the top of the top rail, and a concentrated load of 200 lbs applied in any direction at any location along the top of the top rail
- C. General: In engineering railings to withstand structural loads indicated, determine allowable design working stresses of railing materials based on the following:
 - 1. Steel: 72 percent of minimum yield strength.
- D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior metal fabrications by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.
 - 1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

1.5 SUBMITTALS

- A. Product Data: For the following:
 - 1. Manufacturer's product lines of railings assembled from standard components.
- B. Sustainable Submittals:
 - 1. Product data 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: Include plans, elevations, 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.

1.6 QUALITY ASSURANCE

- A. Source Limitations: Obtain each type of railing from single source from single manufacturer.
- B. Product Options: Information on Drawings and in Specifications establishes requirements for system's 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 structural analysis, preconstruction testing, field testing, and in-service performance.
 - 1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.
- C. Product Options: Drawings indicate size, profiles, and dimensional requirements of railings and are based on the specific system indicated. Refer to Division 01 Section "Product Requirements."
 - 1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for

review.

- D. Welding Qualifications: Qualify procedures and personnel according to the following:
1. AWS D1.1/D1.1M, "Structural Welding Code - 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.

1.8 COORDINATION AND SCHEDULING

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of anchorages for railings. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.
- C. Schedule installation so wall attachments are made only to completed walls. Do not support railings temporarily by any means that do not suit structural performance requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with requirements, provide products by, but not limited to, one of the following:
1. Greco, a CSW Industrial Company.
 2. Livers Bronze Co.
 3. VIVA Railings, L.L.C.

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 formed-steel brackets with predrilled hole for bolted anchorage and with snap-on cover that matches rail finish and conceals bracket base and bolt head.

2.3 STEEL

- A. Tubing: ASTM A500/A500M (cold formed) or ASTM A513.
- B. Bars: Hot-rolled, carbon steel complying with ASTM A29/A29M, Grade 1010.
- C. Plates, Shapes, and Bars: ASTM A36/A36M.

2.4 FASTENERS

- A. Fastener Materials: Unless otherwise indicated, provide the following:
1. Type 304 stainless-steel fasteners.
- B. Fasteners for Anchoring to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings to other types of construction indicated.
- C. Provide concealed fasteners for interconnecting railing components and for attaching railings to other work unless exposed fasteners are unavoidable.
1. Provide Phillips flat-head machine screws for exposed fasteners unless otherwise indicated.
- D. Anchors, General: Anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.
- E. Post-Installed Anchors: Torque-controlled expansion anchors.
1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941, Class Fe, unless otherwise indicated.
 2. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 stainless-steel bolts, ASTM F 593, and nuts, ASTM F 594.

2.5 MISCELLANEOUS MATERIALS

- A. Non-shrink, Non-metallic Grout: Factory-packaged, non-staining, non-corrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

2.6 FABRICATION

- A. General: Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage.
- 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. Locate weep holes in inconspicuous locations.
- F. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.
- G. Connections: Fabricate railings with welded connections unless otherwise indicated.
- H. Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove flux immediately.
 - 4. At exposed connections, finish exposed welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Type 1 welds: no evidence of a welded joint.
- I. Mechanical Connections: Connect members with concealed mechanical fasteners and fittings. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.
 - 1. Fabricate splice joints for field connection using an epoxy structural adhesive if this is manufacturer's standard splicing method.
- J. Form changes in direction as follows:
 - 1. By bending.
- K. Bend members in jigs to produce uniform curvature for each configuration required; maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.
- L. Close exposed ends of hollow railing members with prefabricated end fittings.
- M. Provide wall returns at ends of wall-mounted handrails unless otherwise indicated. Close ends of returns, unless clearance between end of rail and wall is 1/4 inch or less.
- N. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work unless otherwise indicated.
 - 1. At brackets and fittings fastened to plaster or gypsum board partitions, provide crush-resistant fillers, or other means to transfer loads through wall finishes to structural supports and prevent bracket or fitting rotation and crushing of substrate.
- O. Provide inserts and other anchorage devices for connecting railings to concrete or masonry work. Fabricate anchorage devices capable of withstanding loads imposed by railings. Coordinate anchorage devices with supporting structure.
- P. For railing posts set in concrete, provide steel sleeves not less than 6 inches long with inside dimensions not less than 1/2 inch greater than outside dimensions of post, with metal plate forming bottom closure.

2.7 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipment.
- C. Provide exposed fasteners with finish matching appearance, including color and texture, of railings.

2.8 STEEL AND IRON FINISHES

- A. For nongalvanized-steel railings, provide nongalvanized ferrous-metal fittings, brackets, fasteners, and sleeves, but galvanize anchors to be embedded in exterior concrete or masonry.
- B. Preparing Nongalvanized Items for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
- C. Primer Application: Apply shop primer to prepared surfaces of railings unless otherwise indicated. Comply with requirements in SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting. Primer need not be applied to surfaces to be embedded in concrete or masonry.
 - 1. Shop prime uncoated railings with universal shop primer unless zinc-rich primer is indicated.
 - 2. Do not apply primer to galvanized surfaces.

- D. Powder-Coat Finish: Prepare, treat, and coat nongalvanized ferrous metal to comply with resin manufacturer's written instructions and as follows:
 - 1. Prepare uncoated ferrous-metal surfaces to comply with SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 - 2. Treat prepared metal with iron-phosphate pretreatment, rinse, and seal surfaces.
 - 3. Apply thermosetting polyester or acrylic urethane powder coating with cured-film thickness not less than **1.5 mils**.
 - 4. Color: As selected by Architect from manufacturer's full range.

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. Adjust railings before anchoring to ensure matching alignment at abutting joints.
- D. 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 RAILING CONNECTIONS

- A. Non-welded Connections: Use mechanical or adhesive joints for permanently connecting railing components. Use wood blocks and padding to prevent damage to railing members and fittings. Seal recessed holes of exposed locking screws using plastic cement filler colored to match finish of railings.
- B. Welded Connections: Use fully welded joints for permanently connecting railing components. Comply with requirements for welded connections in "Fabrication" Article whether welding is performed in the shop or in the field.

3.4 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 non-shrink, non-metallic grout, 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 non-shrink, non-metallic grout, mixed and placed to comply with anchoring material manufacturer's written instructions.
- C. Cover anchorage joint with flange of same metal as post, welded to post after placing anchoring material.
- D. Leave anchorage joint exposed with anchoring material flush with adjacent surface.
- E. 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 steel railings, weld flanges to posts and bolt to metal-supporting surfaces.

3.5 ATTACHING RAILINGS

- A. Anchor railing ends to concrete and masonry with brackets on underside of rails connected to railing ends and anchored to wall construction with anchors and bolts.
- B. Anchor railing ends to metal surfaces with flanges bolted to metal surfaces and welded to railing ends.
- C. Attach handrails to walls with wall brackets except where end flanges are used. Provide brackets 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.
 - 1. Use type of bracket with flange tapped for concealed anchorage to threaded hanger bolt.
 - 2. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.
- D. Secure wall brackets and railing end flanges to building construction as follows:

1. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.
2. For steel-framed partitions, use hanger or lag bolts set into fire-retardant-treated wood backing between studs. Coordinate with stud installation to locate backing members.

3.6 CLEANING

- A. Clean steel by washing thoroughly with clean water and soap, rinsing with clean water, and wiping dry.
- B. Clean by wiping with a damp cloth and then wiping dry.
- C. 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.

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 the field to the shop; make required alterations and refinish entire unit, or provide new units.

END OF SECTION

SECTION 061000
ROUGH CARPENTRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
1. Rooftop equipment bases and support curbs.
 2. Wood blocking and nailers.
 3. Plywood backing panels.

1.3 DEFINITIONS

- A. Dimension Lumber: Lumber of 2 inches nominal 38 mm actual or greater but less than 5 inches nominal 114 mm actual in least dimension.
- B. Lumber grading agencies, and the abbreviations used to reference them, include the following:
1. NeLMA: Northeastern Lumber Manufacturers' Association.
 2. WCLIB: West Coast Lumber Inspection Bureau.
 3. WWPA: Western Wood Products Association.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.
 2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.
 3. For fire-retardant treatments, include physical properties of treated lumber both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D 5664.
 4. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
 5. Include copies of warranties from chemical treatment manufacturers for each type of treatment.
 6. For adhesives, documentation including printed statement of VOC content.
 7. For composite wood products, documentation indicating that product contains no added formaldehyde.
- B. Sustainable Submittals:
1. Product Data for adhesives, documentation including printed statement of VOC content.
 2. Product Data for composite wood products, documentation indicating that product contains no urea formaldehyde.

1.5 QUALITY ASSURANCE

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

1.6 DELIVERY, STORAGE, AND HANDLING

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

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

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

2.2 WOOD-PRESERVATIVE-TREATED LUMBER

- A. Preservative Treatment by Pressure Process: AWWA U1; Use Category UC2 for interior construction not 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.
- B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or that does not comply with requirements for untreated material.
- C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.
- D. Application: Treat items indicated on Drawings, and the following:
 - 1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
 - 2. Wood sills, sleepers, blocking, and similar concealed members in contact with masonry or concrete.

2.3 FIRE-RETARDANT-TREATED MATERIALS

- A. General: Where fire-retardant-treated materials are indicated, use materials complying with requirements in this article, that are acceptable to authorities having jurisdiction, and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.
- B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with a flame spread index of 25 or less when tested according to ASTM E 84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.
 - 1. Use treatment that does not promote corrosion of metal fasteners.
 - 2. 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 ASTM D 5664 and design value adjustment factors shall be calculated according to ASTM D 6841.
- C. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Kiln-dry plywood after treatment to a maximum moisture content of 15 percent.
- D. Identify fire-retardant-treated wood with appropriate classification marking of qualified testing agency.
- E. Application: Treat all rough carpentry unless otherwise indicated.

2.4 MISCELLANEOUS LUMBER

- A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:
 - 1. Blocking.
 - 2. Nailers.
 - 3. Rooftop equipment bases and support curbs.
- B. For items of dimension lumber size, provide No. 2 grade lumber and any of the following species:
 - 1. Spruce-pine-fir (south); NeLMA, WCLIB, or WWPA.

- C. For blocking not used for attachment of other construction, Utility, Stud, or No. 2 grade lumber of any species may be used provided that it is cut and selected to eliminate defects that will interfere with its attachment and purpose.
 - D. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.
- 2.5 PLYWOOD BACKING PANELS
- A. Equipment Backing Panels: DOC PS 1, Exterior, AC, fire-retardant treated, in thickness indicated or, if not indicated, not less than 3/4-inch nominal thickness.
- 2.6 FASTENERS
- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
 - 1. Where rough 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, Brads, and Staples: ASTM F 1667.
 - C. Power-Driven Fasteners: NES NER-272.
 - D. Wood Screws: ASME B18.6.1.
 - E. Lag Bolts: ASME B18.2.1
 - F. Bolts: Steel bolts complying with ASTM A 307, Grade A with ASTM A 563 hex nuts and, where indicated, flat washers.

PART 3 - EXECUTION

- 3.1 INSTALLATION, GENERAL
- A. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry to other construction; scribe and cope as needed for accurate fit. Locate nailers, blocking, grounds, and similar supports to comply with requirements for attaching other construction.
 - B. Install plywood backing panels by fastening to studs; coordinate locations with utilities requiring backing panels. Install fire-retardant treated plywood backing panels with classification marking of testing agency exposed to view.
 - C. Sort and select lumber so that natural characteristics will not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.
 - D. Comply with AWP A M4 for applying field treatment to cut surfaces of preservative-treated lumber.
 - 1. Use inorganic boron for items that are continuously protected from liquid water.
 - 2. Use copper naphthenate for items not continuously protected from liquid water.
 - E. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
 - 1. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code.
 - 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.
- 3.2 WOOD BLOCKING, AND NAILER INSTALLATION
- A. Install where indicated and where required for attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.
 - B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces unless otherwise indicated.
 - C. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.
- 3.3 PROTECTION
- A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.
 - B. Protect rough carpentry from weather. If, despite protection, rough carpentry becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION

SECTION 066400
PLASTIC PANELING

PART 1 - GENERAL

- 1.1 RELATED DOCUMENTS
- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- 1.2 SUMMARY
- A. Section includes glass-fiber reinforced plastic (FRP) wall paneling and trim accessories.
- 1.3 SUBMITTALS
- A. Product Data: For each type of product indicated.
- B. Sustainable Submittals:
1. Product Data for adhesives sealants, including printed statement of VOC content and chemical components.
 2. Product Data for laminating adhesive used in factory-laminated plastic panels, indicating that product contains no urea formaldehyde.
- 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.
 3. Testing Agency: Acceptable to authorities having jurisdiction.
- 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 PLASTIC SHEET PANELING
- A. General: Gelcoat-finished, glass-fiber reinforced plastic panels complying with ASTM D 5319.
1. Basis-of-Design: Subject to compliance with requirements, provide products as scheduled on Drawings, or comparable products by one of the following:
 - a. Crane, Kemlite Company Inc.
 - b. Marlite.
 - c. Nudo Products, Inc.
 - d. For substitution request, refer to Section "012500 – Substitution Procedures".
 2. Nominal Thickness: Not less than 0.075 inch (1.9 mm).
 3. Surface Finish: Smooth.
 4. Color: As scheduled.
- 2.2 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. Adhesive: As recommended by plastic paneling manufacturer.
1. VOC Content: 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- C. Sealant: Single-component, mildew-resistant, neutral-curing silicone sealant recommended by plastic paneling manufacturer and complying with requirements in Division 07 Section "Joint Sealants."
1. VOC Content: 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

PART 3 - EXECUTION

- 3.1 EXAMINATION
- A. Examine substrates 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.
 - 1. Mark plumb lines on substrate at trim accessory 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. Maintain uniform space between adjacent panels and between panels and floors, ceilings, and fixtures. Fill space with sealant.
 - G. 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 071800
TRAFFIC COATINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes traffic coatings for the following applications:
1. Pedestrian traffic.
 2. Vehicular traffic.

1.3 SUBMITTALS

- A. Product Data: Traffic-coating manufacturer's literature including written instructions for evaluating, preparing, and treating substrate; technical data including tested physical and performance properties; and application instructions.
1. Include VOC content of components.
 2. Traffic-coating manufacturer's color chart.
- B. Shop Drawings: Show extent of each traffic coating. Include details for treating substrate joints and cracks, flashings, deck penetrations, and other termination conditions.
- C. Testing reports.
- D. Samples for Initial Selection: For each type of traffic coating required, provide stepped samples (8 inch square) on rigid backing large enough to illustrate build-up of traffic coatings, of same thickness and material indicated for Work.
- E. Applicator Qualifications:
1. Certification signed by traffic-coating manufacturer, certifying that Applicator complies with manufacturer's requirements to install specified, warranted, traffic coating.
 2. Submit evidence that Applicator's existing company has minimum of 5 years continuous experience in application of specified materials. Submit list of at least five completed projects of similar scope and size, including:
 - a. Project name.
 - b. Owner's name.
 - c. Owner's Representative name, address, and telephone number.
 - d. Description of work.
 - e. Traffic-coating materials used.
 - f. Project supervisor.
 - g. Total cost of traffic-coating work and total cost of project.
 - h. Completion date.
- F. Material Certificates: For each traffic coating, submit a Manufacturer's Certificate, signed by manufacturer, stating that traffic coating complies with ASTM C 957, based on testing of current product formulations within last 3 years.
- G. Maintenance Data: For traffic coatings to include in maintenance manuals. Identify substrates and types of traffic coatings applied. Include recommendations for periodic inspections, cleaning, care, maintenance, and repair of traffic coatings.
- H. Warranty: Copies of traffic-coating manufacturer's warranty and Applicator's warranty, both stating obligations, remedies, limitations, and exclusions.
- I. Following completion of Work, submit traffic-coating manufacturer's warranty inspection reports and completed warranty; submit completed Applicator's warranty.

1.4 QUALITY ASSURANCE

- A. Applicator Qualifications: Qualified firm that is approved, authorized, or licensed by traffic-coating manufacturer to apply traffic coating and that is eligible to receive traffic-coating manufacturer's warranty. Must have installations of specified materials in local area in use for minimum of five years.
1. Employ foreman trained by traffic-coating manufacturer and with minimum of 5-years experience as foreman on similar projects, to be on site at all times during Work.
- B. Source Limitations:
1. Obtain traffic coatings from a single manufacturer.
 2. Obtain primary traffic coating materials, including primers, from traffic coating manufacturer. Obtain

- secondary materials including aggregates, sheet flashings, joint sealants, and substrate repair materials of type and from source recommended in writing by primary material manufacturer.
- C. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."
1. Conduct meeting at Project site.
 2. Review requirements for traffic coating, including:
 - a. Construction schedule and availability of materials, Applicator's personnel, equipment, and facilities needed to make progress and avoid delays.
 - b. Site use, access, staging, and set-up location limitations.
 - c. Forecast weather conditions.
 - d. Ventilation requirements.
 - e. Surface preparation and substrate condition.
 - f. Application procedures.
 - g. Special details and flashings.
 - h. Minimum curing period.
 - i. Testing and inspection requirements.
 - j. Temporary protection and repair of traffic coating.
 - k. Governing regulations if applicable.
 3. Contractor's site foreman, traffic-coating manufacturer's technical representative, traffic-coating Applicator, Owner's Representative, and Architect/Engineer shall attend.
- 1.5 DELIVERY, STORAGE, AND HANDLING
- A. Deliver materials in original packages and containers with seals unbroken labeled with traffic-coating manufacturer's name, product brand name and type, date of manufacture, lot number, and directions for storing and mixing with other components.
 - B. Store materials in original, undamaged containers in clean, dry, protected location on raised platforms with weather-protective, vented coverings, within temperature range required by traffic-coating manufacturer. Protect stored materials from direct sunlight. Traffic-coating manufacturer's standard packaging and covering is not considered adequate weather protection.
 - C. Limit stored materials on structures to safe loading of structure at time materials are stored, and to avoid permanent deck deflection.
 - D. Handle materials to avoid damage.
 - E. Conspicuously mark damaged or opened containers or containers with contaminated materials, and remove from site as soon as possible.
 - F. Remove and replace materials that cannot be applied within stated shelf life.
- 1.6 PROJECT CONDITIONS
- A. Verify existing dimensions and details prior to installation of materials. Notify Architect/ Engineer of conditions found to be different than those indicated in Contract Documents. Architect/Engineer will review situation and inform Contractor and Applicator of changes.
 - B. Comply with Owner's limitations and restrictions for site use and accessibility.
 - C. Environmental Limitations: Apply traffic coating when existing and forecast weather conditions permit traffic coating to be installed according to traffic-coating manufacturer's written instructions and warranty requirements. Do not apply traffic coating under following conditions, unless otherwise recommended by traffic-coating manufacturer and approved by Architect/Engineer.
 1. Do not apply when substrate temperature is below 50 degrees F or less than 5 degrees F above dew point, or outside of range recommended by traffic-coating manufacturer.
 2. Do not apply when ambient temperature is below 40 degrees F or outside of range recommended by traffic-coating manufacturer.
 3. Do not apply to damp or wet substrate; when relative humidity exceeds 85 percent; in snow, rain, fog, or mist; or when snow, rain, fog, or mist is forecast during application or curing period. Apply only to frost-free substrate.
 - D. Install materials in strict accordance with safety requirements required by traffic-coating manufacturer, Material Safety Data Sheets, and local, state, and federal rules and regulations.
 - E. Maintain adequate ventilation during preparation and application of traffic-coating materials. Notify Owner's Representative at least 1 week in advance of Work with materials with noxious vapors. Review application schedule and venting precautions with Owner's Representative prior to beginning application.
 - F. Do not install traffic coating until items that will penetrate membrane have been installed.
- 1.7 WARRANTY
- A. Manufacturer's Warranty:
 1. Written warranty, signed by traffic-coating manufacturer, including
 - a. Repair or replace traffic coating that does not comply with requirements; that does not

- remain watertight; that fails in adhesion, cohesion, or general durability; that experiences abrasion or tearing failure not due to misuse; that experiences surface crazing, fading or chalking; or that deteriorates in manner not clearly specified by submitted traffic-coating manufacturer's data as inherent quality of material for application indicated. Warranty does not include deterioration or failure of traffic coating due to failure of substrate prepared according to requirements, formation of new substrate cracks exceeding 1/16 inch in width, fire, vandalism, or snowplow abuse.
- b. Provide access to warranty repair and replacement areas.
- 2. Warranty Period: 10 years after Substantial Completion date.
- B. Installer's Warranty:
 - 1. Written warranty on warranty form at end of Section, signed by Applicator, including
 - a. Repair or replace traffic coating that does not comply with requirements; that does not remain watertight; that fails in adhesion, cohesion, or general durability; that experiences abrasion or tearing failure not due to misuse; that experiences surface crazing, fading, or chalking; or that deteriorates in manner not clearly specified by submitted traffic-coating manufacturer's data as inherent quality of material for application indicated. Warranty does not include deterioration or failure of traffic coating due to failure of substrate prepared according to requirements, formation of new substrate cracks exceeding 1/16 inch in width, fire, vandalism, or snowplow damage.
 - b. Provide access to warranty repair and replacement areas.
 - c. Repair or replacement, to satisfaction of Owner, of other work or items which may have been displaced or damaged as consequence of defective work.
 - d. Make immediate emergency repairs within 48 hours of notice of leakage.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Traffic Coatings: Complying with ASTM C 957.
- B. Material Compatibility: Provide primers; base, intermediate, and topcoats; and miscellaneous materials that are compatible with one another and with substrate under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
- C. Source Limitations: Obtain materials through one source from single traffic-coating manufacturer. Provide materials not available from traffic-coating manufacturer from sources approved by traffic-coating manufacturer. Provide new materials.
- D. VOC Content: Provide traffic coatings and pavement marking paints, for use inside the weatherproofing system, with VOC content of 150 g/L when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.2 TRAFFIC COATING

- 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. TC-1: Pedestrian System.
 - a. Peda-Gard Pedestrian Traffic-Bearing Waterproofing, manufactured by Neogard, Dallas, TX, consisting of 18 dry mils of base coat, 14 dry mils of wearing surface coat, and 10 pounds of aggregate per 100 square feet.
 - b. Sonoguard Pedestrian System, manufactured by Sonneborn, consisting of 20 dry mils of base coat, 15 dry mils of finish coat, and 10 pounds of aggregate per 100 square feet.
 - 2. TC-2: Heavy-duty pedestrian or medium-duty vehicular system.
 - 1) Auto-Gard Vehicular Traffic-Bearing Waterproofing, manufactured by Neogard, Dallas, TX, consisting of 20 dry mils of base coat, 20 dry mils of wearing surface coat, and 10 to 15 pounds of aggregate per 100 square feet.
 - 2) Sonoguard Light-to-Medium-Duty Vehicular System, manufactured by Sonneborn, consisting of 20 dry mils of base coat, 20 dry mils of finish coat, and 15 pounds of aggregate per 100 square feet.
 - 3. TC-3: Heavy-duty vehicular system.
 - a. Auto-Gard Vehicular Traffic-Bearing Waterproofing with double-texturing, manufactured by Neogard, Dallas, TX, consisting of 20 dry mils of base coat, 32 dry mils of wearing surface coat, and 30 pounds of aggregate per 100 square feet.
 - b. Sonoguard Extra-Heavy-Duty Vehicular System, manufactured by Sonneborn, consisting of 20 dry mils of base coat, 25 dry mils of mid-coat, 15 dry mils of finish coat, and 30 pounds of aggregate per 100 square feet.
 - 4. Primer: Traffic-coating manufacturer's standard, factory-formulated primer recommended for

substrate under conditions of service and application.

5. Top Coat Color: As selected by Architect from manufacturers full range.
6. Aggregate: Uniformly graded, washed silicon carbide sand of particle sizes, shape, and minimum hardness recommended in writing by traffic coating manufacturer.
 - a. Spreading Rate: As recommended by manufacturer for substrate and service conditions indicated, but not less than the following:
 - 1) Intermediate Coat: 8 to 10 lb/100 sq. ft.
 - 2) Topcoat: As required to achieve slip-resistant finish.

2.3 MISCELLANEOUS MATERIALS

- A. Joint Sealants: As specified in Division 07 Section "Joint Sealants."
- B. Sheet Flashing: Non-staining.
 1. Minimum Thickness: 60 mils.
 2. Material: Sheet material recommended in writing by traffic coating manufacturer.
- C. Adhesive: Contact adhesive recommended in writing by traffic coating manufacturer.
- D. Reinforcing Strip: Fiberglass mesh recommended in writing by traffic coating manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, with Installer and traffic-coating manufacturer's representative present, for compliance with requirements and for other conditions affecting performance of traffic coatings.
 1. Applicator and traffic-coating manufacturer's representative shall examine substrate to ensure that it is properly prepared and ready to receive traffic coating. Traffic-coating manufacturer's representative shall report in writing to Applicator and Architect/Engineer conditions which will adversely affect traffic-coating system installation or performance.
- B. Ensure that the Work done by other trades is complete and ready to receive traffic coating.
- C. Verify compatibility with and suitability of substrates.
- D. Begin coating application only after minimum concrete curing and drying period recommended by traffic coating manufacturer has passed, after unsatisfactory conditions have been corrected, and after surfaces are dry.
- E. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Clean and prepare substrates according to ASTM C 1127 and traffic coating manufacturer's written recommendations to produce clean, dust-free, dry substrate for traffic coating application.
- B. Mask adjoining surfaces not receiving traffic coatings, deck drains, and other deck substrate penetrations to prevent spillage, leaking, and migration of coatings.
- C. Close off deck drains (temporarily) and other deck penetrations to prevent spillage and migration of traffic-coating fluids. Re-open deck drains at the end of each work day or when rain is imminent.
- D. Concrete Substrates: Mechanically abrade concrete surfaces to a uniform profile according to ASTM D 4259. Do not acid etch.
 1. Remove grease, oil, paints, and other penetrating contaminants from concrete.
 2. Remove concrete fins, ridges, and other projections.
 3. Remove laitance, glaze, efflorescence, curing compounds, concrete hardeners, form-release agents, and other incompatible materials that might affect coating adhesion.
 4. Remove remaining loose material to provide a sound surface, and clean surfaces according to ASTM D 4258.
 5. Properly patch substrate defects such as delaminations, spalls, voids, form tie holes, honeycombing, and cracks, with latex-modified concrete or another material acceptable to traffic-coating manufacturer and Architect/Engineer.
 6. Verify that concrete curbs, expansion joints, and transitions from one surface plane to another (inside and outside corners) are cleanly formed and free of broken edges and excess concrete.
 7. Verify that substrate is sound and is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D 4263.
 8. Verify that concrete has cured and aged for minimum time period recommended by traffic-coating manufacturer. Test for moisture content by method recommended in writing by manufacturer.

3.3 TERMINATIONS AND PENETRATIONS

- A. Prepare vertical and horizontal surfaces at terminations and penetrations through traffic coatings and at expansion joints, drains, and sleeves according to ASTM C 1127 and manufacturer's written recommendations.

- B. Provide sealant cants at penetrations and at reinforced and non-reinforced, deck-to-wall butt joints.
 - C. Terminate edges of deck-to-deck expansion joints with preparatory base-coat strip.
 - D. Install sheet flashings at deck-to-wall expansion and dynamic joints, and bond to deck and wall substrates according to manufacturer's written recommendations.
- 3.4 JOINT AND CRACK TREATMENT
- A. Prepare, treat, rout, and fill joints and cracks in substrates according to ASTM C 1127 and manufacturer's written recommendations. Before coating surfaces, remove dust and dirt from joints and cracks according to ASTM D 4258.
 - 1. Comply with recommendations in ASTM C 1193 for joint-sealant installation.
- 3.5 TRAFFIC COATING APPLICATION
- A. Apply traffic coating material according to ASTM C 1127 and manufacturer's written recommendations.
 - 1. Start traffic coating application in presence of manufacturer's technical representative.
 - 2. Verify that wet film thickness of each component coat complies with requirements every 100 sq. ft..
 - 3. Install joint reinforcement, centered on joints and horizontal edges of sheet-metal flashing and pans, in detail coat.
 - 4. Wipe detail coat to remove dust and contamination.
 - 5. Apply traffic coatings to prepared wall terminations and vertical surfaces to height indicated, and omit aggregate on vertical surfaces.
 - 6. Apply each coat in one uniform application, broadcast aggregate if required, and backroll for even coverage. Allow each coat to cure before apply next coat. Sweep or vacuum off excess aggregate.
 - 7. Apply at least 4 inches up sides of columns, walls, and other vertical surfaces, and up curb faces and across top curb surfaces.
 - 8. Omit aggregate on vertical surfaces.
 - 9. If pinholes occur in base coat, apply additional base coat material using flat squeegee or other tool approved by traffic-coating manufacturer, to fill holes before proceeding with subsequent coats.
 - 10. Prevent contamination or damage during application and curing.
 - 11. Cure traffic coatings according to manufacturer's written recommendations. Prevent contamination and damage during application and curing stages.
- 3.6 FIELD QUALITY CONTROL
- A. Testing: Engage a qualified testing agency to perform the following field tests and inspections and prepare test reports:
 - 1. Samples of material delivered to Project site shall be taken, identified, sealed, and certified in presence of Contractor.
 - 2. Sample one 1-inch-square sample minimum of traffic-coating system for every 4,000 square feet of traffic-coating installed. Dry film thickness will be measured.
 - a. Dry film thickness is satisfactory if not less than minimum thickness specified by traffic-coating manufacture or this Section, whichever is greater.
 - b. If dry film thickness too thin, apply additional material at no cost to Owner, or perform other remedial action recommended by traffic-coating manufacturer or Architect/Engineer.
 - c. Patch sample areas with traffic-coating system.
 - 3. Chain drag traffic-coating areas at conclusion of Work to locate debonded areas. Remove and replace debonded areas.
 - 4. If test results show traffic coating materials do not comply with requirements, remove non-complying materials, prepare surfaces, and reapply traffic coatings.
 - B. Final Traffic Coating Inspection: Arrange for traffic coating manufacturer's technical personnel to inspect membrane installation on completion.
 - 1. Notify Architect or Owner 48 hours in advance of date and time of inspection.
 - C. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
- 3.7 PROTECTING AND CLEANING
- A. Protect traffic coatings from damage and wear during remainder of construction period.
 - B. Clean spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.
 - C. Replace Work or materials damaged beyond repair, in opinion of Architect/Engineer, at no cost to Owner.

END OF SECTION

SECTION 072100
THERMAL INSULATION

PART 1 - GENERAL

- 1.1 RELATED DOCUMENTS
- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- 1.2 SUMMARY
- A. Section Includes:
1. Glass-fiber blanket insulation.
- 1.3 SUBMITTALS
- A. Product Data: For each type of product indicated.
- B. Sustainable Submittals:
1. Product data 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. Research/Evaluation Reports: For foam-plastic insulation, from ICC-ES.
- 1.4 QUALITY ASSURANCE
- A. 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.
- 1.5 DELIVERY, STORAGE, AND HANDLING
- A. Protect insulation materials from physical damage and from deterioration due to moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.
- B. Protect foam-plastic board insulation as follows:
1. Do not expose to sunlight except to necessary extent for period of installation and concealment.
 2. Protect against ignition at all times. Do not deliver foam-plastic board materials to Project site before installation time.
 3. Quickly complete installation and concealment of foam-plastic board insulation in each area of construction.

PART 2 - PRODUCTS

- 2.1 GLASS-FIBER BLANKET INSULATION
- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. CertainTeed Corporation.
 2. Guardian Building Products, Inc.
 3. Johns Manville.
 4. Knauf Insulation.
 5. Owens Corning.
- B. Unfaced, Glass-Fiber Blanket Insulation: 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.

PART 3 - EXECUTION

- 3.1 PREPARATION
- A. Clean substrates of substances that are harmful to insulation or that interfere with insulation attachment.

3.2 INSTALLATION, GENERAL

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

3.3 INSTALLATION OF INSULATION FOR FRAMED CONSTRUCTION

- A. Apply insulation units to substrates by method indicated, complying with manufacturer's written instructions. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.
- B. Glass-Fiber 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.
 - 4. For wood-framed construction, install blankets according to ASTM C 1320 and as follows:
 - a. With faced blankets having stapling flanges, secure insulation by inset, stapling flanges to sides of framing members.

3.4 INSTALLATION OF INSULATION IN CEILINGS FOR SOUND ATTENUATION

- A. Where glass-fiber blankets are indicated for sound attenuation above ceilings, install blanket insulation over entire ceiling area in thicknesses indicated. Extend insulation **48 inches** up either side of partitions.

3.5 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.

3.6 SCHEDULE

- A. Wood Framing (Exterior Walls)
 - 1. Insulation Type: Glass-Fiber Blanket Insulation
 - 2. R-Value: R-19 minimum.
 - 3. Installation: Friction.

END OF SECTION

SECTION 072418**WATER-DRAINAGE EXTERIOR INSULATION AND FINISH SYSTEM (EIFS)****PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes water-drainage exterior insulation and finish system (EIFS) applied over water-resistive coating over sheathing.

1.3 SYSTEM DESCRIPTION

- A. Class PB EIFS: A non-load-bearing, exterior wall cladding system that consists of an insulation board attached adhesively, mechanically, or both to the substrate; an integrally reinforced base coat; and a textured protective finish coat.
- B. Water-Drainage EIFS: EIFS with a means that allows water entering into an EIFS assembly to drain to the exterior.

1.4 PERFORMANCE REQUIREMENTS

- A. EIFS Performance: Comply with the following:
 - 1. Bond Integrity: Free from bond failure within EIFS components or between system and supporting wall construction, resulting from exposure to fire, wind loads, weather, or other in-service conditions.
 - 2. Weathertightness: Resistant to water penetration from exterior into water-drainage EIFS and assemblies behind it or through them into interior of building that results in deterioration of thermal-insulating effectiveness or other degradation of EIFS and assemblies behind it, including substrates, supporting wall construction, and interior finish, and including a means that allows water entering into an EIFS assembly to drain to the exterior.
- B. Class PB EIFS: Provide EIFS having physical properties and structural performance that comply with the following:
 - 1. Abrasion Resistance: Sample consisting of 1-inch- thick EIFS mounted on 1/2-inch- thick gypsum board; cured for a minimum of 28 days; and showing no cracking, checking, or loss of film integrity after exposure to 528 quarts 500 L of sand when tested per ASTM D 968, Method A.
 - 2. Absorption-Freeze Resistance: No visible deleterious effects and negligible weight loss after 60 cycles per EIMA 101.01.
 - 3. Accelerated Weathering: Five samples per ICC-ES AC235 showing no cracking, checking, crazing, erosion, rusting, blistering, peeling, delamination, or other characteristics that might affect performance as a wall cladding after testing for 2000 hours when viewed under 5 times magnification per ASTM G 153 or ASTM G 154.
 - 4. Freeze-Thaw: No surface changes, cracking, checking, crazing, erosion, rusting, blistering, peeling, or delamination, or indications of delamination between components when viewed under 5 times magnification after 60 cycles per EIMA 101.01.
 - 5. Mildew Resistance of Finish Coat: Sample applied to 2-by-2-inch clean glass substrate, cured for 28 days, and showing no growth when tested per ASTM D 3273 and evaluated according to ASTM D 3274.
 - 6. Salt-Spray Resistance: No deleterious affects when tested according to ICC-ES AC235.
 - 7. Tensile Adhesion: No failure in the EIFS, adhesive, base coat, or finish coat when tested per EIMA 101.03.
 - 8. Water Penetration: Sample consisting of 1-inch- thick EIFS mounted on 1/2-inch- thick gypsum board, cured for 28 days, and showing no water penetration into the plane of the base coat to expanded polystyrene board interface of the test specimen after 15 minutes at 6.24 lbf/sq. ft. of air pressure difference or 20 percent of positive design wind pressure, whichever is greater, across the specimen during a test period when tested per EIMA 101.02.
 - 9. Water Resistance: Three samples, each consisting of 1-inch- thick EIFS mounted on 1/2-inch- thick gypsum board; cured for 28 days; and showing no cracking, checking, crazing, erosion, rusting, blistering, peeling, or delamination after testing for 14 days per ASTM D 2247.
 - 10. Impact Resistance: Sample consisting of 1-inch- thick EIFS when constructed, conditioned, and tested per EIMA 101.86; and meeting or exceeding the following:

- a. Standard Impact Resistance: 25 to 49 inch-lb.
 - b. Medium Impact Resistance: 50 to 89 inch-lb.
 - c. High Impact Resistance: 90 to 150 inch-lb.
 - d. Ultra-High Impact Resistance: More than 150 inch-lb.
11. Drainage: According to ICC-ES AC24.
 12. Structural Performance Testing: EIFS assembly and components shall comply with ICC-ES AC235 when tested per ASTM E 330.
 13. Design Wind Loads: As indicated on structural drawings or as otherwise determined using design wind loads applicable to Project from basic wind speed indicated in miles per hour, according to ASCE 7, Section 6.5, "Method 2-Analytical Procedure."

1.5 SUBMITTALS

- A. Product Data: For each type and component of EIFS indicated.
- B. Shop Drawings: For EIFS. Include plans, elevations, sections, details of components, details of penetration and termination, flashing details, joint locations and configurations, fastening and anchorage details including mechanical fasteners, and connections and attachments to other work.
- C. Samples for Initial Selection: For each type of finish-coat color and texture indicated. Include similar Samples of joint sealants and exposed accessories involving color selection.
- D. Qualification Data: For Installer and testing agency.
- E. Manufacturer Certificates: Signed by manufacturers certifying that EIFS and joint sealants comply with requirements.
- F. Field quality-control reports and special inspection reports.
- G. Maintenance Data: For EIFS to include in maintenance manuals.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An installer who is certified in writing by EIFS manufacturer as qualified to install manufacturer's system using trained workers.
- B. Source Limitations: Obtain EIFS from single source from single EIFS manufacturer and from sources approved by EIFS manufacturer as compatible with system components.
- C. Fire-Test-Response Characteristics: Provide EIFS and system components with the following fire-test-response characteristics as determined by testing identical EIFS and system components per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify products with appropriate markings of applicable testing agency.
 1. Fire-Resistance Characteristics: Provide materials and construction tested for fire resistance per ASTM E 119.
 2. Full-Scale Multistory Fire Test: Tested mockup, representative of completed multistory wall assembly of which EIFS is a part, complies with UBC Standard 26-4 for test method and required fire-test-response characteristics of exterior non-load-bearing wall panel assemblies containing foam-plastic insulation.
 3. Full-Scale Diversified Fire Test: Tested mockup, representative of completed multistory wall assembly of which EIFS is a part, showing no significant contribution to vertical or horizontal flame spread per ASTM E 108 modified for testing vertical walls.
 4. Intermediate-Scale Multistory Fire Test: Tested mockup, representative of completed multistory wall assembly of which EIFS is a part, complies with NFPA 285 for test method and required fire-test-response characteristics of exterior non-load-bearing wall panel assemblies containing foam-plastic insulation.
 5. Radiant Heat Exposure: No ignition of EIFS when tested according to NFPA 268.
 6. Potential Heat: Acceptable level when tested according to NFPA 259.
 7. Surface-Burning Characteristics: Provide insulation board, adhesives, base coats, and finish coats with flame-spread index of 25 or less and smoke-developed index of 450 or less, per ASTM E 84.
- D. Preinstallation Conference: Conduct conference at Project site.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in original, unopened packages with manufacturers' labels intact and clearly identifying products.
- B. Store materials inside and under cover; keep them dry and protected from weather, direct sunlight, surface contamination, aging, corrosion, damaging temperatures, construction traffic, and other causes.
 1. Stack insulation board flat and off the ground.
 2. Protect plastic insulation against ignition at all times. Do not deliver plastic insulating materials to Project site before installation time.
 3. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

1.8 PROJECT CONDITIONS

- A. Weather Limitations: Maintain ambient temperatures above 40 deg F for a minimum of 24 hours before, during, and after adhesives or coatings are applied. Do not apply EIFS adhesives or coatings during rainfall. Proceed with installation only when existing and forecasted weather conditions and ambient outdoor air, humidity, and substrate temperatures permit EIFS to be applied, dried, and cured according to manufacturers' written instructions and warranty requirements.

1.9 COORDINATION

- A. Coordinate installation of EIFS with related Work specified in other Sections to ensure that wall assemblies, including sheathing, weather-resistant sheathing paper, flashing, trim, joint sealants, windows, and doors, are protected against damage from the effects of weather, age, corrosion, moisture, and other causes. Do not allow water to penetrate behind flashing and drainage plane that is behind water-drainage EIFS.

PART 2 - PRODUCTS**2.1 MANUFACTURERS**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Dryvit Systems, Inc.
 2. El Rey Stucco Company, Inc.; a brand of ParexLahabra, Inc.
 3. Finestone; Degussa Wall Systems, Inc.
 4. Parex, Inc.; a brand of ParexLahabra, Inc.
 5. Senergy; Degussa Wall Systems, Inc.
 6. Sto Corp.

2.2 MATERIALS

- A. Compatibility: Provide water-resistive coating, adhesive, fasteners, board insulation, reinforcing meshes, base- and finish-coat systems, sealants, and accessories that are compatible with one another and with substrates and approved for use by EIFS manufacturer for Project.
- B. Water-Resistive Coatings: EIFS manufacturer's standard formulation and accessories for use as water/weather-resistive barriers, compatible with substrate, and complying with physical and performance criteria of ICC-ES AC209.
1. Sheathing Joint Tape: Type recommended by EIFS manufacturer for sealing joints between and penetrations through sheathing.
 2. VOC Content of Coatings Used as Insulation Adhesive: 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- C. Primer/Sealer: EIFS manufacturer's standard substrate conditioner with VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24), designed to seal substrates from moisture penetration and to improve the bond between substrate of type indicated and adhesive used for application of insulation.
- D. Flexible-Membrane Flashing: Cold-applied, fully self-adhering, self-healing, rubberized-asphalt and polyethylene-film composite sheet or tape and primer; EIFS manufacturer's standard or product recommended in writing by EIFS manufacturer.
- E. Insulation Adhesive: EIFS manufacturer's standard formulation designed for indicated use; compatible with substrate; and complying with one of the following:
1. Job-mixed formulation of portland cement complying with ASTM C 150, Type I, and polymer-based adhesive specified for base coat.
- F. Molded, Rigid Cellular Polystyrene Board Insulation: Comply with ASTM C 578, Type I; EIFS manufacturer's requirements; and EIMA's "EIMA Guideline Specification for Expanded Polystyrene (EPS) Insulation Board" for most stringent requirements for material performance and qualities of insulation, including dimensions and permissible variations, and the following:
1. Aging: Before cutting and shipping, age insulation in block form by air drying for not less than six weeks or by another method approved by EIMA that produces equivalent results.
 2. Flame-Spread and Smoke-Developed Indexes: 25 and 450 or less, respectively, per ASTM E 84.
 3. Dimensions: Provide insulation boards not more than 24 by 48 inches and in thickness indicated but not more than 4 inches thick or less than thickness allowed by ASTM C 1397.
 4. Channeled Board Insulation: EIFS manufacturer's standard factory-fabricated profile with linear, vertical drainage channels, slots, or waves on the back side of board.
 5. Board Insulation Closure Blocks: EIFS manufacturer's standard density, size, and configuration.
 6. Foam Shapes: Provide with profiles and dimensions indicated on Drawings.

- G. Reinforcing Mesh: Balanced, alkali-resistant, open-weave, glass-fiber mesh treated for compatibility with other EIFS materials, made from continuous multi-end strands with retained mesh tensile strength of not less than 120 lbf/in. per ASTM E 2098; complying with ASTM D 578 and the following:
 - 1. Standard-Impact Reinforcing Mesh: Not less than 4.0 oz./sq. yd..
 - 2. Intermediate-Impact Reinforcing Mesh: Not less than 10 oz./sq. yd.
 - 3. High-Impact Reinforcing Mesh: Not less than 15 oz./sq. yd..
 - 4. Strip Reinforcing Mesh: Not less than 3.75 oz./sq. yd.
 - 5. Detail Reinforcing Mesh: Not less than 4.0 oz./sq. yd.
 - 6. Corner Reinforcing Mesh: Not less than 7.2 oz./sq. yd.
 - H. Base-Coat Materials: EIFS manufacturer's standard mixture complying with one of the following requirements:
 - 1. Job-mixed formulation of portland cement complying with ASTM C 150, Type I, white or natural color; and manufacturer's standard polymer-emulsion adhesive designed for use with portland cement.
 - I. Waterproof Adhesive/Base-Coat Materials: EIFS manufacturer's standard waterproof formulation with VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24), complying with one of the following:
 - 1. Job-mixed formulation of portland cement complying with ASTM C 150, Type I, white or natural color; and manufacturer's standard polymer-emulsion adhesive designed for use with portland cement.
 - 2. Job-combined formulation of manufacturer's standard polymer-emulsion adhesive and manufacturer's standard dry mix containing portland cement.
 - J. Finish-Coat Materials: EIFS manufacturer's standard acrylic-based coating with enhanced mildew resistance complying with the following:
 - 1. Factory-mixed formulation of polymer-emulsion binder, colorfast mineral pigments, sound stone particles, and fillers.
 - 2. Sealer: Manufacturer's waterproof, clear acrylic-based sealer for protecting finish coat.
 - 3. Colors: Match Architect's samples.
 - K. Water: Potable.
 - L. Trim Accessories: Type as designated or required to suit conditions indicated and to comply with EIFS manufacturer's written instructions; manufactured from UV-stabilized PVC; and complying with ASTM D 1784, manufacturer's standard Cell Class for use intended, and ASTM C 1063.
 - 1. Drip Screed/Track: Prefabricated, one-piece type for attachment behind insulation with face leg extended to form a drip, of depth required to suit thickness of coating and insulation, with face leg perforated for bonding to coating and back leg.
 - 2. Weep Screed/Track: Prefabricated, one-piece type for attachment behind insulation with perforated face leg extended to form a drip and weep holes in track bottom, of depth required to suit thickness of coating and insulation, with face leg perforated for bonding to coating and back leg; designed to drain incidental moisture that gets into wall construction to the exterior at terminations of EIFS with drainage.
 - 3. Expansion Joint: Prefabricated, one-piece V profile; designed to relieve stress of movement.
 - 4. Window Sill Flashing: Prefabricated type for both flashing and sloping sill over framing beneath windows; with end and back dams; designed to direct water to exterior.
- 2.3 ELASTOMERIC SEALANTS
- A. Elastomeric Sealant Products: Provide EIFS manufacturer's listed and recommended chemically curing, elastomeric sealant that is compatible with joint fillers, joint substrates, and other related materials, and complies with requirements for products and testing indicated in ASTM C 1481 and with requirements in Division 07 Section "Joint Sealants" for products corresponding to description indicated below:
 - 1. Multicomponent, non-sag urethane sealant.
 - 2. Single-component, non-sag, neutral-curing silicone sealant.
 - 3. Provide sealants, for use inside the weatherproofing system, with a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - B. Sealant Color: Match Architect's samples.
- 2.4 MIXING
- A. General: Comply with EIFS manufacturer's requirements for combining and mixing materials. Do not introduce admixtures, water, or other materials except as recommended by EIFS manufacturer. Mix materials in clean containers. Use materials within time period specified by EIFS manufacturer or discard.

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 EIFS.
- B. Examine roof edges, wall framing, flashings, openings, substrates, and junctures at other construction for suitable conditions where EIFS will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.
 - 1. Begin coating application only after surfaces are dry.
 - 2. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Protect contiguous work from moisture deterioration and soiling caused by application of EIFS. Provide temporary covering and other protection needed to prevent spattering of exterior finish coats on other work. Protect EIFS, substrates, and wall construction behind them from inclement weather during installation.
- B. Prevent penetration of moisture behind drainage plane of EIFS and deterioration of substrates. Prepare and clean substrates to comply with EIFS manufacturer's written instructions to obtain optimum bond between substrate and adhesive for insulation.
- C.

3.3 EIFS INSTALLATION, GENERAL

- A. Comply with EIFS manufacturer's written instructions for installation of EIFS as applicable to each type of substrate indicated.

3.4 SUBSTRATE PROTECTION APPLICATION

- A. Primer/Sealer: Apply over gypsum sheathing substrates to protect substrates from degradation and where required by EIFS manufacturer for improving adhesion of insulation to substrate.
- B. Water-Resistive Coatings: Apply over substrates to protect substrates from degradation and to provide water-/weather-resistive barrier.
 - 1. Tape and seal joints, exposed edges, terminations, and inside and outside corners of sheathing unless otherwise indicated by EIFS manufacturer's written instructions.
- C. Waterproof Adhesive/Base Coat: Apply over sloped surfaces and window sills.
- D. Flexible-Membrane Flashing: Install over weather-resistive barrier, applied and lapped to shed water; seal at openings, penetrations, terminations, and where indicated by EIFS manufacturer's written instructions to protect wall assembly from degradation. Prime substrates, if required, and install flashing to comply with EIFS manufacturer's written instructions and details.

3.5 TRIM INSTALLATION

- A. Trim: Apply trim accessories at perimeter of EIFS, at expansion joints, at window sills, and elsewhere as indicated, according to EIFS manufacturer's written instructions. Coordinate with installation of insulation.
 - 1. Weep Screed/Track: Use at bottom termination edges, at window and door heads of water-drainage EIFS unless otherwise indicated.
 - 2. Window Sill Flashing: Use at windows unless otherwise indicated.
 - 3. Expansion Joint: Use where indicated on Drawings.

3.6 INSULATION INSTALLATION

- A. Board Insulation: Adhesively attach insulation to substrate in compliance with ASTM C 1397, EIFS manufacturer's written instructions, and the following:
 - 1. Apply adhesive to insulation by notched-trowel method in a manner that results in coating the entire surface of sheathing with adhesive once insulation is adhered to sheathing unless EIFS manufacturer's written instructions specify using primer/sealer with ribbon-and-dab method. Apply adhesive to a thickness of not less than 1/4 inch 6.4 mm for factory mixed and not less than 3/8 inch 9.6 mm for field mixed, measured from surface of insulation before placement.
 - 2. Apply adhesive to insulation by notched-trowel method in a manner that results in coating the entire surface of drainage mat with adhesive once insulation is adhered to drainage mat.
 - 3. Apply adhesive to ridges on back of insulation by notched-trowel method in a manner that results in full adhesive contact over the entire surface of ridges, leaving channels free of adhesive once insulation is adhered to substrate.
 - 4. Press and slide insulation into place. Apply pressure over the entire surface of insulation to accomplish uniform contact, high initial grab, and overall level surface.

5. Allow adhered insulation to remain undisturbed for period recommended by EIFS manufacturer, but not less than 24 hours, before beginning rasping and sanding insulation, or applying base coat and reinforcing mesh.
6. Apply insulation over drainage mat and dry substrates in courses with long edges of boards oriented horizontally.
7. Begin first course of insulation from a level base line and work upward.
8. Stagger vertical joints of insulation boards in successive courses to produce running bond pattern.
9. Locate joints so no piece of insulation is less than 12 inches wide or 6 inches high. Offset joints not less than 6 inches from corners of window and door openings and not less than 4 inches from aesthetic reveals.
10. Adhesive Attachment: Offset joints of insulation not less than 6 inches from horizontal and 4 inches from vertical joints in sheathing.
11. Place insulation with adhesive strips and channels, slots, or waves aligned in the vertical position for drainage. Align drainage channels, slots, or waves with channels, slots, or waves in insulation boards above and below.
12. Interlock ends at internal and external corners.
13. Abut insulation tightly at joints within and between each course to produce flush, continuously even surfaces without gaps or raised edges between boards. If gaps greater than 1/16 inch occur, fill with insulation cut to fit gaps exactly; insert insulation without using adhesive or other material.
14. Cut insulation to fit openings, corners, and projections precisely and to produce edges and shapes complying with details indicated.
15. Rasp or sand flush entire surface of insulation to remove irregularities projecting more than 1/32 inch from surface of insulation and to remove yellowed areas due to sun exposure; do not create depressions deeper than 1/16 inch.
16. Cut aesthetic reveals in outside face of insulation with high-speed router and bit configured to produce grooves, rabbets, and other features that comply with profiles and locations indicated. Do not reduce insulation thickness at aesthetic reveals to less than 3/4 inch.
17. Install foam shapes and attach to sheathing.
18. Install insulation closure blocks using ribbon-and-dab method to create air zones where indicated.
19. Form joints for sealant application by leaving gaps between adjoining insulation edges and between insulation edges and dissimilar adjoining surfaces. Make gaps wide enough to produce joint widths indicated after encapsulating joint substrates with base coat and reinforcing mesh.
20. Form joints for sealant application with back-to-back casing beads for joints within EIFS and with perimeter casing beads at dissimilar adjoining surfaces. Make gaps between casing beads and between perimeter casing beads and adjoining surfaces of width indicated.
21. After installing insulation and before applying field-applied reinforcing mesh, fully wrap board edges. Cover edges of board and extend encapsulating mesh not less than 2-1/2 inches over front and back face unless otherwise indicated on Drawings.
22. Treat exposed edges of insulation as follows:
 - a. Except for edges forming substrates of sealant joints, encapsulate with base coat, reinforcing mesh, and finish coat.
 - b. Encapsulate edges forming substrates of sealant joints within EIFS or between EIFS and other work with base coat and reinforcing mesh.
 - c. At edges trimmed by accessories, extend base coat, reinforcing mesh, and finish coat over face leg of accessories.
23. Coordinate installation of flashing and insulation to produce wall assembly that does not allow water to penetrate behind flashing and water-/weather-resistive barrier.

3.7 BASE-COAT INSTALLATION

- A. Base Coat: Apply to exposed surfaces of insulation and foam shapes in minimum thickness recommended in writing by EIFS manufacturer, but not less than 1/16-inch dry-coat thickness.
- B. Reinforcing Mesh: Embed type indicated below in wet base coat to produce wrinkle-free installation with mesh continuous at corners and overlapped not less than 2-1/2 inches or otherwise treated at joints to comply with ASTM C 1397 and EIFS manufacturer's written instructions. Do not lap reinforcing mesh within 8 inches of corners. Completely embed mesh, applying additional base-coat material if necessary, so reinforcing-mesh color and pattern are not visible.
 1. Standard-impact reinforcing mesh unless otherwise indicated.
 2. Intermediate-impact reinforcing mesh at window sills and parapet caps.
- C. Double-Layer Reinforcing Mesh Application: Where indicated, apply second base coat and second layer of standard intermediate-impact reinforcing mesh, overlapped not less than 2-1/2 inches or otherwise treated at joints to comply with ASTM C 1397 and EIFS manufacturer's written instructions in same manner as first application. Do not apply until first base coat has cured.

- D. Foam Shapes: Fully embed reinforcing mesh in base coat.
 - E. Double Base-Coat Application: Where indicated, apply second base coat in same manner and thickness as first application except without reinforcing mesh. Do not apply until first base coat has cured.
- 3.8 FINISH-COAT INSTALLATION
- A. Finish Coat: Apply over dry base coat, maintaining a wet edge at all times for uniform appearance, in thickness required by EIFS manufacturer to produce a uniform finish of color and texture matching approved sample and free of cold joints, shadow lines, and texture variations.
 - 1. Texture: Match Architect's samples.
 - 2. Embed aggregate in finish coat according to EIFS manufacturer's written instructions to produce a uniform applied-aggregate finish of color and texture matching approved sample.
 - B. Sealer Coat: Apply over dry finish coat, in number of coats and thickness required by EIFS manufacturer.
- 3.9 INSTALLATION OF JOINT SEALANTS
- A. Prepare joints and apply sealants, of type and at locations indicated, to comply with applicable requirements in Division 07 Section "Joint Sealants" and in ASTM C 1481.
 - 1. Apply joint sealants after base coat has cured but before applying finish coat.
 - 2. Clean surfaces to receive sealants to comply with indicated requirements and EIFS manufacturer's written instructions.
 - 3. Apply primer recommended in writing by sealant manufacturer for surfaces to be sealed.
 - 4. Install sealant backing to control depth and configuration of sealant joint and to prevent sealant from adhering to back of joint.
 - 5. Apply masking tape to protect areas adjacent to sealant joints. Remove tape immediately after tooling joints, without disturbing joint seal.
 - 6. Recess sealant sufficiently from surface of EIFS so an additional sealant application, including cylindrical sealant backing, can be installed without protruding beyond EIFS surface.
- 3.10 FIELD QUALITY CONTROL
- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
 - B. EIFS Tests and Inspections: For the following:
 - 1. According to ICC-ES AC24.
 - 2. Insert testing requirements of authorities having jurisdiction.
 - C. Remove and replace EIFS where test results indicate that EIFS do not comply with specified requirements.
 - D. Prepare test and inspection reports.
- 3.11 CLEANING AND PROTECTION
- A. Remove temporary covering and protection of other work. Promptly remove coating materials from window and door frames and other surfaces outside areas indicated to receive EIFS coatings.

END OF SECTION

SECTION 072500
WEATHER BARRIERS

PART 1 - GENERAL

- 1.1 RELATED DOCUMENTS
- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- 1.2 SUMMARY
- A. Section Includes:
1. Sheet building wrap.
 2. Flexible flashing.
- 1.3 ACTION SUBMITTALS
- A. Product Data: For each type of product.
1. For building wrap, include data on air and water-vapor permeance based on testing according to referenced standards.
- 1.4 INFORMATIONAL SUBMITTALS
- A. Evaluation Reports: For water-resistive barrier and flexible flashing, from ICC-ES.

PART 2 - PRODUCTS

- 2.1 WATER-RESISTIVE BARRIER
- A. Building Wrap: ASTM E 1677; with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, when tested according to ASTM E 84; UV stabilized; and acceptable to authorities having jurisdiction.
1. Basis-of-Design: Subject to compliance with requirements, provide products as indicated on Drawings, or comparable products by one of the following:
 - a. Dow Chemical Company (The); Styrofoam Weathermate Plus Brand Housewrap.
 - b. DuPont (E. I. du Pont de Nemours and Company); Tyvek CommercialWrap.
 - c. Pactiv, Inc.; GreenGuard Classic Wrap.
 - d. For substitution request, refer to Section "012500 – Substitution Procedures".
 2. Water-Vapor Permeance: Not less than 20 perms per ASTM E 96/E 96M, Desiccant Method (Procedure A).
 3. Air Permeance: Not more than 0.004 cfm/sq. ft. at 0.3-inch when tested according to ASTM E 2178.
 4. Allowable UV Exposure Time: Not less than three months.
- B. Building-Wrap Tape: Pressure-sensitive plastic tape recommended by building-wrap manufacturer for sealing joints and penetrations in building wrap.
- 2.2 MISCELLANEOUS MATERIALS
- A. Flexible Flashing: Composite, self-adhesive, flashing product consisting of a pliable, butyl rubber or rubberized-asphalt compound, bonded to a high-density polyethylene film, aluminum foil, or spunbonded polyolefin to produce an overall thickness of not less than 0.030 inch/0.8 mm.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. DuPont (E. I. du Pont de Nemours and Company); DuPont Flashing Tape.
 - b. Grace Construction Products, a unit of W. R. Grace & Co. - Conn.; Vycor Butyl Self Adhered Flashing.
 - c. Protecto Wrap Company; BT-25 XL.
 - d. Fortifiber Building Systems Group; Fortiflash 25.
 - e. Polyguard Products, Inc.; Polyguard JT-20 Tape.
- B. Primer for Flexible Flashing: Product recommended by manufacturer of flexible flashing for substrate.
- C. Nails and Staples: ASTM F 1667.

PART 3 - EXECUTION**3.1 WATER-RESISTIVE BARRIER INSTALLATION**

- A. Cover exposed exterior surface of sheathing with water-resistive barrier securely fastened to framing immediately after sheathing is installed.
- B. Cover sheathing with water-resistive barrier as follows:
 - 1. Cut back barrier 1/2 inch on each side of the break in supporting members at expansion- or control-joint locations.
 - 2. Apply barrier to cover vertical flashing with a minimum 4-inch overlap unless otherwise indicated.
- C. Building Wrap: Comply with manufacturer's written instructions.
 - 1. Seal seams, edges, fasteners, and penetrations with tape.
 - 2. Extend into jambs of openings and seal corners with tape.

3.2 FLEXIBLE FLASHING INSTALLATION

- A. Apply flexible flashing where indicated to comply with manufacturer's written instructions.
 - 1. Prime substrates as recommended by flashing manufacturer.
 - 2. Lap seams and junctures with other materials at least 4 inches except that at flashing flanges of other construction, laps need not exceed flange width.
 - 3. Lap flashing over water-resistive barrier at bottom and sides of openings.
 - 4. Lap water-resistive barrier over flashing at heads of openings.
 - 5. After flashing has been applied, roll surfaces with a hard rubber or metal roller to ensure that flashing is completely adhered to substrates.

END OF SECTION

SECTION 072600
UNDER SLAB VAPOR BARRIER

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes:
 - 1. Sheet materials for controlling vapor diffusion through concrete slabs-on-grade.

1.3 SUBMITTALS

- A. Written certification from the manufacturer that the materials and their application as noted in this Specification and on the Drawings is appropriate and approved for this project.
- B. Product Data: Manufacturer's product data, specifications, and installation instructions. Include vapor barrier manufacturer's requirements for placement, seaming and pipe book installation.
- C. Sample Warranties: Copies of waterproofing manufacturer's warranty, Installer's warranty, and General Contractor's warranty, all stating obligations, remedies, limitations, and exclusions. Submitted with Bid.
- D. Test Reports: Manufacturer's independent laboratory test reports showing compliance with ASTM and ACI Standards.
- E. Installer Certificates: Signed by manufacturers certifying that installers comply with requirements.
- F. Submit evidence that Installer's existing company has minimum of 5-years continuous experience in application of specified materials.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer (applicator) who is acceptable to manufacturer, who has completed applications similar in material and extent to that required for this Project, and whose work has resulted in construction with a record of successful in-service performance.
- B. Source Limitations: Vapor Barrier and components to be from one source from a single manufacturer.

1.5 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 application.
- B. Store materials in a clean dry location in accordance with manufacturer's written instructions to prevent deterioration from moisture or other detrimental effects.
- C. Stack membrane on elevated wood platform to eliminate warping.
- D. Protect materials during handling and application to prevent damage or contamination.

1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Comply with manufacturer's written recommendations for substrate temperature and moisture content, ambient temperature and humidity, ventilation, and other conditions affecting materials performance. Do not apply on frozen ground.
- B. Close areas to traffic during application and for time period after application recommended in writing by manufacturer.

1.7 COORDINATION

- A. Coordinate placement of sheet vapor barrier with Division 03 sections.
- B. Coordinate placement of sealer and hardener with Division 03 sections and with requirements of finish flooring products, including adhesives, specified in Division 09 Sections.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Sheet Vapor Barrier:
 - 1. Type: 15 mil polyolefin film meeting requirements of ASTM E 1745, Class A.
 - 2. Water Vapor Transmittance (After mandatory condition per ASTM E154 sections 8,11,12,13): Maximum perm rating of 0.01 as tested in accordance with ASTM E 1745 Section 7.

3. Strength: ASTM E 1745: Class A.
- B. Acceptable Products:
 1. Subject to compliance with requirements, provide one of the following:
 - a. Stego Wrap Vapor Barrier by Stego Industries, LLC, 15 mils.
 - b. Zero-Perm Vapor Barrier by Alumiseal.
 - c. Xtreme by Tex-Trude.
 - d. For substitution request, refer to Section "012500 – Substitution Procedures".
- C. Accessories:
 1. Bonding Agent: Manufacturer's approved or recommended vapor barrier bonding agent.
 2. Sealing and Seaming Tape: High density polyethylene tape a minimum of 4 inches in width, compatible with vapor barrier membrane, and manufactured by or recommended by vapor barrier membrane manufacturer. Tape for joints shall have at least the same permeability rating as the vapor barrier specified.
 3. Vapor Proofing Mastic: Manufacturer's approved or recommended vapor proofing mastic with the same permeability rating as the vapor barrier specified.
 4. Pipe Boot: Construct pipe boots from vapor barrier material and pressure sensitive tape in accordance with manufacturer's instructions.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine surfaces to receive membrane. Notify Architect if surfaces are not acceptable. Do not begin surface preparation or application until unacceptable conditions have been corrected.

3.2 PREPARATION

- A. Level or tamp or roll aggregate, sand or granular base.

3.3 INSTALLATION

- A. Vapor Barrier:
 1. Place, protect, and repair vapor barrier sheets according to ASTM E 1643 and manufacturer's written instructions.
 2. Unroll vapor barrier with the longest dimension parallel with the direction of the concrete pour.
 3. Install vapor barrier without tears, voids, and holes. Lap ends and edges as recommended by manufacturer, but not less than 6 inches over adjacent sheets. Seal laps with tape.
 4. Turn up sheets at perimeter, at footings and vertical walls, and against penetrations, and seal joints with tape.
 5. Seal joints, tears, holes, perimeter, and penetrations through vapor with tape in accordance with manufacturer's recommendations.
 6. Point exposed edges with pointing mastic to prevent water from traveling under membrane.
 7. Adhere membrane to vertical surfaces with adhesive.

3.4 PROTECTION

- A. Protect complete membrane from damage. Prior to pouring concrete, inspect membrane for punctures or damage and repair as required to maintain vapor barrier integrity.

END OF SECTION

SECTION 074646
FIBER CEMENT SIDING

PART 1 - GENERAL

- 1.1 SECTION INCLUDES
- A. Wood-fiber cement siding.
- 1.2 SUBMITTALS
- A. See Section 013000 - Administrative Requirements, for submittal procedures.
 - B. Product Data: Manufacturer's data sheets on each product to be used, including:
 - 1. Manufacturer's requirements for related materials to be installed by others.
 - 2. Preparation instructions and recommendations.
 - 3. Storage and handling requirements and recommendations.
 - 4. Installation methods, including nail patterns.
 - C. Warranty: Submit copy of manufacturer's warranty, made out in Owner's name, showing that it has been registered with manufacturer.
- 1.3 QUALITY ASSURANCE
- A. Installer Qualifications: Company specializing in performing work of the type specified in this section with minimum 3 years of experience.
- 1.4 DELIVERY, STORAGE, AND HANDLING
- A. Store products under waterproof cover and elevated above grade, on a flat surface.

PART 2 - PRODUCTS

- 2.1 SIDING
- A. Individual, horizontal and vertical boards made of cement and cellulose fiber formed under high pressure with integral surface texture, complying with ASTM C 1186 Type A Grade II; with machined edges, for nail attachment.
 - 1. Finish, texture and dimensions: As scheduled on Drawings.
 - 2. Thickness: 5/16 inch, nominal.
 - 3. Warranty: 50 year limited; transferable.
 - B. Manufacturers:
 - 1. Basis-of-Design: Subject to compliance with requirements, provide products as scheduled on Drawings, or comparable products by one of the following:
 - a. CertainTeed Corporation: www.certainteed.com.
 - b. James Hardie Building Products, Inc: www.jameshardie.com.
 - c. Nichiha USA, Inc: www.nichiha.com.
 - C. Soffit Panels: Panels made of cement and cellulose fiber formed under high pressure with integral surface texture, complying with ASTM C 1186 Type A Grade II; with machined edges, for nail attachment.
 - 1. Manufacturer: Same as siding.
 - 2. Finish, texture and dimensions: As scheduled on Drawings.
- 2.2 ACCESSORIES
- A. Trim: Same material and texture as siding and soffit, 3/4 inch thickness
 - 1. Acceptable Product: Hardietrim by James Hardie Building Products.
 - B. Fasteners: Galvanized or corrosion resistant; length as required to penetrate minimum 1-1/4 inch.
 - C. Joint Sealer: As specified in Section 079005.
 - D. Finish Paint: Latex house paint acceptable to siding manufacturer; primer recommended by paint manufacturer.

PART 3 - EXECUTION**3.1 PREPARATION**

- A. Examine substrate and clean and repair as required to eliminate conditions that would be detrimental to proper installation.
- B. Verify that water-resistive barrier has been installed over substrate completely and correctly.
- C. Do not begin until unacceptable conditions have been corrected.
- D. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

- A. Install sheet metal flashing:
 - 1. Above door and window trim and casings.
 - 2. Above horizontal trim in field of siding.

3.3 INSTALLATION

- A. Install in accordance with manufacturer's instructions and recommendations.
 - 1. Read warranty and comply with all terms necessary to maintain warranty coverage.
 - 2. Install in accordance with conditions stated in model code evaluation report applicable to location of project.
 - 3. Use trim details indicated on drawings.
 - 4. Touch up all field cut edges before installing.
 - 5. Pre-drill nail holes if necessary to prevent breakage.
- B. Over Wood and Gypsum or Wood-Composite Sheathing: Fasten siding through sheathing into studs.
- C. Allow space between both ends of siding panels that butt against trim for thermal movement; seal joint between panel and trim with exterior grade sealant.
- D. Joints in Horizontal Siding: Avoid joints in lap siding except at corners; where joints are inevitable stagger joints between successive courses.
- E. Do not install siding less than 6 inches from surface of ground nor closer than 1 inch to roofs, patios, porches, and other surfaces where water may collect.
- F. After installation, seal all joints except lap joints of lap siding. Seal around all penetrations. Paint all exposed cut edges.

3.4 PROTECTION

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

SECTION 075419**PVC ROOFING – ADHERED****PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

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

1.2 SUMMARY

- A. Section Includes:
 1. Adhered PVC membrane roofing system.
 2. Roof insulation.

1.3 DEFINITIONS

- A. PVC: Thermoplastic polyolefin.
- B. Roofing Terminology: See ASTM D 1079 and glossary in NRCA's "The NRCA Roofing and Waterproofing Manual" for definitions of terms related to roofing work in this Section.

1.4 PERFORMANCE REQUIREMENTS

- A. General Performance: Installed membrane roofing and base flashings shall withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Membrane roofing and base flashings shall remain watertight.
- B. Material Compatibility: Provide roofing materials that are compatible with one another under conditions of service and application required, as demonstrated by membrane roofing manufacturer based on testing and field experience.
- C. Roofing System Design: Provide membrane roofing system that is identical to systems that have been successfully tested by a qualified testing and inspecting agency to resist uplift pressure calculated according to ASCE/SEI 7.
- D. Energy Performance: Provide roofing system with initial Solar Reflectance Index not less than 78 when calculated according to ASTM E 1980, based on testing identical products by a qualified testing agency.

1.5 SUBMITTALS

- A. Product Data: For each type of product indicated.
 1. Product data for roof materials, indicating that roof materials comply with Solar Reflectance Index requirement.
 2. Product data for adhesives and sealants, including printed statement of VOC content.
- B. Shop Drawings: For roofing system. Include plans, elevations, sections, details, and attachments to other work.
 1. Base flashings and membrane terminations.
 2. Insulation fastening patterns for corner, perimeter, and field-of-roof locations.
 3. Walkway plan and details.
 4. Proposed watertight temporary tie-off details for the proposed substrate.
 5. Interface with sheet metal components (per section 076200), including but not limited to:
 - a. Counterflashing
 - b. Stack Flashing Assembly
 - c. Edge and fascia
 - d. Interface with coping assemblies.
 - e. Interface with roofing accessories including but not limited to:
 - 1) Equipment curbs
 - 2) Roof hatches
 - 3) Expansion joint assemblies
- C. Qualification Data: For qualified Installer and manufacturer. Provide a letter signed by a manufacturer's representative that the roof installer is authorized to install the specified system.
- D. Manufacturer Certificates: Signed by roofing manufacturer certifying that roofing system complies with requirements specified in "Performance Requirements" Article.
 1. Submit evidence of compliance with performance requirements.
- E. Maintenance Data: For roofing system to include in maintenance manuals.
- F. Warranties: Sample Warranty: Copy of roofing-system manufacturer's warranty, stating obligations,

remedies, limitations, and exclusions.

1.6 QUALITY ASSURANCE

- A. **Manufacturer Qualifications:** A qualified manufacturer that is FM Approvals approved for membrane roofing system identical to that used for this Project. The manufacturer shall have a minimum of ten (10) years experience in manufacturing of thermal polyolefin membranes.
- B. **Installer Qualifications:** A qualified firm that is approved, authorized, or licensed by membrane roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's special warranty. The installer shall have a minimum of five (5) years experience in the installation of thermal polyolefin membranes.
- C. **Source Limitations:** Obtain components including roof insulation for membrane roofing system from same manufacturer as membrane roofing or approved by membrane roofing manufacturer.
- D. **Exterior Fire-Test Exposure:** ASTM E 108, Class A; for application and roof slopes indicated, as determined by testing identical membrane roofing materials by a qualified testing agency. Materials shall be identified with appropriate markings of applicable testing agency.
- E. **Fire-Resistance Ratings:** Where indicated, provide fire-resistance-rated roof 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.
- F. **Preinstallation Roofing Conference:** Conduct conference at Project site.
 - 1. Meet with 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, approval or listing agency markings, and directions for storing and mixing with other components.
- B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid material from direct sunlight.
 - 1. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.
- C. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation. Cover roof insulation with breathable tarps at all times prior to 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. **Special Warranty:** Manufacturer's standard or customized form, without monetary limitation, in which manufacturer agrees to repair or replace components of membrane roofing system that fail in materials or workmanship within specified warranty period.
 - 1. Special warranty includes membrane roofing, base flashings, roof insulation, cover boards, and other components of membrane roofing system.

2. Warranty Period: 20 years from date of Substantial Completion.
- B. Special Project Warranty: Submit roofing Installer's warranty, on warranty form at end of this Section, signed by Installer, covering the Work of this Section, including all components of membrane roofing system such as membrane roofing, base flashing, roof insulation, fasteners, cover boards, substrate boards, vapor retarders, roof pavers, and walkway products, for the following warranty period:
 1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PVC ROOFING

- A. PVC Sheet: ASTM D 4434/D 4434M, Type III, fabric-reinforced and fabric backed.
 1. Manufacturers: Subject to compliance with requirements, provide products by Duro-Last Roofing, Inc., or comparable product by one of the following:
 - a. Carlisle SynTec Incorporated.
 - b. Cooley Engineered Membranes.
 - c. Custom Seal Roofing.
 - d. Flex Membranes International.
 - e. GAF Materials Corporation.
 - f. GenFlex Roofing Systems.
 - g. Johns Manville.
 - h. Mule-Hide Products Co., Inc.
 - i. Sarnafil Inc.
 - j. Versico Incorporated.
 - k. For substitution request, refer to Section "012500 – Substitution Procedures".
 2. Thickness: 60 mils, nominal.
 3. Exposed Face Color: White.

2.2 AUXILIARY MEMBRANE ROOFING MATERIALS

- A. General: Auxiliary membrane roofing materials recommended by roofing system manufacturer for intended use, and compatible with membrane roofing.
 1. Liquid-type auxiliary materials shall comply with 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 when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
 - 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. Contact Adhesive: 80 g/L.
 - f. Other Adhesives: 250 g/L.
 - g. Single-Ply Roof Membrane Sealants: 450 g/L.
 - h. Nonmembrane Roof Sealants: 300 g/L.
 - i. Sealant Primers for Nonporous Substrates: 250 g/L.
 - j. Sealant Primers for Porous Substrates: 775 g/L.
- B. Sheet Flashing: Manufacturer's standard PVC sheet flashing of same color as sheet membrane.
- C. Bonding Adhesive: Manufacturer's standard, water based.
- D. Metal Termination Bars: Manufacturer's standard, predrilled stainless-steel or aluminum bars, approximately 1 by 1/8 inch thick; with anchors.
- E. Metal Battens: Manufacturer's standard, aluminum-zinc-alloy-coated or zinc-coated steel sheet, approximately 1 inch wide by 0.05 inch thick, prepunched.
- F. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening membrane to substrate, and acceptable to membrane roofing system manufacturer.
- G. Miscellaneous Accessories: Provide pourable sealers, preformed cone and vent sheet flashings, preformed inside and outside corner sheet flashings, T-joint covers, lap sealants, termination reglets, and other accessories.

2.3 ROOF INSULATION

- A. General: Preformed roof insulation boards manufactured or approved by PVC membrane roofing manufacturer, selected from manufacturer's standard sizes suitable for application, of thicknesses indicated and that produce FM Approvals-approved roof insulation.
- B. Polyisocyanurate Board Insulation: ASTM C 1289, Type II, Class 1, Grade 2, felt or glass-fiber mat facer

on both major surfaces.

1. Thickness or R Value: Insulation system shall have a minimum R-20 (continuous insulation) Long Term Thermal Resistance (LTTR) value as determined in accordance with CAN/ULC-S770 and the corresponding thickness required to meet this minimum requirement by authority of jurisdiction.
- C. Provide preformed polyisocyanurate saddles, crickets, tapered edge strips, and other insulation shapes where indicated for sloping to drain. Fabricate to slopes indicated. The configuration of the saddles and crickets must provide a minimum of 1/8 inch per foot slope in all valleys.
1. For insulation that will be placed using adhesive, board sizes shall not exceed 4 ft. by 4 ft. maximum. Largest appropriate sized approaching, but not exceeding 4 ft. by 4 ft. as appropriate, shall be installed where possible. Using multiple smaller sized sections of insulation where larger sections would be more appropriate shall not be allowed.

2.4 INSULATION ACCESSORIES

- A. Primer: As required by insulation adhesive manufacturer.
- B. Insulation Adhesive:
 1. Polyurethane adhesive acceptable to the roof system manufacturer in order to meet the specified wind uplift resistance. Adhesive shall be compatible with the roof decks, specified insulation, and specified cover board, and shall be acceptable to roof system manufacturer in order to meet wind uplift and warranty requirements.
 2. Adhesives shall be approved by Factory Mutual (FM) and listed in the Factory Mutual Approval Guide for Class 1 fire rating and Class FM 1-90 windstorm rating. Submit manufacturer's recommended pattern to engineering for acceptance.
- C. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening roof insulation and cover boards to substrate, and acceptable to roofing system manufacturer.
- D. Cover Board: ASTM C 1177/C 1177M, glass-mat, water-resistant gypsum substrate, 3/8" minimum, or as required to meet uplift requirement., factory primed.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Georgia-Pacific Corporation; DensDeck Prime.
 - b. USG: SecuRock

2.5 WALKWAYS

- A. Flexible Walkways Maintenance Pads: Factory-formed, nonporous, heavy-duty, slip-resisting, surface-textured walkway pads or rolls, approximately 3/16 inch thick, and acceptable to membrane roofing system manufacturer. As indicated on the drawings, or at a minimum from point of roof access to each piece and surrounding piece of equipment, which require regular maintenance.

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 curbs are set and braced and that roof drain bodies are securely clamped in place.
 2. Verify that wood blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.
 3. Verify that surface plane flatness and fastening of steel roof deck complies with requirements in Division 05 Section "Steel Decking."
 4. Verify that minimum concrete drying period recommended by roofing system manufacturer has passed.
 5. Verify that concrete substrate is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D 4263.
 6. Verify that concrete curing compounds that will impair adhesion of roofing components to roof deck have been removed.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing installation according to roofing system manufacturer's written instructions. Remove sharp projections.
- B. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.

- 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.
- D. Install acoustical roof deck rib insulation strips, specified in Division 05 Section "Steel Decking," according to acoustical roof deck manufacturer's written instructions, immediately before installation of overlying construction and to remain dry.

3.3 INSULATION 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 and insulation manufacturer's written instructions for installing roof insulation.
- C. Install tapered insulation under area of roofing to conform to slopes indicated.
- D. Install insulation under area of roofing to achieve required thickness. Where overall insulation thickness is 2.7 inches or greater, install two or more layers with joints of each succeeding layer staggered from joints of previous layer a minimum of 6 inches in each direction.
 - 1. Where installing composite and noncomposite insulation in two or more layers, install noncomposite board insulation for bottom layer and intermediate layers, if applicable, and install composite board insulation for top layer.
- 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 according to requirements in FM Approvals' "RoofNav" for specified Windstorm Resistance Classification.
 - 2. Fasten insulation to resist uplift pressure at corners, perimeter, and field of roof.
 - 3. Steel Decks: Fasteners must fully engage the top rib of steel roof decks.
 - 4. Steel Decks: The ends of the insulation boards must lap a minimum of 1 inch onto the top rib.
- H. 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 fasten to roof deck.
 - 1. Fasten cover boards according to requirements in FM Approvals' "RoofNav" for specified Windstorm Resistance Classification.
 - 2. Fasten cover boards to resist uplift pressure at corners, perimeter, and field of roof.

3.4 ADHERED MEMBRANE ROOFING INSTALLATION

- A. Adhere roofing over area to receive roofing according to roofing system manufacturer's written instructions. Unroll roofing and allow to relax before retaining.
 - 1. Install sheet according to ASTM D 5036.
- B. Adhere membrane roofing over area to receive roofing and install according to membrane roofing system manufacturer's written instructions.
- C. Start installation of membrane roofing in presence of membrane roofing system manufacturer's technical personnel.
- D. Accurately align membrane roofing and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.
- E. Bonding Adhesive: Apply to substrate and underside of membrane roofing at rate required by manufacturer and allow to partially dry before installing membrane roofing. Do not apply to splice area of membrane roofing.
- F. In addition to adhering, mechanically fasten membrane roofing securely at terminations, penetrations, and perimeter of roofing.
- G. Apply membrane roofing with side laps shingled with slope of roof deck where possible.
- H. Seams: Clean seam areas, overlap membrane roofing, and hot-air weld side and end laps of membrane roofing and sheet flashings according to manufacturer's written instructions to ensure a watertight seam installation.
 - 1. Test lap edges with probe to verify seam weld continuity. Apply lap sealant to seal cut edges of sheet membrane.
 - 2. Verify field strength of seams a minimum of twice daily and repair seam sample areas.
 - 3. Repair tears, voids, and lapped seams in roofing that does not comply with requirements.
- I. Spread sealant bed over deck drain flange at roof drains and securely seal membrane roofing in place with

clamping ring.

3.5 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 to seam area of flashing.
- C. Flash penetrations and field-formed inside and outside corners with cured or uncured sheet flashing.
- D. Clean seam areas, overlap, and firmly roll sheet flashings into the adhesive. Hot-air weld side and end laps to ensure a watertight seam installation.
- E. Terminate and seal top of sheet flashings and mechanically anchor to substrate through termination bars.
- F. For those base flashings that exceed the maximum allowable height required by the manufacturer, provide attachments along the membrane as required by the manufacturer.

3.6 WALKWAY INSTALLATION

- A. Flexible Walkways: Install walkway products in locations indicated or as noted. Heat weld to substrate or adhere walkway products to substrate with compatible adhesive according to roofing system manufacturer's written instructions.
 - 1. Provide walkways around each element requiring routine access and maintenance (mechanical equipment, drains, etc).
 - 2. Provide path from each entry point onto the roof to the elements requiring maintenance.
 - 3. Provide path from each entry point to each of the permanently mounted davit and outrigger system locations.

3.7 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion.
- C. Repair or remove and replace components of membrane roofing system where inspections indicate that they do not comply with specified requirements.
- D. Additional inspections, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.8 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 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.

3.9 ROOFING INSTALLER'S WARRANTY

- A. WHEREAS **[Insert name]** of **[Insert address]**, herein called the "Roofing Installer," has performed roofing and associated work ("work") on the following project:
 - 1. Owner: **[Insert name of Owner]**.
 - 2. Address: **[Insert address]**.
 - 3. Building Name/Type: **[Insert information]**.
 - 4. Address: **[Insert address]**.
 - 5. Area of Work: **[Insert information]**.
 - 6. Acceptance Date: **[Insert date]**.
 - 7. Warranty Period: **[Insert time]**.
 - 8. Expiration Date: **[Insert date]**.
- B. AND WHEREAS Roofing Installer has contracted (either directly with Owner or indirectly as a subcontractor) to warrant said work against leaks and faulty or defective materials and workmanship for designated Warranty Period,
- C. NOW THEREFORE Roofing Installer hereby warrants, subject to terms and conditions herein set forth, that during Warranty Period he will, at his own cost and expense, make or cause to be made such repairs to or replacements of said work as are necessary to correct faulty and defective work and as are necessary to maintain said work in a watertight condition.
- D. This Warranty is made subject to the following terms and conditions:

1. Specifically excluded from this Warranty are damages to work and other parts of the building, and to building contents, caused by:
 - a. Lightning;
 - b. Peak gust wind speed exceeding 110 mph;
 - c. Fire;
 - d. Failure of roofing system substrate, including cracking, settlement, excessive deflection, deterioration, and decomposition;
 - e. Faulty construction of parapet walls, copings, chimneys, skylights, vents, equipment supports, and other edge conditions and penetrations of the work;
 - f. Vapor condensation on bottom of roofing; and
 - g. Activity on roofing by others, including construction contractors, maintenance personnel, other persons, and animals, whether authorized or unauthorized by Owner.
 2. When work has been damaged by any of foregoing causes, Warranty shall be null and void until such damage has been repaired by Roofing Installer and until cost and expense thereof have been paid by Owner or by another responsible party so designated.
 3. Roofing Installer is responsible for damage to work covered by this Warranty but is not liable for consequential damages to building or building contents resulting from leaks or faults or defects of work.
 4. During Warranty Period, if Owner allows alteration of work by anyone other than Roofing Installer, including cutting, patching, and maintenance in connection with penetrations, attachment of other work, and positioning of anything on roof, this Warranty shall become null and void on date of said alterations, but only to the extent said alterations affect work covered by this Warranty. If Owner engages Roofing Installer to perform said alterations, Warranty shall not become null and void unless Roofing Installer, before starting said work, shall have notified Owner in writing, showing reasonable cause for claim, that said alterations would likely damage or deteriorate work, thereby reasonably justifying a limitation or termination of this Warranty.
 5. During Warranty Period, if original use of roof is changed and it becomes used for, but was not originally specified for, a promenade, work deck, spray-cooled surface, flooded basin, or other use or service more severe than originally specified, this Warranty shall become null and void on date of said change, but only to the extent said change affects work covered by this Warranty.
 6. Owner shall promptly notify Roofing Installer of observed, known, or suspected leaks, defects, or deterioration and shall afford reasonable opportunity for Roofing Installer to inspect work and to examine evidence of such leaks, defects, or deterioration.
 7. This Warranty is recognized to be the only warranty of Roofing Installer on said work and shall not operate to restrict or cut off Owner from other remedies and resources lawfully available to Owner in cases of roofing failure. Specifically, this Warranty shall not operate to relieve Roofing Installer of responsibility for performance of original work according to requirements of the Contract Documents, regardless of whether Contract was a contract directly with Owner or a subcontract with Owner's General Contractor.
- E. IN WITNESS THEREOF, this instrument has been duly executed this **[Insert day]** day of **[Insert month]**, **[Insert year]**.
1. Authorized Signature: **[Insert signature]**.
 2. Name: **[Insert name]**.
 3. Title: **[Insert title]**.

END OF SECTION

SECTION 076210
FLEXIBLE FLASHING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:

1. Formed Products: Concealed flashing within wall assemblies to protect and shed incidental water to the exterior.

1.3 PERFORMANCE REQUIREMENTS

- A. General: Flashing and trim assemblies as indicated shall withstand structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.
- B. Thermal Movements: Provide sheet metal flashing and trim that allows for thermal movements from ambient and surface temperature changes.
1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each manufactured product and accessory.
- B. Shop Drawings: Show fabrication and installation layouts of sheet metal flashing and trim, including plans, elevations, expansion-joint locations, and keyed details. Distinguish between shop- and field-assembled work.

1.5 DELIVERY, STORAGE, AND HANDLING

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

PART 2 - PRODUCTS

2.1 FLEXIBLE FLASHING

- A. Self-Adhesive flexible flashing product consisting of a pliable, adhesive rubberized-asphalt compound, bonded to a high-density, cross-laminated polyethylene film to produce an overall thickness of not less than 40 mils.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Advanced Building Products Inc.; Strip-N-Flash.
 - b. Carlisle Coatings & Waterproofing; CCW-705 Air & Vapor Barrier Strips.
 - c. Grace Construction Products; Perm-A-Barrier Detail Membrane.
 - d. Henry; Blueskin SA

2.2 THRU-WALL FLASHING

- A. Self-Adhesive thru-wall flashing product consisting of a pliable, adhesive rubberized-asphalt compound, bonded to a high-density, cross-laminated polyethylene film to produce an overall thickness of not less than 40 mils.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Advanced Building Products Inc.; Strip-N-Flash.
 - b. Carlisle Coatings & Waterproofing; CCW-705-TWF Thru-Wall Flashing.
 - c. Grace Construction Products; Perm-A-Barrier Wall Flashing.
 - d. Henry; Blueskin TWF Thru-Wall Flashing

2.3 HIGH TEMPERATURE FLASHING

- A. Self-Adhering, High-Temperature Sheet: Minimum 30 to 40 mils thick, consisting of slip-resisting polyethylene-film top surface laminated to layer of butyl or SBS-modified asphalt adhesive, with release-paper backing; cold applied. Provide primer when recommended by manufacturer.
 - 1. Thermal Stability: ASTM D 1970; stable after testing at 240 deg F.
 - 2. Low-Temperature Flexibility: ASTM D 1970; passes after testing at minus 20 deg F.
 - 3. Products: Subject to compliance with requirements, provide one of the following:
 - a. Carlisle Coatings & Waterproofing Inc.; CCW WIP 300HT.
 - b. Grace Construction Products, a unit of W. R. Grace & Co.; Ultra.
 - c. Henry Company; Blueskin PE200 HT.
 - d. Owens Corning; WeatherLock Metal High Temperature Underlayment.

2.4 MISCELLANEOUS MATERIALS

- A. General: Provide materials and types of fasteners, separators, sealants, and other miscellaneous items as required for complete metal flashing installation and recommended by manufacturer of primary sheet metal or manufactured item unless otherwise indicated.
- B. Elastomeric Sealant: ASTM C 920, elastomeric silicone polymer sealant; low modulus; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

PART 3 - EXECUTION**3.1 EXAMINATION**

- A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions and other conditions affecting performance of the Work.
 - 1. Verify compliance with requirements for installation tolerances of substrates.
 - 2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
- B. For the record, 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 FLASHING INSTALLATION

- A. General: Install as indicated on Drawings and per Manufacturer's recommendations.
- B. Self-Adhering Sheet Flashing: Install self-adhering sheet flashing, wrinkle free. Apply primer if required by flashing manufacturer. Comply with temperature restrictions of flashing manufacturer for installation. Apply in shingle fashion to shed water, with end laps of not less than 6 inches staggered 24 inches between courses. Overlap side edges not less than 3-1/2 inches. Roll laps with roller. Cover flashing with subsequent construction within 14 days.
- C. Location:
 - 1. Flexible Flashing: As indicated on drawings, or at all exterior windows, doors or other penetrations where high temperature flashing is not required.
 - 2. Thru-Wall Flashing: As indicated on drawings, or at all masonry cavity wall conditions requiring flashing (head of windows, doors, openings, shelf angles, base of wall).
 - 3. High Temperature Flashing: As indicated on drawings, or at all locations where flashing will be in contact with metal coping or metal panels where high temperatures exist.

END OF SECTION

SECTION 077100**ROOF SPECIALTIES****PART 1 - GENERAL**

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Copings.
 - 2. Roof-edge flashings.
 - 3. Roof-edge drainage systems.
 - 4. Reglets and counterflashings.

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. SPRI Wind Design Standard: Manufacture and install copings roof-edge flashings tested according to SPRI ES-1 and capable of resisting pressure as required by code:
- C. Indicate wind design pressure on Drawings or in subparagraph below. Design pressure is determined by formulas in the IBC or SPRI ES-1, as applicable, that account for basic wind speed, exposure factor, building height, building importance factor, and pressure coefficient that combines a gust factor.
- D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, hole elongation, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Provide clips that resist rotation and avoid shear stress as a result of thermal movements. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 - 1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Retain first paragraph below for Work that involves custom fabrication or if manufacturer's product data are inadequate.
- C. 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.
- D. Remaining paragraphs are defined in Division 01 Section "Submittal Procedures" as "Informational Submittals."
- E. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for copings.
- F. Maintenance Data: For roofing specialties to include in maintenance manuals.
- G. Installer Qualifications: Submit evidence that Installer's existing company has minimum of 5-years continuous experience in application of specified materials. Submit list of at least five completed projects of similar scope and size, including:
 - 1. Project name.
 - 2. Owner's name.
 - 3. Owner's Representative name, address, and telephone number.
 - 4. Description of work.
 - 5. Sheet metal members installed.
 - 6. Project supervisor.
 - 7. Total cost of sheet metal work and total cost of project.

8. Completion date

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 fascia gutter downspout, approximately 10 feet long, including supporting construction, seams, attachments, underlayment, and accessories.
 - 2. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.
- B. Pre-installation Meeting
 - 1. Conduct meeting at Project site.
 - 2. Review requirements for sheet metal Work, including:
 - a. Construction schedule and availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - b. Site use, access, staging, and set-up location limitations.
 - c. Approved mockup procedures.
 - d. Forecast weather conditions.
 - e. Surface preparation and substrate condition and pretreatment.
 - f. Installation procedures.
 - g. Special details.
 - h. Testing and inspection requirements.
 - i. Site protection measures.
 - j. Governing regulations if applicable.
 - 3. Contractor's site foreman, waterproofing manufacturer's technical representative, waterproofing Installer, sheet metal fabricator, sheet metal Installer, Owner's Representative, and Architect/Engineer shall attend.

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.

1.7 WARRANTY

- A. Special Finish Warranty: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. 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. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 EXPOSED METALS

- A. Aluminum .050" thickness, Z275.
 - 1. Surface: Smooth, flat finish.
 - 2. Exposed Coil-Coated Finishes: Prepainted by the coil-coating process to comply with ASTM A 755. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - a. Two-Coat Fluoropolymer: AAMA 621. System consisting of primer and fluoropolymer color topcoat containing not less than 70 percent PVDF resin by weight.

2.2 CONCEALED METALS

- A. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653, G90 Z275 coating designation.

2.3 UNDERLAYMENT MATERIALS

- A. Self-adhering underlayment in first paragraph below is suitable for high temperatures associated with exposed metals used in roofing applications. These underlayments are used to resist leaks from roof areas where ice dams may form. Revise if high-temperature underlayment is not required.

- B. Self-Adhering, High-Temperature Sheet: Minimum 30 to 40 mils thick, consisting of slip-resisting polyethylene-film top surface laminated to layer of butyl or SBS-modified asphalt adhesive, with release-paper backing; cold applied. Provide primer when recommended by underlayment manufacturer.
 - 1. Thermal Stability: ASTM D 1970; stable after testing at 240 deg F.
 - 2. Low-Temperature Flexibility: ASTM D 1970; passes after testing at minus 20 deg F.
 - 3. Products: Subject to compliance with requirements, provide one of the following:
 - a. Carlisle Coatings & Waterproofing; CCW WIP 300HT.
 - b. Grace Construction Products, a unit of W. R. Grace & Co.; Ultra.
 - c. Henry Company; Blueskin PE200 HT.

2.4 MISCELLANEOUS MATERIALS

- A. General: Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items required by manufacturer for a complete installation.
- B. Fasteners: Manufacturer's recommended fasteners, suitable for application and designed to meet performance requirements. Furnish the following unless otherwise indicated:
 - 1. Exposed Penetrating Fasteners: Gasketed screws with hex washer heads matching color of sheet metal.
- C. Elastomeric Sealant: ASTM C 920, elastomeric silicone polymer sealant of type, grade, class, and use classifications required by roofing-specialty manufacturer for each application.
- D. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D 1187.

2.5 COPINGS

- A. Copings: Manufactured coping system consisting of formed-metal coping cap in section lengths a minimum of 8 feet and not exceeding 12 feet, concealed anchorage; corner units, end cap units, and concealed splice plates with same finish as coping caps.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Metal-Era, Inc., Perma-tite Coping or comparable product by one of the following:
 - a. Hickman Company, W. P.
 - b. Johns Manville.
 - 2. Coping-Cap Material: Aluminum: Conforming to ASTM B202-92a (UNS Alloy Designation A93003-H14 or A933004-H34), .050" minimum thickness. Exposed aluminum sheet metal shall have a high-performance organic finish, thermocured and containing not less than 70 percent polyvinylidene fluoride resin by weight, complying with AAMA 2604.
 - 3. Corners: Factory mitered and mechanically clinched and sealed watertight.
 - 4. Manufacturers offer a variety of special fabrications and face-leg profiles.
 - 5. Special Fabrications: As indicated.
 - 6. Coping-Cap Attachment Method: Snap-on, fabricated from coping-cap material.
 - 7. Snap-on-Coping Anchor Plates: Concealed, stainless steel sheet, 12 inches wide, with integral cleats.

2.6 ROOF-EDGE FLASHINGS

- A. Roof-Edge Fascia: Manufactured, two-piece, roof-edge fascia consisting of snap-on metal fascia cover in section lengths not exceeding 12 feet and a continuous formed- or extruded-aluminum anchor bar with integral drip-edge cleat to engage fascia cover. Provide matching corner units.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Hickman Company, W. P.
 - b. Johns Manville.
 - c. Metal-Fab Manufacturing, LLC.
 - 2. Fascia Cover: Fabricated from the following exposed metal:
 - a. Aluminum: Conforming to ASTM B202-92a (UNS Alloy Designation A93003-H14 or A933004-H34), .050" minimum thickness. Exposed aluminum sheet metal shall have a high-performance organic finish, thermo-cured and containing not less than 70 percent polyvinylidene fluoride resin by weight, complying with AAMA2604.
 - 2. Corners: Factory mitered and mechanically clinched and sealed watertight.
 - 3. Splice Plates: Concealed, of same material, finish, and shape as fascia cover.
 - 4. Special Fabrications: As indicated.
 - 5. Fascia Accessories: Integral drip edge.
 - a. Finish: High-Performance Organic Finish: Two-coat fluoropolymer finish complying with AAMA 2604 and containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 1) Color and Gloss: As selected by Architect from Manufacturers full range.

2.7 ROOF-EDGE DRAINAGE SYSTEMS

- A. 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:
- 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: Conforming to ASTM B202-92a (UNS Alloy Designation A93003-H14 or A933004-H34), .050" minimum thickness. Exposed aluminum sheet metal shall have a high- performance organic finish, thermocured and containing not less than 70 percent polyvinylidene fluoride resin by weight, complying with AAMA2604.
 - 2. Gutter Profile: Insert style according to SMACNA's "Architectural Sheet Metal Manual."
 - 3. Corners: Factory mitered and mechanically clinched and sealed watertight.
 - 4. Gutter Supports: Gutter brackets with finish matching the gutters.
 - 5. Gutter Accessories: As indicated.
- C. Downspouts: Fabricate rectangular downspouts complete with mitered elbows. Furnish with metal hangers, from same material as downspouts, and anchors.
 - 1. Fabricated Hanger Style: SMACNA figure designation 1-35A.
 - 2. Manufactured Hanger Style: SMACNA figure designation 1-34A.
 - 3. Fabricate from the following materials:
 - a. Prefinished Aluminum

2.8 REGLETS AND COUNTERFLASHINGS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide or comparable product by one of the following:
 - 1. Cheney Flashing Company.
 - 2. Fry Reglet Corporation.
 - 3. Heckmann Building Products Inc.
 - 4. Hickman Company, W. P.
 - 5. Metal-Era, Inc.
 - 6. MM Systems Corporation.
- B. Reglets: Manufactured units formed to provide secure interlocking of separate reglet and counterflashing pieces, from the following exposed metal:
 - 1. Aluminum .050" thickness
 - 2. Corners: Factory mitered and mechanically clinched and sealed watertight.
 - 3. Surface-Mounted Type: Provide reglets with slotted holes for fastening to substrate, with neoprene or other suitable weatherproofing washers, and with channel for sealant at top edge.
- C. Counterflashings: Manufactured units of heights to overlap top edges of base flashings by 4 inches and in lengths not exceeding 12 feet designed to snap into reglets and compress against base flashings with joints lapped, from the following exposed metal:
 - 1. Aluminum: Conforming to ASTM B202-92a (UNS Alloy Designation A93003-H14 or A933004-H34), .050" minimum thickness. Exposed aluminum sheet metal shall have a high-performance organic finish, thermocured and containing not less than 70 percent polyvinylidene fluoride resin by weight, complying with AAMA 2604.
 - 2. Wind Clips: 24 gauge stainless steel, spaced 24 inches on center.
- D. Miscellaneous Materials
 - 1. General: Provide materials and types of fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items required for installation.
 - 2. Fasteners: Self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads. Size fasteners to provide penetration into substrate of at least 3/4 inches for wood screws.
 - a. Use stainless-steel fasteners, except that aluminum fasteners may be used with aluminum sheet metal.
 - b. Exposed Fasteners: Heads match color of sheet metal by means of factory-applied coating.
 - c. Fasteners for Flashing and Trim: Blind fasteners or self-drilling screws, gasketed, with hex washer head.
 - 1) Blind Fasteners: High-strength aluminum or stainless-steel rivets.
 - 3. Metal-to-Metal Joint Sealant
 - a. One-component silicone elastomeric sealant, FS TT-S-00230C Class A, TT-S-001543A Class A:

- 1) "Silpruf Silicone Weatherproofing Sealant," manufactured by General Electric Company, Silicone Products Department, Waterford, NY
 - 2) "Dow-Corning 795 Silicone Building Sealant," manufactured by Dow Corning Corporation, Midland, MI
 - 3) "Spectrum 1", manufactured by Tremco, Beachwood, O
4. Concrete-to-Metal Joint Sealant
- a. One-component silicone elastomeric sealant, FS TT-S-00230C Class A, TT-S-001543A Class A:
 - 1) "Silpruf Silicone Weatherproofing Sealant," manufactured by General Electric Company, Silicone Products Department, Waterford, NY
 - 2) "Dow-Corning 795 Silicone Building Sealant," manufactured by Dow Corning Corporation, Midland, MI
 - 3) "Spectrum 1", manufactured by Tremco, Beachwood
 - b. Color of exposed sealant shall be as approved by ARCHITECT from manufacturer's full colors similar to finishes of the adjacent substrate.
5. Joint Filler
- a. Closed-cell expanded polyethylene (rod), non-gassing:
 - 1) "Expand-O-Foam", manufactured by (Williams Products, Inc.
 - 2) "Sof Rod", manufactured by Nomanco, Inc.
 - 3) "Sonofoam Backer-Rod", manufactured by Sonneborn-Contech
6. Joint Cleaner: Type recommended by the manufacturer of the sealing compound for the specific joint surface and conditions.
7. Joint Primer and Sealer: Type recommended by the manufacturer of the sealing compound for the specific joint surface and conditions.
8. Bond Breaker: Polyethylene tape compatible with sealants used.

2.9 GENERAL FINISH REQUIREMENTS

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

PART 3 - EXECUTION

3.1 EXAMINATION

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

3.2 UNDERLAYMENT INSTALLATION

- A. Self-Adhering Sheet Underlayment: Install wrinkle free. Apply primer if required by underlayment manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation; use primer rather than nails for installing underlayment at low temperatures. Apply in shingle fashion to shed water. Overlap edges not less than 3-1/2 inches. Roll laps with roller. Cover underlayment within 14 days.
- B. Slip Sheet: Install with tape or adhesive for temporary anchorage to minimize use of mechanical fasteners under copper sheet metals roof specialties. Apply in shingle fashion to shed water, with lapped joints of not less than 2 inches.

3.3 INSTALLATION, GENERAL

- A. General: Install roof specialties according to manufacturer's written instructions. Anchor roof specialties securely in place, with provisions for thermal and structural movement. Use fasteners, solder, protective coatings, separators, sealants, and other miscellaneous items as required to complete roof-specialty systems.
 1. Install roof specialties level, plumb, true to line and elevation; with limited oil-canning and without warping, jogs in alignment, buckling, or tool marks.
 2. Provide uniform, neat seams with minimum exposure of solder and sealant.

3. Install roof specialties to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before manufacture.
 4. Torch cutting of roof specialties is not permitted.
 5. Do not use graphite pencils to mark 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.
 1. Coat concealed side of roof specialties with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.
 2. Underlayment: Where installing metal flashing directly on cementitious or wood substrates, install a course of self-adhering, high-temperature sheet underlayment.
 - C. Expansion Provisions: Allow for thermal expansion of exposed roof specialties.
 1. Space movement joints at a maximum of 12 feet with no joints within 18 inches of corners or intersections unless otherwise shown on Drawings.
 2. When ambient temperature at time of installation is between 40 and 70 deg F, set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures.
 - D. Fastener Sizes: Use fasteners of sizes 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 with elastomeric sealant as required by roofing-specialty manufacturer.
 - F. Seal joints as required for watertight construction. Place sealant to be completely concealed in joint. Do not install sealants at temperatures below 40 deg F.
- 3.4 COPING INSTALLATION
- A. Install cleats, anchor plates, and other anchoring and attachment accessories and devices with concealed fasteners.
 - B. Anchor copings to meet performance requirements.
 1. Interlock face and back leg drip edges of snap-on coping cap into cleated anchor plates anchored to substrate at 30-inch centers.
- 3.5 ROOF-EDGE FLASHING INSTALLATION
- A. Install cleats, cants, and other anchoring and attachment accessories and devices with concealed fasteners.
 - B. Anchor roof edgings with manufacturer's required devices, fasteners, and fastener spacing to meet performance requirements.
- 3.6 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 seal with sealant 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.
 2. Install continuous leaf guards on gutters with non-corrosive fasteners, removable for cleaning gutters.
 - 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. Splash Pans: Install where downspouts discharge on low-slope roofs. Set in elastomeric sealant.
 - E. Conductor Heads: Anchor securely to wall with elevation of conductor top edge 1 inch below gutter discharge.
- 3.7 REGLET AND COUNTERFLASHING INSTALLATION
- A. General: Coordinate installation of reglets and counterflashings with installation of base flashings.
 - B. Surface-Mounted Reglets: Install reglets to receive flashings where flashing without embedded reglets is indicated on Drawings. Install at height so that inserted counterflashings overlap 4 inches over top edge of base flashings.

- C. Counterflashings: Insert counterflashings into reglets or other indicated receivers; ensure that counterflashings overlap 4 inches over top edge of base flashings. Lap counterflashing joints a minimum of 4 inches and bed with elastomeric sealant. Fit counterflashings tightly to base flashings.

3.8 INSTALLATION OF SEALANT MATERIALS

- A. All surfaces to receive the joint sealants shall be examined by the contractor. Any surfaces, which are found to be unsuitable for installation of the joint sealants, shall be brought to the attention of the Architect for resolution. Application or installation of the material constitutes acceptance of the surface of the substrate.
- B. All surfaces to receive sealants shall be clean, dry, and free of any loose materials, dirt, dust, laitance, rust, oil, frost, and other contaminants.
 - 1. The surfaces shall be blast cleaned with oil free compressed air to remove the dust of cleaning.
 - 2. The surfaces shall be cleaned with sealant manufacturer's approved solvents.
- C. Use appropriate primers on concrete, masonry and metal surfaces to receive joint sealants in accordance with the recommendations of the sealant manufacturer.
- D. The contractor shall make test applications at the beginning of the sealant work, in all types of prepared joints or surface applications, to determine if preparation steps have been adequate for optimum sealant adhesion. These test applications will be reviewed by the Architect prior to the start of the work.
- E. Install all materials in accordance with the manufacturer's printed instructions, as well as the following:
 - 1. Install bond breakers and backer rods in locations and of the type recommended by the sealant manufacturer to prevent bond of sealant to surfaces where such bond might impair the performance of the sealant. Backer rods shall typically be installed under 25% compression of rod material unless otherwise recommended by sealant manufacturer.
 - 2. Application of joint sealant materials shall be made by cartridge-type caulking guns.
 - 3. Compounds shall not be installed when surface and ambient temperatures are below 40oF unless specifically approved by the Architect. Compounds also shall not be installed when surface and ambient temperatures are above 100° F.
 - 4. Run sealant beads sufficiently slow enough to be certain that the entire cavity is filled from bottom up. Air pockets or voids along the edges are not acceptable.
 - 5. Tool sealant surfaces to the shapes shown, or if none is shown, to flush or slightly concave surface. Tooling of sealants with soap, detergent or other lubricant is not allowed.
- F. All surfaces adjacent to sealants shall be protected, unless otherwise approved by the Architect. Use pressure sensitive tape to prevent staining of adjacent surfaces, or spillage and migration of sealant out of the joints.
- G. Do not place dissimilar sealant materials in contact with each other. Follow sealant manufacturer's recommendations for separation of dissimilar materials.
- H. All sealant material to be covered shall be allowed to fully cure in accordance with manufacturer's recommendations

3.9 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 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Equipment supports.
 - 2. Roof hatches.
 - 3. Pipe supports.

1.3 PERFORMANCE REQUIREMENTS

- A. General Performance: Roof accessories 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. Design Wind Loads: As indicated on structural drawings or as otherwise determined using design wind loads applicable to Project from basic wind speed indicated in miles per hour, according to ASCE 7, Section 6.5, "Method 2-Analytical Procedure."

1.4 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. Sustainable Submittals:
 - 1. Provide product cost and pre-and post-consumer recycled content.
- C. Shop Drawings: For roof accessories. Include plans, elevations, keyed details, and attachments to other work. Indicate dimensions, loadings, and special conditions. Distinguish between plant- and field-assembled work.
- D. Samples: For each exposed product and for each color and texture specified, prepared on Samples of size to adequately show color.
- E. Operation and Maintenance Data: For roof accessories to include in operation and maintenance manuals. Provide at project close-out.
- F. Warranty: Sample of special warranty.

1.5 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 non-corrosive installation.
- B. Coordinate dimensions with rough-in information or Shop Drawings of equipment to be supported.

1.6 WARRANTY

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

PART 2 - PRODUCTS**2.1 METAL MATERIALS**

- A. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A 792/A 792M, AZ50 coated.
 - 1. Exposed Coil-Coated Finish: Prepainted by the coil-coating process to comply with ASTM A 755/A 755M. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - a. Two-Coat Fluoropolymer Finish: AAMA 621. System consisting of primer and fluoropolymer color topcoat containing not less than 70 percent PVDF resin by weight.
 - 2. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester-backer finish consisting of prime coat and wash coat, with a minimum total dry film thickness of 0.5 mil.
- B. Aluminum Extrusions and Tubes: ASTM B 221, manufacturer's standard alloy and temper for type of use, finished to match assembly where used, otherwise mill finished.
- C. Stainless-Steel Sheet and Shapes: ASTM A 240/A 240M or ASTM A 666, Type 304.
- D. Steel Shapes: ASTM A 36/A 36M, hot-dip galvanized according to ASTM A 123/A 123M unless otherwise indicated.
- E. Galvanized-Steel Tube: ASTM A 500, round tube, hot-dip galvanized according to ASTM A 123/A 123M.
- F. Steel Pipe: ASTM A 53/A 53M, galvanized.

2.2 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. Glass-Fiber Board Insulation: ASTM C 726, thickness as indicated.
- C. Wood Nailers: Softwood lumber, pressure treated with waterborne preservatives for aboveground use, acceptable to authorities having jurisdiction, containing no arsenic or chromium, and complying with AWPA C2; not less than 1-1/2 inches thick. Provide fire retardant treated where required by code.
- D. Underlayment:
 - 1. Felt: ASTM D 226, Type II (No. 30), asphalt-saturated organic felt, non-perforated.
- E. Fasteners: Roof accessory manufacturer's recommended fasteners suitable for application and metals being fastened. Match finish of exposed fasteners with finish of material being fastened. Provide non-removable fastener heads to exterior exposed fasteners. Furnish the following unless otherwise indicated:
 - 1. Fasteners for Zinc-Coated or Aluminum-Zinc Alloy-Coated Steel: Series 300 stainless steel or hot-dip zinc-coated steel according to ASTM A 153/A 153M or ASTM F 2329.
 - 2. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.
 - 3. Fasteners for Copper Sheet: Copper, hardware bronze, or passivated Series 300 stainless steel.
 - 4. Fasteners for Stainless-Steel Sheet: Series 300 stainless steel.
- F. Elastomeric Sealant: ASTM C 920, elastomeric silicone polymer sealant as recommended by roof accessory manufacturer for installation indicated; low modulus; of type, grade, class, and use classifications required to seal joints and remain watertight.

2.3 EQUIPMENT SUPPORTS

- A. Equipment Supports: Internally reinforced metal equipment supports capable of supporting superimposed live and dead loads, including equipment loads and other construction indicated on Drawings; with welded or mechanically fastened and sealed corner joints, integral metal cant, and integrally formed deck-mounting flange at perimeter bottom.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Curbs Plus, Inc.
 - b. Custom Solution Roof and Metal Products.
 - c. Pate Company (The).
 - d. Thybar Corporation.
- B. Size: Coordinate dimensions with roughing-in information or Shop Drawings of equipment to be supported.
- C. Material: 0.050 inch thick aluminum.
 - 1. Finish: Two-coat fluoropolymer.
 - 2. Color: As selected by Architect from manufacturer's full range.
- D. Construction:
 - 1. Insulation: Factory insulated with 1-1/2-inch- thick glass-fiber board insulation.
 - 2. Liner: Same material as equipment support, of manufacturer's standard thickness and finish.
 - 3. Factory-installed continuous wood nailers 3-1/2 inches wide at tops of equipment supports.
 - 4. Metal Counterflashing: Manufacturer's standard, removable, fabricated of same metal and finish as equipment support.

5. Fabricate equipment supports to minimum height of 12 inches unless otherwise indicated.
6. Security Grille: Provide where indicated.

2.4 ROOF HATCH

- A. Roof Hatches: Metal roof-hatch units with lids and insulated double-walled curbs, welded or mechanically fastened and sealed corner joints, continuous lid-to-curb counterflashing and weathertight perimeter gasketing, stepped integral metal cant raised the thickness of roof insulation, and integrally formed deck-mounting flange at perimeter bottom.
 1. Basis-of-Design: Subject to compliance with requirements, provide products by Precision Ladders, Inc., or comparable products by one of the following:
 - a. Babcock-Davis.
 - b. Bilco Company (The).
 - c. J. L. Industries, Inc.
 - d. Milcor Inc.; Commercial Products Group of Hart & Cooley, Inc.
 - e. Nystrom.
 - f. O'Keeffe's Inc.
 - g. For substitution request, refer to Section "012500 – Substitution Procedures".
- B. Type and Size: As indicated on Drawings.
- C. Loads: Minimum 40-lbf/sq. ft. external live load and 20-lbf/sq. ft. internal uplift load.
- D. Hatch Material: 14 GA Galvanized Steel, unless indicated otherwise.
 1. Finish: Primed.
 2. Color: As selected by Architect from manufacturer's full range.
- E. Construction:
 1. Insulation: Glass-fiber board.
 2. Curb Liner: Manufacturer's standard, of same material and finish as metal curb.
 3. On ribbed or fluted metal roofs, form flange at perimeter bottom to conform to roof profile.
 4. Fabricate curbs to minimum height of 12 inches above roof surface unless otherwise indicated.
 5. Sloping Roofs: Where slope or roof deck exceeds 1:48, fabricate curb with perimeter curb height that is 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.
- F. Hardware: Stainless steel spring latch with turn handles, butt- or pintle-type hinge system, and padlock hasps inside and outside.
 1. Provide two-point latch on lids larger than 84 inches.
- G. Guardrail System: Roof hatch manufacturer's standard guardrail device for attachment to hatch. Required for all roof hatches located within 10 feet of roof edge.
 1. Height: 42 inches above finished roof deck
- H. Ladder-Assist Post: Roof-hatch manufacturer's standard device for attachment to roof-access ladder.
 1. Operation: Post locks in place on full extension; release mechanism returns post to closed position.
 2. Height: 42 inches above finished roof deck.
 3. Material: Aluminum.
 4. Post: 1-5/8-inch- diameter pipe.
 5. Finish: Manufacturer's standard baked enamel or powder coat.
 - a. Color: As selected by Architect from manufacturer's full ranger.

2.5 PIPE SUPPORTS

- A. Pipe Supports:
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Portable Pipe Hangers Inc.
 2. Pipe Support Height: As indicated on Drawings.
 3. Roller Assembly: With stainless-steel roller and high density polypropylene base plate, sized for supported pipes.

2.6 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

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

3.2 INSTALLATION

- A. General: Install roof accessories according to manufacturer's written instructions.
 - 1. Install roof accessories level, plumb, true to line and elevation, and without warping, jogs in alignment, excessive oil canning, buckling, or tool marks.
 - 2. Anchor roof accessories securely in place so they are capable of resisting indicated loads.
 - 3. Use fasteners, separators, sealants, and other miscellaneous items as required to complete installation of roof accessories and fit them to substrates.
 - 4. Install roof accessories to resist exposure to weather without failing, rattling, leaking, or loosening of fasteners and seals.
- B. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.
 - 1. Underlayment: Where installing roof accessories directly on cementitious or wood substrates, install a course of felt underlayment and cover with a slipsheet, or install a course of polyethylene sheet.
- C. Equipment Support Installation: Install equipment supports so top surfaces are level with each other.
- D. Roof-Hatch Installation:
 - 1. Install roof hatch so top surface of hatch curb is level.
 - 2. Verify that roof hatch operates properly. Clean, lubricate, and adjust operating mechanism and hardware.
 - 3. Attach ladder-assist post according to manufacturer's written instructions.
- E. Pipe Support Installation: Install pipe supports so top surfaces are in contact with and provide equally distributed support along length of supported item.
- F. Seal joints with elastomeric sealant as required by roof accessory manufacturer.

3.3 REPAIR AND CLEANING

- A. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing according to ASTM A 780.
- B. Touch up factory-primed surfaces with compatible primer ready for field painting according to Division 09 painting Sections.
- C. Clean exposed surfaces according to manufacturer's written instructions.
- D. Clean off excess sealants.
- E. Replace roof accessories that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

END OF SECTION

SECTION 078446
FIRE-RESISTIVE JOINT SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 1. Joints in or between fire-resistance-rated constructions.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Product 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.
- C. Installer Certificates: From Installer indicating fire-resistive joint systems have been installed in compliance with requirements and manufacturer's written recommendations.
- D. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for fire-resistive joint systems.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: A firm that has been approved by FM Global according to FM Global 4991, "Approval of Firestop Contractors," or been evaluated by UL and found to comply with UL's "Qualified Firestop Contractor Program Requirements."
- B. Installer Qualifications: A firm experienced in installing fire-resistive joint systems similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful performance. Qualifications include having the necessary experience, staff, and training to install manufacturer's products per specified requirements. Manufacturer's willingness to sell its fire-resistive joint system products to Contractor or to Installer engaged by Contractor does not in itself confer qualification on buyer.
- C. Fire-Test-Response Characteristics: Fire-resistive joint systems shall comply with the following requirements:
 1. Fire-resistive joint system tests are performed by a qualified testing agency acceptable to authorities having jurisdiction.
 2. Fire-resistive joint systems are identical to those tested per testing standard referenced in "Fire-Resistive Joint Systems" Article. Provide rated systems complying with the following requirements:
 - a. Fire-resistive joint system products bear classification marking of qualified testing agency.
 - b. Fire-resistive joint systems correspond to those indicated by reference to designations listed by the following:
 - 1) UL in its "Fire Resistance Directory."
 - 2) Intertek ETL SEMKO in its "Directory of Listed Building Products."

1.5 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. Install and cure fire-resistive joint systems per manufacturer's written instructions using natural means of ventilation or, where this is inadequate, forced-air circulation.

1.6 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. Notify Owner's testing agency at least seven days in advance of fire-resistive joint system installations;

confirm dates and times on day preceding each series of installations.

PART 2 - PRODUCTS

2.1 FIRE-RESISTIVE JOINT SYSTEMS

- A. 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.
- B. Joints in or between Fire-Resistance-Rated Construction: Provide fire-resistive joint systems with ratings determined per ASTM E 1966 or UL 2079:
 - 1. Joints include those installed in or between fire-resistance-rated walls floor or floor/ceiling assemblies and roofs or roof/ceiling assemblies.
 - 2. Fire-Resistance Rating: Equal to or exceeding the fire-resistance rating of construction they will join.
 - 3. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. A/D Fire Protection Systems Inc.
 - b. Hilti, Inc.
 - c. Nelson Firestop Products.
 - d. RectorSeal Corporation.
 - e. Specified Technologies Inc.
 - f. 3M Fire Protection Products.
- C. VOC Content: Provide fire-resistive joint systems that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
 - 1. Architectural Sealants: 250 g/L.
 - 2. Sealant Primers for Nonporous Substrates: 250 g/L.
 - 3. Sealant Primers for Porous Substrates: 775 g/L.
- D. Accessories: Provide components of fire-resistive joint systems, including primers and forming materials, that are needed to install fill materials and to maintain ratings required. Use only components specified by fire-resistive joint system manufacturer and approved by the qualified testing 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 the Work.
- B. 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 the Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove stains. Remove tape as soon as possible without disturbing fire-resistive joint system's seal with substrates.

3.3 INSTALLATION

- A. General: Install fire-resistive joint systems to comply with manufacturer's written installation instructions and published drawings for products and applications indicated.
- B. Install forming materials and other accessories of types required to support fill materials during their application and in position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.
 - 1. After installing fill materials and allowing them to fully cure, remove combustible forming materials

- and other accessories not indicated as permanent components of fire-resistive joint system.
- C. Install fill materials for fire-resistive joint systems by proven techniques to produce the following results:
1. Fill voids and cavities formed by joints and forming 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 the 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.
- B. Where deficiencies are found or fire-resistive joint systems are damaged or removed due to testing, repair or replace fire-resistive joint systems so they comply with requirements.
- C. Proceed with enclosing fire-resistive joint systems with other construction only after inspection reports are issued and installations comply with requirements.
- 3.5 CLEANING AND PROTECTING
- A. Clean off excess fill materials adjacent to joints as the 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 joints 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.
- 3.6 FIRE-RESISTIVE JOINT SYSTEM SCHEDULE
- A. Where UL-classified systems are indicated, they refer to system numbers in UL's "Fire Resistance Directory" under product Category XHBN or Category XHDG.
- B. Where Intertek ETL SEMKO-listed systems are indicated, they refer to design numbers in Intertek ETL SEMKO's "Directory of Listed Building Products" under product category Firestop Systems.
- 3.7 FIRE-RESISTIVE JOINT SYSTEMS
- A. Where UL-classified fire-resistive joint systems are indicated, they refer to alphanumeric designations listed in UL's "Fire Resistance Directory" under product Category XHBN.
- B. Floor-to-Floor, Fire-Resistive Joint System (FRJS-1):
1. Acceptable UL-Classified Products:
 - a. FFD1011, FFD1012, FFD1013, FFD1026 by Hilti.
 - b. FFD1024 & FFD1027 – Grace Flamesafe.
 2. Assembly Rating: Refer to Drawings.
 3. Nominal Joint Width: As indicated.
 4. Movement Capabilities: Class II; refer to Drawings.
- C. Floor-to-Wall, Fire-Resistive Joint System (FRJS-2):
1. Acceptable UL-Classified Products:
 - a. FWD1011, FWD1012, FWD1013, FWD1021 by Hilti.
 - b. FWD1020 & FWD1024 – Grace Flamesafe.
 2. Assembly Rating: Refer to Drawings.
 3. Nominal Joint Width: As indicated.
 4. Movement Capabilities: Class II; refer to Drawings.
- D. Head-of-Wall, Fire-Resistive Joint System (FRJS-3):
1. Acceptable UL-Classified Products:
 - a. HWD0042, HWD0045, HWD0046, HWD0097, HWD0098 by Hilti.
 - b. HWD0107, HWD0146, HWD0144, HWD1047, HWD1021, HWD1024, HWD0148, HWD0149, HWD0150, HWD-0267, HWD-0299, HWD-257 & HWD-0300– Grace Flamesafe.
 2. Assembly Rating: Refer to Drawings.
 3. Nominal Joint Width: As indicated.
 4. Movement Capabilities: Class II; refer to Drawings.
- E. Wall-to-Wall, Fire-Resistive Joint System (FRJS-4):
1. Acceptable UL-Classified Products:
 - a. WWD1011, WWD1012, WWD0017 by Hilti.
 - b. WWD1028 & WWD1029 – Grace Flamesafe.
 2. Assembly Rating: Refer to Drawings.
 3. Nominal Joint Width: As indicated.

4. Movement Capabilities: Class II; refer to Drawings.

END OF SECTION

SECTION 079200
JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
1. Silicone joint sealants.
 2. Urethane joint sealants.
 3. Latex joint sealants.
 4. Preformed joint sealants.
 5. Acoustical joint sealants.

1.3 PRECONSTRUCTION TESTING

- A. Preconstruction Compatibility and Adhesion Testing: Submit to joint-sealant manufacturers, for testing indicated below, samples of materials that will contact or affect joint sealants.
1. Use ASTM C 1087 to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.
 2. Submit not fewer than [eight] [Insert number] pieces of each kind of material, including joint substrates, shims, joint-sealant backings, secondary seals, and miscellaneous materials.
 3. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
 4. For materials failing tests, obtain joint-sealant manufacturer's written instructions for corrective measures including use of specially formulated primers.
 5. Testing will not be required if joint-sealant manufacturers submit joint preparation data that are based on previous testing, not older than 24 months, of sealant products for adhesion to, and compatibility with, joint substrates and other materials matching those submitted.

1.4 SUBMITTALS

- A. Product Data: For each joint-sealant product indicated.
- B. Sustainable Submittal:
1. Product data for sealants and sealant primers, including printed statement of VOC content.
- C. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.
- 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. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating that sealants comply with requirements.
- F. Field-Adhesion Test Reports: For each sealant application tested.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.
- B. Source Limitations: Obtain each kind of joint sealant from single source from single manufacturer.

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: Manufacturer's standard form in which Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
 - 1. Warranty Period: Two years from date of Substantial Completion.
- B. Special Manufacturer's Warranty: Manufacturer's standard form in which joint-sealant manufacturer agrees to furnish 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: 20 years from date of Substantial Completion for silicone sealants.
- C. Special warranties specified in this article exclude deterioration or failure of joint sealants from the following:
 - 1. Movement of the structure caused by structural settlement or errors attributable to design or construction resulting in 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 joint-sealant manufacturer, based on testing and field experience.
- B. VOC Content of Interior Sealants: Provide sealants and sealant primers for use inside the weatherproofing system that comply with the following limits for VOC content when calculated according to 40 CFR 59, Part 59, Subpart D (EPA Method 24):
 - 1. Architectural Sealants: 250 g/L.
 - 2. Sealant Primers for Nonporous Substrates: 250 g/L.
 - 3. Sealant Primers for Porous Substrates: 775 g/L.
- C. Liquid-Applied Joint Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied joint sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.
 - 1. Suitability for Immersion in Liquids. Where sealants are indicated for Use I for joints that will be continuously immersed in liquids, provide products that have undergone testing according to ASTM C 1247. Liquid used for testing sealants is deionized water, unless otherwise indicated.
- D. Stain-Test-Response Characteristics: Where sealants are specified to be non-staining to porous substrates, provide products that have undergone testing according to ASTM C 1248 and have not stained porous joint substrates indicated for Project.
- E. Suitability for Contact with Food: Where sealants are indicated for joints that will come in repeated contact with food, provide products that comply with 21 CFR 177.2600.
- F. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

2.2 SILICONE JOINT SEALANTS

- A. Single-Component, Nonsag, Neutral-Curing Silicone Joint Sealant (S-GP): ASTM C 920, Type S, Grade NS, Class 50, for Use NT.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. BASF Building Systems; Omniseal 50.
 - b. Dow Corning Corporation; 795.
 - c. GE Advanced Materials - Silicones; SilGlaze II SCS2800.
 - d. Pecora Corporation; 864.
 - e. Sika Corporation; Sikasil WS 295.
- B. Mildew-Resistant, Single-Component, Acid-Curing Silicone Joint Sealant (S-S): ASTM C 920, Type S, Grade NS, Class 25, for Use NT.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. BASF Building Systems; Omniplus.
 - b. Dow Corning Corporation; 786 Mildew Resistant.
 - c. GE Advanced Materials - Silicones; Sanitary SCS1700.
 - d. Tremco Incorporated; Tremsil 200 Sanitary.
 - e. Sika Corporation; Sikasil GP.

2.3 URETHANE JOINT SEALANTS

- A. Multi-component, Non-sag, Urethane Joint Sealant (U-MC): ASTM C 920, Type M, Grade NS, Class 50, for Use NT.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Pecora Corporation; Dynatrol II.
 - b. Polymeric Systems, Inc.; PSI-270.
 - c. Sika Corporation; Sikaflex 2c NS.
- B. Multi-component, Self-Leveling, Traffic-Grade, Urethane Joint Sealant (U-TB): ASTM C 920, Type M, Grade SL, Class 50, for Use T.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Polymeric Systems, Inc.; PSI-270.
 - b. Tremco Incorporated; Dymeric 240 FC.
 - c. Pecora; Dynatread.
 - d. Sika Corporation; Sikaflex 2c SL.

2.4 LATEX JOINT SEALANTS

- A. Latex Joint Sealant (AL): Acrylic latex or siliconized acrylic latex, ASTM C 834, Type OP, Grade NF.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. BASF Building Systems; Sonolac.
 - b. Bostik, Inc.; Chem-Calk 600.
 - c. May National Associates, Inc.
 - d. Pecora Corporation; AC-20+.
 - e. Tremco Incorporated; Tremflex 834.
 - f. Comparable product by Sika.

2.5 PREFORMED JOINT SEALANTS (PF)

- A. Preformed Foam Joint Sealant: Manufacturer's standard preformed, pre-compressed, open-cell foam sealant manufactured from urethane foam with minimum density of 10 lb/cu. ft. and impregnated with a nondrying, water-repellent agent. Factory produce in pre-compressed sizes in roll or stick form to fit joint widths indicated; coated on one side with a pressure-sensitive adhesive and covered with protective wrapping.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. EMSEAL Joint Systems, Ltd.; Emseal 25V.
 - b. Sandell Manufacturing Co., Inc.; Polyseal.
 - c. Willseal USA, LLC; Willseal 150.
 - d. MM Systems, Color Joint Silicone
 - e. BASF, WABO Weather Seal II

2.6 ACOUSTICAL JOINT SEALANTS (AC)

- A. Acoustical Joint Sealant: Manufacturer's standard non-sag, paintable, non-staining latex sealant complying with ASTM C 834. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Grabber Acoustical Smoke and Sound Sealant.

2.7 MISCELLANEOUS MATERIALS

- A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.
- B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.
- C. Masking Tape: Non-staining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.
- D. Backer Rod:
1. General: Provide sealant backings of material and type that are non-staining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing
 2. Elastomeric Tubing Sealant Backings: Neoprene, butyl, EPDM, or silicone tubing complying with ASTM D 1056, nonabsorbent to water and gas, and capable of remaining resilient at temperatures down to minus 26 deg F. Provide products with low compression set and of size and shape to

- provide a secondary seal, to control sealant depth, and otherwise contribute to optimum sealant performance
3. 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

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, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:
 - a. Concrete.
 - b. Masonry.
 - c. Unglazed surfaces of ceramic tile.
 - d. Exterior insulation and finish systems.
 3. Remove laitance and form-release agents from concrete.
 4. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:
 - a. Metal.
 - b. Glass.
 - c. Porcelain enamel.
 - d. Glazed surfaces of ceramic tile.
- B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.
- C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF JOINT SEALANTS

- A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.
- B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- C. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
 1. Do not leave gaps between ends of sealant backings.
 2. Do not stretch, twist, puncture, or tear sealant backings.
 3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.
- D. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
 1. Place sealants so they directly contact and fully wet joint substrates.
 2. Completely fill recesses in each joint configuration.
 3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum

- sealant movement capability.
- E. Tooling of Non-sag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
1. Remove excess sealant from surfaces adjacent to joints.
 2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
 3. Provide concave joint profile per Figure 8A in ASTM C 1193, unless otherwise indicated.
 4. Provide flush joint profile where indicated per Figure 8B in ASTM C 1193.
 5. Provide recessed joint configuration of recess depth and at locations indicated per Figure 8C in ASTM C 1193.
 - a. Use masking tape to protect surfaces adjacent to recessed tooled joints.
- F. Installation of Preformed Silicone-Sealant System: Comply with the following requirements:
1. Apply masking tape to each side of joint, outside of area to be covered by sealant system.
 2. Apply silicone sealant to each side of joint to produce a bead of size complying with preformed silicone-sealant system manufacturer's written instructions and covering a bonding area of not less than 3/8 inch. Hold edge of sealant bead 1/4 inch inside masking tape.
 3. Within 10 minutes of sealant application, press silicone extrusion into sealant to wet extrusion and substrate. Use a roller to apply consistent pressure and ensure uniform contact between sealant and both extrusion and substrate.
 4. Complete installation of sealant system in horizontal joints before installing in vertical joints. Lap vertical joints over horizontal joints. At ends of joints, cut silicone extrusion with a razor knife.
- G. Installation of Preformed Foam Sealants: Install each length of sealant immediately after removing protective wrapping. Do not pull or stretch material. Produce seal continuity at ends, turns, and intersections of joints. For applications at low ambient temperatures, apply heat to sealant in compliance with sealant manufacturer's written instructions.
- H. Acoustical Sealant Installation: At sound-rated assemblies and elsewhere as indicated, seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and with manufacturer's written recommendations.
- 3.4 FIELD QUALITY CONTROL
- A. Field-Adhesion Testing: Field test joint-sealant adhesion to joint substrates as follows:
1. Extent of Testing: Test completed and cured sealant joints as follows:
 - a. Perform 10 tests for the first 1000 feet of joint length for each kind of sealant and joint substrate.
 - b. Perform 1 test for each 1000 feet of joint length thereafter or 1 test per each floor per elevation.
 2. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C 1193 or Method A, Tail Procedure, in ASTM C 1521.
 - a. For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.
 3. Inspect tested joints and report on the following:
 - a. Whether sealants filled joint cavities and are free of voids.
 - b. Whether sealant dimensions and configurations comply with specified requirements.
 - c. Whether sealants in joints connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. Compare these results to determine if adhesion passes 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 fill, 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.

3.7 JOINT-SEALANT SCHEDULE

A. Sealant Schedule:

1. Exterior locations:
 - a. Wall joints:
 - 1) Bordered on both sides by porous building material (concrete, stone, masonry, exterior insulation and finish systems): Designation S-GP [PF]
 - 2) Bordered on both sides by non-porous building material (coated and uncoated metals, anodized aluminum, porcelain tile, and glass): Designation S-GP [PF]
 - 3) Bordered on one side by porous building material (concrete, stone, masonry) and other side by non-porous building material (coated and uncoated metals, anodized aluminum, porcelain tile, and glass): Designation S-GP. [PF]
 - a. Perimeter of penetrations through walls: Designation S-GP
 - b. Control joints (filling of V-grooves) and perimeter of penetrations in Portland cement plaster walls: Designation S-GP.
 - c. Expansion joints in ceilings, soffits, and overhead surfaces: Designation S-GP
 - d. Control joints and perimeter of penetrations in ceilings, soffits, and overhead surfaces: Designation S-GP
 - e. Wall and ceiling joints between frames and their rough opening: Designation S-GP.
 - f. Wall and ceiling joints between frames and adjoining surfaces: Designation S-GP.
 - g. Joints and perimeter of penetrations in horizontal pedestrian and vehicle traffic surfaces: Designation U-TB.
 - h. Joints in Division 07 Section 07 "Sheet Metal Flashing and Trim:" Designation S-GP.
2. Interior Joints:
 - a. Wall and ceiling joints subject to movement: Designation U-MC.
 - b. Wall and ceiling joints not subject to movement: Designation AL.
 - c. Interior side of exterior openings: U-MC.
 - d. Floor joints: Designation U-TB.
 - e. Wall and ceiling joints between frames and their rough opening: Designation AL.
 - f. Wall and ceiling joints between frames and adjoining surfaces: Designation AL.
 - g. Interior Sanitary Joints; Joints Between Plumbing Fixtures and Adjoining Floor, Wall, and Ceiling Surfaces; Joints Between Shower Door Enclosure Components and Adjacent Finish Surfaces; Joints in Dietary and Food Preparation Areas, Kitchens, Food Storage Areas, and Areas Subject to Frequent Wet Cleaning, including joints between walls and floors, Joints Between Back Splashes and Wall Substrates: Designation S-S.

END OF SECTION

SECTION 081113
HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
1. Standard hollow metal doors frames.

1.3 DEFINITIONS

- A. Minimum Thickness: Minimum thickness of base metal without coatings.
- B. Standard Hollow Metal Work to comply with the following Steel Door Institute Performance Standards:
1. Hollow metal work fabricated according to ANSI/SDI A250.8 (R2008).
 2. ANSI/SDI A250.4 (2001) - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames, Frames Anchors and Hardware Reinforcing.
 3. ANSI/SDI A250.6 (R2009) - Recommended Practice for Hardware Reinforcing on Standard Steel Doors and Frames.
 4. ANSI/SDI A250.10 (R2004) - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames.
 5. ANSI/SDI A250.11 (2001) - Recommended Erection Instructions for Steel Frames.
 6. ANSI/SDI A250.13 (2008) – Testing and Rating of Severe windstorm Resistant Components for Swinging Door Assemblies.
 7. SDI 111 (2008 – Recommendations for Selection and Usage Guide for Standard Steel Doors and Frames.
 8. SDI 117 (2009) – Manufacturing Tolerances Standard Steel Doors and Frames.
 9. SDI 122 (2007) - Installation and Troubleshooting Guide for Standard Steel Doors and Frames.
 10. SDI 124 (1998) - Maintenance of Standard Steel Doors and Frames.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, core descriptions, fire-resistance rating, and finishes.
- B. Sustainable Submittals:
1. Provide product cost and pre-and post-consumer recycled content.
- C. Shop Drawings: Include the following:
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. Other Action Submittals:
1. 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.
 2. Supplier to submit shop drawing schedules with in two weeks of written notification from Contractor in the event to expedite the process of frames to jobsite.
 3. Certificate: current certificate stating the manufacture is a member of SDI.
- E. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each type of hollow metal door and frame assembly.

1.5 QUALITY ASSURANCE

- A. Source Limitations: Obtain hollow metal doors and frames from single source manufacturer.
- B. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 and UL10C, embossed labels are acceptable on standard 3 sided door frames.
 - 1. Oversize Fire-Rated Door Assemblies: For units exceeding sizes of tested assemblies, provide certification by a qualified testing agency that doors comply with standard construction requirements for tested and labeled fire-rated door assemblies except for size.
 - 2. Temperature-Rise Limit [**At vertical exit enclosures and exit passageways**], provide doors that have a maximum transmitted temperature end point of not more than 450 deg F above ambient after 30 minutes of standard fire-test exposure.
- C. Fire-Rated, Borrowed-Light Frame 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 indicated, based on testing according to NFPA 257 or UL 9. Label each individual glazed lite.
- D. Smoke-Control Door Assemblies: Comply with NFPA 105.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver hollow metal work palletized, wrapped, or crated to provide protection during transit and Project- site storage. Do not use non-vented plastic.
 - 1. Provide additional protection to prevent damage to finish of factory-finished units.
- B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.
- C. Store hollow metal work 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.
 - 2. Any scratches or disfigurements caused in shipping or handling are promptly cleaned and touched up with a rust-inhibitive primer to new conditions

1.7 PROJECT CONDITIONS

- A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

1.8 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. Manufacturers: Subject to compliance with requirements, provide products by one of the following: Manufacturers of current SDI membership:
 - 1. Amweld Building Products, LLC.
 - 2. Benchmark; a division of Therma-Tru Corporation.
 - 3. Ceco Door Products; an Assa Abloy Group company.
 - 4. Curries Company; an Assa Abloy Group company.
 - 5. Steelcraft; an Ingersoll-Rand company.

2.2 MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A 1008, Commercial Steel (CS), Type B; suitable for exposed applications.
- B. Hot-Rolled Steel Sheet: ASTM A 1011, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.
- C. Metallic-Coated Steel Sheet: ASTM A 653, Commercial Steel (CS), Type B; with minimum G60 Z180 or A60ZF180 metallic coating.
- D. Frame Anchors: ASTM A 591, Commercial Steel (CS), 40Z 12G coating designation; mill phosphatized.
 - 1. For anchors built into exterior walls, steel sheet complying with ASTM A 1008 or ASTM A 1011, hot-dip galvanized according to ASTM A 153, Class B.
- E. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153.
- F. 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.

- G. Glazing: Comply with requirements in Division 08 Section "Glazing."

2.3 STANDARD HOLLOW METAL 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/SDI A250.8.
1. Design: Flush panel.
 2. Core Construction: Manufacturer's standard kraft-paper honeycomb, polystyrene, polyurethane, polyisocyanurate, mineral-board, or vertical steel-stiffener core.
 - a. Fire Door Core: As required to provide fire-protection and temperature-rise ratings indicated.
 - b. Steel-stiffened door at interior and exterior shipping and receiving locations.
 - c. Thermal-Rated (Insulated) Doors: Where indicated, provide doors fabricated with thermal-resistance value (R-value) of not less than 11.0 when tested to ASTM C518 calculated and 3.0 when tested to ASTM C1363 operable.
 - 1) Locations: All exterior doors, and as indicated on Door Schedule.
 3. Vertical Edges for Single-Acting Doors:
 - a. Beveled Edges: 1/8 inch in 2 inches.
 - 1) At meeting edges of pairs of doors bevel edge at active leaf, square edge at inactive leaf.
 - 2) Universal hinge preps for reverse swinging of doors are not acceptable.
 4. Vertical Edges for Double-Acting Doors: Round vertical edges with 2-1/8-inch radius.
 5. Top and Bottom Edges: Closed with flush or inverted 0.042-inch-thick, end closures or channels of same material as face sheets.
 6. Tolerances: Comply with SDI 117, "Manufacturing Tolerances for Standard Steel Doors and Frames."
 7. Provide hollow metal doors with at least 30 percent total recycled; 10 percent post-consumer content.
- B. Exterior Doors: Face sheets fabricated from metallic-coated steel sheet. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:
1. Level 3 and Physical Performance Level A (Extra Heavy Duty), Model 1 (Full Flush)).
- C. Interior Doors: Face sheets fabricated from cold-rolled steel sheet unless metallic-coated sheet is indicated. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:
1. Level 3 and Physical Performance Level B (Heavy Duty), Model 2 (Full Flush).
- 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 HOLLOW METAL FRAMES

- A. General: Comply with ANSI/SDI A250.8 and with details indicated for type and profile.
- B. Exterior Frames: Fabricated from metallic-coated steel sheet.
1. Fabricate frames with mitered or coped corners.
 2. Fabricate frames as face welded joints and back weld joints continuously, unless otherwise indicated.
 3. Frames for Level 3 Steel Doors: (14 gage) thick steel sheet.
- C. Interior Frames: Fabricated from cold-rolled steel sheet unless metallic-coated sheet is indicated.
1. Fabricate frames with mitered or coped corners.
 2. Fabricate frames as full profile and face welded unless otherwise indicated.
 3. Frames for Level 3 Steel Doors: (16 gage) - thick steel sheet.
 4. Frames 48-inches and wider in opening width are required to be min. 14 gage thick steel sheet.
 5. Frames for Wood Doors: (16 gage) thick steel sheet.
 6. Frames for Borrowed Lights: (16 gage) thick steel sheet.
- D. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 with reinforcement plates from same material as frames.
- E. Provide knock down, pre-finished frames where indicated.

2.5 FRAME ANCHORS

- A. Jamb Anchors:
1. Stud Anchors: Welded frames for installation in stud partitions shall be provided with welded in steel anchors of suitable design, not less than 18 gage thickness, secured inside each jamb as follows:
 - a. Frames up to 60" height: 2 anchors.
 - b. Frames greater than 60" up to 90" 4 anchors.
 - c. Frames greater than 90" up to 96" 5 anchors.
 - d. Frames greater than 96": 5 anchors plus one for each 24" or fraction thereof over 96" spaced at 24" maximum between anchors.
 2. Hot-dip galvanize all anchors in exterior walls.
- B. Floor Anchors: Formed from same material as frames, not less than 0.067 inch thick, and as follows:
1. Monolithic Concrete Slabs: Floor anchors shall be provided with two holes for fasteners and shall be fastened inside jambs with at least four (4) spot welds per anchor

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. Field cuts are not acceptable.
- D. Cut-off (Sanitary) Stops (for healthcare environments only): Where indicated on door schedule/frame type, terminate stops 6 inches above finish floor with a 45 degree angle cut, and close open end of stop with steel sheet closure. Cover opening in extension of frame with welded-steel filler plate, with welds ground smooth and flush with frame.

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. Sight-Proof 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. Grout Guards: Formed from same material as frames, not less than 0.016 inch thick.

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).
 4. Continuous Hinge Reinforcement: Provide continuous 12 gage strap tack welded to door edge for continuous hinges specified in hardware sets in Div. 8 Door hardware, unless door has continuous steel channel for hinge reinforcement.
- 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. Welded Frames: Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible.
 2. Sidelight and Transom Bar Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by butt welding.
 3. Hinge Reinforcement: Provide high frequency hinge reinforcements at door openings 42-inch and wider with mortise/butt type hinges at top hinge location to deter against hinge reinforcement sag; required at all openings with automatic openers.
 4. Continuous Hinge Reinforcement: Provide continuous 12 gage strap tack welded to frame stop for continuous hinges specified in hardware sets in Div. 8 Door hardware.
 5. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
 6. Door Silencers: Except on weather-stripped or gasketed doors, drill stops to receive door silencers as follows. Keep holes clear during construction. Silencers to be supplied by frame manufacturer regardless if specified in Div. 8 Door Hardware.
 - 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 Division 08 Section "Door Hardware."
1. Locate hardware as indicated, or if not indicated, according to ANSI/SDI A250.8.
 2. Reinforce doors and frames to receive non-templated, 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 Sections.
- 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.
 6. Gap for butted or mitered joints in glass stop should not exceed .0625-inch.
- 2.11 STEEL FINISHES
- A. Prime Finish: Apply manufacturer's standard 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.

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. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Remove welded-in shipping spreaders installed at factory after installation of frame in wall. 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 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 post-installed expansion anchors.
 - a. Floor anchors may be set with powder-actuated fasteners instead of post-installed expansion anchors if so indicated and approved on Shop Drawings.
 3. Field Supplied 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.
 4. In-Place Gypsum Board Partitions: Secure frames in place with post-installed expansion anchors through floor anchors at each jamb. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
 5. 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 installation requirements in Division 08 Section "Glazing" and with hollow metal manufacturer's written instructions.
 1. Secure stops with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches o.c. and not more than 2 inches o.c. from each corner.

2 Secure exterior removable stops with security head stainless steel screws.

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. Adjust frames and doors per SDI 122 Installation for trouble shooting openings.
- C. Remove grout and other bonding material from hollow metal work immediately after installation.
- D. 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.
- E. Metallic-Coated Surfaces: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.

END OF SECTION

SECTION 081216
ALUMINUM FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes interior aluminum frames for doors installed in gypsum board partitions.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, fire-resistance rating, and finishes.
- B. Shop Drawings: Include the following:
1. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
 2. Locations of reinforcements and preparations for hardware.
 3. Details of each different wall-opening condition.
 4. Details of anchorages, joints, field splices, and connections.
 5. Details of accessories.
 6. Details of moldings, removable stops, and glazing.
 7. Details of conduits and preparations for power, signal, and control systems.
- C. Schedule: For interior aluminum frames. Use same designations indicated on Drawings. Coordinate with door hardware schedule and glazing.
- D. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each type of interior aluminum frame.
- E. Sustainable Submittal:
1. Product data 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.

1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain interior aluminum frames from single source from single manufacturer.
- B. Fire-Rated Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.
- C. Smoke- and Draft-Control Assemblies: At corridors, smoke barriers, smoke partitions, and elsewhere as indicated, provide assemblies tested according to UL 1784 and installed in compliance with NFPA 105.
1. Air Leakage Rate: Maximum air leakage of 0.3 cfm/sq. ft. at the tested pressure differential of 0.3-inch wg of water.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver interior aluminum frames palletized, wrapped, or crated to provide protection during transit and Project-site storage. Do not use non-vented plastic. Store interior aluminum frames under cover at Project site.

1.6 WARRANTY

- A. Provide warranty against defects in materials for a period of 1 year from date of substantial completion and for 3 years for finishes

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers:
1. Frameworks Manufacturing.
 2. Versatrac.
 3. Wilson Partitions.
 4. Aluma Pro L.P.
 5. Modulex.

2.2 COMPONENTS

- A. Aluminum Framing: ASTM B 221, Alloy 6063-T5 or alloy and temper required to suit structural and finish requirements, not less than 0.062 inch thick. Billets shall be composed of at least 33% recycled aluminum.
- B. Door Frames: Extruded aluminum, reinforced for hinges, strikes, and closers. Refer to Drawings for frame types.
 - 1. 90-Minute Fire-Protection Rating (where indicated in schedule): Fabricate aluminum frame assemblies with a cold-formed, primed, interior steel liner.
- C. Glazing Frames: Extruded aluminum, for glazing thickness indicated.
- D. Ceiling Tracks: Extruded aluminum.
- E. Trim: Extruded aluminum, not less than 0.062 inch thick, with removable snap-in glazing stops and door stops without exposed fasteners.

2.3 ACCESSORIES

- A. Fasteners: Aluminum, nonmagnetic, stainless-steel or other non-corrosive metal fasteners compatible with frames, stops, panels, reinforcement plates, hardware, anchors, and other items being fastened.
- B. Door Silencers: Manufacturer's standard continuous mohair, wool pile, or vinyl seals.
- C. Smoke Seals: Intumescent strip or fire-rated gaskets.
- D. Glazing Gaskets: Manufacturer's standard extruded or molded plastic, to accommodate glazing thickness indicated; black color.
- E. Glazing: Comply with requirements in Division 08 Section "Glazing."
- F. Hardware: Comply with requirements in Division 08 door hardware Sections.

2.4 FABRICATION

- A. Provide concealed corner reinforcements and alignment clips for accurately fitted hairline joints at butted or mitered connections.
- B. Factory prepare interior aluminum frames to receive templated mortised hardware; include cutouts, reinforcements, mortising, drilling, and tapping, according to the Door Hardware Schedule and templates furnished as specified in Division 08 Section "Door Hardware."
 - 1. Locate hardware as required by fire-rated label for assembly.
- C. Fabricate frames for glazing with removable stops to allow glazing replacement without dismantling frame.
 - 1. Locate removable stops on the inside of spaces accessed by keyed doors.
- D. Fabricate components to allow secure installation without exposed fasteners.

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. 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.

2.6 ALUMINUM FINISHES

- A. Clear Anodic Finish: AAMA 611, AA-M12C22A21, Class II, 0.010 mm or thicker.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine walls, floors, and ceilings, with Installer present, for conditions affecting performance of the Work.
- B. Verify that wall thickness does not exceed standard tolerances allowed by throat size indicated.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Install interior aluminum frames plumb, rigid, properly aligned, and securely fastened in place; comply with manufacturer's written instructions.
- B. Set frames accurately in position and plumbed, aligned, and securely anchored to substrates.
 - 1. At fire-protection-rated openings, install interior aluminum frames according to NFPA 80.
- C. Install frame components in the longest possible lengths; components up to 96 inches long must be one piece.
 - 1. Fasten to suspended ceiling grid on maximum 48-inch centers, using sheet metal screws or other fasteners approved by frame manufacturer.
 - 2. Use concealed installation clips to produce tightly fitted and aligned splices and connections.
 - 3. Secure clips to extruded main-frame components and not to snap-in or trim members.

4. Do not leave screws or other fasteners exposed to view when installation is complete.

3.3 CLEANING

- A. Clean exposed frame surfaces promptly after installation, using cleaning methods recommended by frame manufacturer and according to AAMA 609 & 610.
- B. Touch up marred frame surfaces so touchup is not visible from a distance of 48 inches. Remove and replace frames with damaged finish that cannot be satisfactorily repaired.

END OF SECTION

SECTION 081416
FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
1. Solid-core doors with wood-veneer and.

1.3 SUBMITTALS

- A. Product Data:
1. For each type of door indicated. Include details of core and edge construction, louvers, and trim for openings. Include factory-finishing specifications.
 2. Chain-of-custody certificates certifying that flush wood doors comply with forest certification requirements. Include evidence that manufacturer is certified for chain of custody by an FSC-accredited certification body.
 - a. Include statement indicating costs for each certified wood product.
 - b. For adhesives and composite wood products, documentation indicating that product contains no urea formaldehyde.
 - c. Interior wood flush doors to contain a minimum of 20% recycled content.
 - d. Interior wood flush doors to include materials made from agricultural products that are typically harvested within a 10-year or shorter cycle.
- B. Sustainable Submittals:
1. Product Data 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.
- C. 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.
 5. Indicate fire-protection ratings for fire-rated doors.
 6. Indicate molding of trim for cutouts.
- D. Samples for Initial Selection: For factory finished door faces.
1. Factory finishes applied to actual door face veneer 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.
- E. Warranty: Sample of special warranty.

1.4 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A qualified manufacturer that is certified for chain of custody by an FSC-accredited certification body.
- B. Source Limitations: Obtain flush wood doors from single manufacturer.
- C. Quality Standard: In addition to requirements specified, comply with AWI's "Architectural Woodwork Quality Standards Illustrated" for veneers faces and WDMA I.S.1-A, "Architectural Wood Flush Doors" for performance of the door. along with "WI's "Manual of Millwork."
1. Provide AWI Quality Certification Labels or an AWI letter of licensing for Project indicating that doors comply with requirements of grades specified.
 2. Provide WI-Certified Compliance Certificate indicating that doors comply with requirements of grades specified.
 3. Provide WI-Certified Compliance Certificate for installation.

- D. Fire-Rated Wood Doors: Doors complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.
 - 1. Indicate rating and listing agent with permanently attached label on edge of door, if continuous hinge is used adhere label on top of door.
- 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 and wrap bundles of doors in plastic sheathing.
 - 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 doors until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
- 1.7 WARRANTY
- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Warping (bow, cup, or twist) more than 1/4 inch in a 42-by-84-inch section.
 - b. Telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch span.
 - c. Telegraphing of core construction and delamination of face in decorative laminated faced doors.
 - 2. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors.
 - 3. Warranty Period for Solid-Core Interior Doors: Life of installation.

PART 2 - PRODUCTS

- 2.1 MANUFACTURERS
- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Algoma Hardwoods, Inc.
 - 2. Eggers Industries.
 - 3. Graham; an Assa Abloy Group company.
 - 4. Marshfield Door Systems, Inc.
 - 5. VT Industries Inc.
- 2.2 DOOR CONSTRUCTION, GENERAL
- A. Low-Emitting Materials: Provide doors made with adhesives and composite wood products that do not contain urea formaldehyde.
 - B. Provide doors made with FSC-certified wood for all new wood content.
 - C. WDMA I.S.1-A Performance Grade: Extra Heavy Duty.
 - D. Particleboard-Core Doors:
 - 1. Particleboard: ANSI A208.1, Grade LD-1.
 - 2. Agrifiber board: Straw-based particleboard complying with ANSI A208.1, Grade LD-2 or M-2, except for density.
 - 3. Blocking: Provide wood blocking in particleboard-core doors as needed to eliminate through-bolting hardware.
 - a. 8-inch top-rail blocking, in doors indicated to have closers.
 - b. 5-inch bottom-rail blocking, in exterior doors and doors indicated to have kick, mop, or armor plates.
 - c. 5-inch midrail blocking, in doors indicated to have exit devices.
 - 4. Provide doors with structural-composite-lumber (SCL) cores instead of particleboard cores for the following door types:
 - a. Indicated to receive exit devices.
 - b. Doors with more than 40 percent of core removed.
 - c. Lock and Light cutout stiles less than 5 1/2 inches between cutouts.
 - d. Shipping and receiving doors.
 - E. Fire-Protection-Rated Doors: Provide core specified or mineral core as needed to provide fire-protection rating indicated.

1. Edge Construction: Provide edge construction with intumescent seals concealed by outer stile. Comply with specified requirements for exposed edges.
 2. Pairs: Provide fire-retardant stiles that are listed and labeled for applications indicated without formed-steel edges and astragals. Comply with specified requirements for exposed edges.
- 2.3 VENEERED-FACED DOORS FOR TRANSPARENT FINISH
- A. Interior Solid-Core Doors:
1. Grade: Custom (Grade A faces).
 2. Species: As indicated on Drawings.
 3. Cut: As indicated on Drawings.
 4. Match between Veneer Leaves: Book match.
 5. Assembly of Veneer Leaves on Door Faces: Center-balance match.
 6. Room Match: Provide door faces of compatible color and grain within each separate room or area of building.
 7. Transom Match: As indicated.
 8. Core: Particleboard and comply with section 2.2.
 9. Construction: Five plies. Stiles and rails are bonded to core, then entire unit abrasive planed before veneering.
 10. WDMA I.S.1-A Performance Grade: Extra Heavy Duty.
- 2.4 DOORS FOR OPAQUE FINISH
- A. Interior Solid-Core Doors:
1. Grade: Custom.
 2. Faces: Any closed-grain hardwood of mill option.
 - a. Apply medium-density overlay to standard-thickness, closed-grain, hardwood face veneers.
 - b. Hardboard Faces: AHA A135.4, Class 1 (tempered) or Class 2 (standard).
 - c. MDF Faces: ANSI A208.2, Grade 150 or 160.
 3. Vertical and Top / Bottom Edges: Any closed-grain hardwood, finished to match face veneer.
 4. Core: Particleboard and comply with section 2.2.
 5. Construction: Five plies. Stiles and rails are bonded to core, then entire unit abrasive planed before veneering.
 6. Construction: plies, either bonded or non-bonded construction.
 7. WDMA I.S.1-A Performance Grade: Extra Heavy Duty.
- 2.5 LOUVERS AND LIGHT FRAMES
- A. Metal Frames for Light Openings in Fire-Rated Doors over 20-minute rating: Manufacturer's standard frame formed of 0.048-inch- thick, cold-rolled steel sheet; with factory baked-enamel or powder-coated finish; and approved for use in doors of fire-protection rating indicated.
- 2.6 FABRICATION
- A. Factory fit doors to suit frame-opening sizes indicated. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.
1. Comply with 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, DHI A115-W series standards, and hardware templates.
1. Coordinate with hardware mortises in metal frames to verify dimensions and alignment before factory machining.
 2. Metal Astragals: Factory machine astragals and formed-steel edges for hardware for pairs of fire-rated doors.
 3. Pre-drill hinge screw holes at factory for templated hinges.
 4. Factory drill raceways for power cords to electrified hardware as scheduled in Door Hardware Sets.
 5. Where armor plates are specified in Door Hardware Sets, ensure blocking and labeling is sufficient in door and fire label approves the attachment of the listed armor plate.
- C. Openings: Cut and trim openings through doors in factory.
1. Light Openings: Trim openings with moldings of material and profile indicated.
 2. Glazing: Factory install glazing in doors indicated to be factory finished. Comply with applicable requirements in Division 08 Section "Glazing."
 3. Louvers: Factory install louvers in prepared openings.
- D. Exterior Doors: Factory treat exterior doors with water repellent after fabrication has been completed but before factory finishing.

2.7 FACTORY FINISHING

- A. General: Comply with referenced quality standard for factory finishing. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.
 - 1. Finish faces, all four edges, edges of cutouts, and mortises. Stains and fillers may be omitted on bottom edges, edges of cutouts, and mortises.
- B. Finish doors at factory.
- C. Finish doors at factory that are indicated to receive transparent finish. Field finish doors indicated to receive opaque finish.
- D. Finish doors at factory where indicated in schedules or on Drawings as factory finished.
- E. Transparent Finish:
 - 1. Grade: Premium.
 - 2. Finish: Meets or exceeds TR6 finish performance requirements as per WDMA I.S. 1A
 - 3. Staining: As selected by Architect from manufacturer's full range of custom colors.
 - 4. Effect: Semi-filled finish, produced by applying an additional finish coat to partially fill the wood pores.
 - 5. Sheen: Satin.
- F. Opaque Finish:
 - 1. Grade: Custom.
 - 2. Finish: AWI conversion varnish or catalyzed polyurethane system.
 - 3. Color: Match Architect's sample.
 - 4. Sheen: Satin.

PART 3 - EXECUTION**3.1 EXAMINATION**

- A. Examine doors and installed door frames 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 Division 08 Section "Door Hardware."
- B. Installation Instructions: Install doors to comply with manufacturer's written instructions and the referenced quality standard, and as indicated.
 - 1. Install fire-rated doors in corresponding fire-rated frames according to NFPA 80.
- 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 ADJUSTING

- A. Operation: Rehang or replace doors that do not swing or operate freely.
- B. Finished Doors: Replace doors that are damaged or that do not comply with requirements. Doors may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION

SECTION 084113
ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 1. Exterior storefront framing.

1.3 DEFINITIONS

- A. ADA/ABA Accessibility Guidelines: U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disability Act (ADA) and Architectural Barriers Act (ABA) Accessibility Guidelines for Buildings and Facilities."

1.4 PERFORMANCE REQUIREMENTS

- A. General Performance: Aluminum-framed systems shall withstand the effects of the following performance requirements without exceeding performance criteria or failure due to defective manufacture, fabrication, installation, or other defects in construction:
1. Movements of supporting structure indicated on Drawings including, but not limited to, story drift and deflection from uniformly distributed and concentrated live loads.
 2. Dimensional tolerances of building frame and other adjacent construction.
 3. Failure includes the following:
 - a. Deflection exceeding specified limits.
 - b. Thermal stresses transferring 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 by thermal and structural movements.
 - e. Loosening or weakening of fasteners, attachments, and other components.
 - f. Sealant failure.
 - g. Failure of operating units.
- B. Delegated Design: Design aluminum-framed systems, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- C. Structural Loads:
1. Design Wind Loads: As indicated on structural drawings or as otherwise determined using design wind loads applicable to Project from basic wind speed indicated in miles per hour, according to ASCE 7, Section 6.5, "Method 2-Analytical Procedure."
- D. Deflection of Framing Members:
1. Deflection Normal to Wall Plane: Limited to edge of glass in a direction perpendicular to glass plane shall not exceed $L/175$ of the glass edge length for each individual glazing lite or an amount that restricts edge deflection of individual glazing lites to 3/4 inch, whichever is less.
 2. Deflection Parallel to Glazing Plane: Limited to $L/360$ of clear span or 1/8 inch, whichever is smaller.
- E. Structural-Test Performance: Provide aluminum-framed 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 Durations: As required by design wind velocity, but not fewer than 10 seconds.
- F. Story Drift: Provide aluminum-framed systems that accommodate design displacement of adjacent stories indicated.
1. Design Displacement: As indicated on Drawings.
 2. Test Performance: Meet criteria for passing, based on building occupancy type, when tested according to AAMA 501.4 at design displacement and 1.5 times design displacement.
- G. Air Infiltration: Provide aluminum-framed systems with maximum air leakage through fixed glazing and

- framing areas of 0.06 cfm/sq. ft. of fixed wall area when tested according to ASTM E 283 at a minimum static-air-pressure difference of 1.57 lbf/sq. ft.
- H. Water Penetration under Static Pressure: Provide aluminum-framed systems that do not evidence water penetration through fixed glazing and framing areas when tested according to ASTM E 331 at a minimum static-air-pressure difference of 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft.
- I. Water Penetration under Dynamic Pressure: Provide aluminum-framed systems that do not evidence water leakage through fixed glazing and framing areas when tested according to AAMA 501.1 under dynamic pressure equal to 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft.
1. Maximum Water Leakage: No uncontrolled water penetrating aluminum-framed systems or water appearing on systems' normally exposed interior surfaces from sources other than condensation. Water leakage does not include water controlled by flashing and gutters that is drained to exterior and water that cannot damage adjacent materials or finishes.
- J. 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.
 2. Test Performance: No buckling; stress on glass; sealant failure; excess stress on framing, anchors, and fasteners; or reduction of performance when tested according to AAMA 501.5.
 - a. High Exterior Ambient-Air Temperature: That which produces an exterior metal-surface temperature of 180 deg F.
 - b. Low Exterior Ambient-Air Temperature: 0 deg F.
 3. Interior Ambient-Air Temperature: 75 deg F.
- K. Condensation Resistance: Provide aluminum-framed systems with fixed glazing and framing areas having condensation-resistance factor (CRF) of not less than 53 when tested according to AAMA 1503.
- L. Thermal Conductance: Provide aluminum-framed systems with fixed glazing and framing areas having an average U-factor of not more than **[0.57 Btu/sq. ft. x h x deg F] [0.69 Btu/sq. ft. x h x deg F]** when tested according to AAMA 1503.
- 1.5 SUBMITTALS
- A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for aluminum-framed systems.
- B. Sustainable Submittal:
1. Product data for adhesives and sealants used inside of the weatherproofing system, including printed statement of VOC content.
 2. Provide product cost and pre-and post-consumer recycled content.
- C. Shop Drawings: For aluminum-framed systems. Include plans, elevations, sections, details, and attachments to other work.
1. Include details of provisions for system expansion and contraction and for drainage of moisture in the system to the exterior.
 2. For entrance doors, include hardware schedule and indicate operating hardware types, functions, quantities, and locations.
- D. Samples for Initial Selection: For units with factory-applied color finishes.
- E. Other Action Submittals:
1. Entrance Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing fabrication and assembly of entrance door hardware, as well as procedures and diagrams. Coordinate final entrance door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of entrance door hardware.
- F. Delegated-Design Submittal: For aluminum-framed 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.
1. Detail fabrication and assembly of aluminum-framed systems.
 2. Include design calculations.
- G. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for aluminum-framed systems, indicating compliance with performance requirements.
- 1.6 QUALITY ASSURANCE
- A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.
- B. Engineering Responsibility: Prepare data for aluminum-framed systems, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in systems similar to those indicated

- for this Project.
- C. 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.
 - 1. Do not revise intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If revisions are proposed, submit comprehensive explanatory data to Architect for review.
 - D. Source Limitations for Aluminum-Framed Systems: Obtain from single source from single manufacturer.
- 1.7 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.
- 1.8 WARRANTY
- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of aluminum-framed systems that do not comply with requirements or that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including, but not limited to, excessive deflection.
 - b. Noise or vibration caused by thermal movements.
 - c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 - d. Water leakage through fixed glazing and framing areas.
 - e. Failure of operating components.
 - 2. Warranty Period: Two years from date of Substantial Completion.
 - B. Special Finish Warranty: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. 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. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

- 2.1 MANUFACTURERS
- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. EFCO Corporation.
 - 2. Kawneer North America; an Alcoa company.
 - 3. United States Aluminum.
 - 4. Vistawall Architectural Products; The Vistawall Group; a Bluescope Steel company.
 - 5. YKK AP America Inc.
 - 6. Provide aluminum materials with at least 30 percent recycled content.
- 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.
- 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: Screw spline, thermally broken thermally improved.
 - 2. Glazing System: Retained mechanically with gaskets on four sides.
 - 3. Glazing Plane: As indicated.
 - B. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with non-staining, nonferrous shims for aligning system components.
 - C. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, non-staining, non-bleeding

fasteners and accessories compatible with adjacent materials.

1. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
 2. Reinforce members as required to receive fastener threads.
 3. Use exposed fasteners with countersunk Phillips screw heads, finished to match framing system.
- D. Concealed Flashing: Manufacturer's standard corrosion-resistant, non-staining, non-bleeding flashing compatible with adjacent materials.
- E. Framing System Gaskets and Sealants: Manufacturer's standard, recommended by manufacturer for joint type.
1. Provide sealants for use inside of the weatherproofing system that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.4 GLAZING SYSTEMS

- A. Glazing: As specified in Division 08 Section "Glazing."
- B. Glazing Gaskets: Manufacturer's standard compression types; replaceable, molded or extruded, of profile and hardness required to maintain watertight seal.
- C. Spacers and Setting Blocks: Manufacturer's standard elastomeric type.

2.5 ENTRANCE DOOR SYSTEMS

- A. Entrance Doors: Manufacturer's standard glazed entrance doors for manual-swing operation.
 1. Door Construction: 1-3/4-inch overall thickness, with minimum 0.125-inch-thick, extruded-aluminum tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deeply penetrated and fillet welded or that incorporate concealed tie rods.
 2. Door Design: Medium stile; 3-1/2-inch nominal width.
 3. Glazing Stops and Gaskets: Beveled, snap-on, extruded-aluminum stops and preformed gaskets.
- B. Entrance Door Hardware: As specified in Division 08 Section "Door Hardware."

2.6 ACCESSORY MATERIALS

- A. Joint Sealants: For installation at perimeter of aluminum-framed systems, as specified in Division 07 Section "Joint Sealants."
 1. Provide sealants for use inside of the weatherproofing system that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- 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.

2.7 FABRICATION

- A. Form or extrude aluminum shapes before finishing.
- B. 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 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. Provisions for field replacement of glazing from interior for vision glass and exterior for spandrel glazing or metal panels.
 7. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.
- C. Mechanically Glazed Framing Members: Fabricate for flush glazing without projecting stops.
- D. Storefront Framing: Fabricate components for assembly using screw-spline system.
- E. Entrance Door Frames: Reinforce as required to support loads imposed by door operation and for installing entrance door hardware.
 1. At exterior doors, provide compression weather stripping at fixed stops.
 2. At interior doors, provide silencers at stops to prevent metal-to-metal contact. Install three silencers on strike jamb of single-door frames and two silencers on head of frames for pairs of doors.
- F. Entrance Doors: Reinforce doors as required for installing entrance door hardware.
 1. At pairs of exterior doors, provide sliding-type weather stripping retained in adjustable strip and mortised into door edge.
 2. At exterior doors, provide weather sweeps applied to door bottoms.

- G. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.8 ALUMINUM FINISHES

- A. Clear Anodic Finish: AAMA 611, AA-M12C22A21, Class I, 0.018 mm or thicker.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas 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 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 non-movement 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 applying sealant or tape, or by 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 Division 07 Section "Joint Sealants" to produce weathertight installation.
- E. Install components plumb and true in alignment with established lines and grades, and without warp or rack.
- F. Install glazing as specified in Division 08 Section "Glazing."
- G. Entrance Doors: Install doors to produce smooth operation and tight fit at contact points.
 1. Exterior Doors: Install to produce weathertight enclosure and tight fit at weather stripping.
 2. Field-Installed Entrance Door Hardware: Install surface-mounted entrance door hardware according to entrance door hardware manufacturers' written instructions using concealed fasteners to greatest extent possible.
- H. Install perimeter joint sealants as specified in Division 07 Section "Joint Sealants" to produce weathertight installation.

3.3 ERECTION TOLERANCES

- A. Install aluminum-framed systems to comply with the following maximum erection 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.
- B. Diagonal Measurements: Limit difference between diagonal measurements to 1/8 inch.

3.4 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified independent testing and inspecting agency to perform field tests and inspections.
- 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 phases 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 "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 1.57 lbf/sq. ft.

1. Water Penetration: Areas shall be tested according to ASTM E 1105 at a minimum uniform and cyclic static-air-pressure difference of 0.67 times the static-air-pressure difference specified for laboratory testing under "Performance Requirements" Article, but not less than 4.18 lbf/sq. ft., and shall not evidence water penetration.
 2. 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 if 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.
 - E. Aluminum-framed assemblies will be considered defective if they do not pass tests and inspections.
 - F. Prepare test and inspection reports.
- 3.5 ADJUSTING
- A. Adjust operating entrance door hardware to function smoothly as recommended by manufacturer.

END OF SECTION

SECTION 088000**GLAZING****PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

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

1.2 SUMMARY

- A. Section includes glazing for the following products and applications, including those specified in other Sections where glazing requirements are specified by reference to this Section:
 - 1. Doors.
 - 2. Storefront framing.

1.3 DEFINITIONS

- A. Glass Manufacturers: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.
- B. Glass Thicknesses: Indicated by thickness designations in millimeters according to ASTM C 1036.
- C. Interspace: Space between lites of an insulating-glass unit.

1.4 PERFORMANCE REQUIREMENTS

- A. General: Installed glazing systems shall withstand normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.
- B. Delegated Design: Design glass, including comprehensive engineering analysis according to ASTM E 1300 by a qualified professional engineer, using the following design criteria:
 - 1. Design Wind Pressures: As indicated on Drawings.
 - 2. Vertical Glazing: For glass surfaces sloped 15 degrees or less from vertical, design glass to resist design wind pressure based on glass type factors for short-duration load.
 - 3. Maximum Lateral Deflection: For glass supported on all four edges, limit center-of-glass deflection at design wind pressure to not more than 1/50 times the short-side length or 1 inch, whichever is less.
 - 4. Differential Shading: Design glass to resist thermal stresses induced by differential shading within individual glass lites.
- C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.
 - 1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

1.5 SUBMITTALS

- A. Product Data: For each glass product and glazing material indicated.
- B. Glass Samples: For each type of glass product other than clear monolithic vision glass; 12 inches square.
 - 1. Coated glass.
 - 2. Insulating glass.
- C. Glazing Accessory Samples: For gaskets, sealants, and colored spacers, in 12-inch lengths. Install sealant Samples between two strips of material representative in color of the adjoining framing system.
- D. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.
- E. Delegated-Design Submittal: For glass indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- F. Product Certificates: For glass and glazing products, from manufacturer.
- G. Preconstruction adhesion and compatibility test report.

1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications for Insulating-Glass Units with Sputter-Coated, Low-E Coatings: A qualified insulating-glass manufacturer who is approved and certified by coated-glass manufacturer.
- B. Installer Qualifications: A qualified installer who employs glass installers for this Project who are certified under the National Glass Association's Certified Glass Installer Program.

- C. Glass Testing Agency Qualifications: A qualified independent testing agency accredited according to the NFRC CAP 1 Certification Agency Program.
 - D. Sealant Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated.
 - E. Source Limitations for Glass: Obtain insulating glass from single source from single manufacturer for each glass type.
 - F. Source Limitations for Glazing Accessories: Obtain from single source from single manufacturer for each product and installation method.
 - G. 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. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."
 - H. Safety Glazing Labeling: Where safety glazing labeling is indicated, permanently mark glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.
 - I. Preinstallation Conference: Conduct conference at Project site.
 - 1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - 2. Review temporary protection requirements for glazing during and after installation.
- 1.7 DELIVERY, STORAGE, AND HANDLING
- A. Protect glazing materials according to manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.
 - B. Comply with insulating-glass manufacturer's written recommendations for venting and sealing units to avoid hermetic seal ruptures due to altitude change.
- 1.8 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 glazing sealants when ambient and substrate temperature conditions are outside limits permitted by sealant manufacturer or below 40 deg F.
- 1.9 WARRANTY
- A. Manufacturer's Special Warranty for Coated-Glass Products: Manufacturer's standard form in which coated-glass manufacturer agrees to replace coated-glass units that deteriorate within specified warranty period. Deterioration of coated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in coating.
 - 1. Warranty Period: 10 years from date of Substantial Completion.
 - B. Manufacturer's Special Warranty on Insulating Glass: Manufacturer's standard form in which insulating-glass manufacturer agrees to replace insulating-glass units that deteriorate within specified warranty period. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.
 - 1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

- 2.1 GLASS PRODUCTS, GENERAL
- A. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass lites in thicknesses as needed to comply with requirements indicated.
 - 1. Minimum Glass Thickness for Exterior Lites: Not less than 6.0 mm.
 - 2. Thickness of Tinted Glass: Provide same thickness for each tint color indicated throughout Project.
 - B. Strength: Where float glass is indicated, provide annealed float glass, Kind HS heat-treated float glass, or Kind FT heat-treated float glass as needed to comply with "Performance Requirements" Article. Where heat-strengthened glass is indicated, provide Kind HS heat-treated float glass or Kind FT heat-treated float glass as needed to comply with "Performance Requirements" Article. Where fully tempered glass is indicated, provide Kind FT heat-treated float glass.

- C. Thermal and Optical Performance Properties: Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:
1. For monolithic-glass lites, properties are based on units with lites 6.0 mm thick.
 2. For insulating-glass units, properties are based on units of thickness indicated for overall unit and for each lite.
 3. U-Factors: Center-of-glazing values, according to NFRC 100 and based on LBL's WINDOW 5.2 computer program, expressed as Btu/sq. ft. x h x deg F.
 4. Solar Heat-Gain Coefficient and Visible Transmittance: Center-of-glazing values, according to NFRC 200 and based on LBL's WINDOW 5.2 computer program.
 5. Visible Reflectance: Center-of-glazing values, according to NFRC 300.

2.2 GLASS PRODUCTS

- A. Fully Tempered Float Glass: ASTM C1048, Kind FT (fully tempered), Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.
1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.

2.3 INSULATING GLASS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. PPG.
 2. Oldcastle.
 3. Viracon.
- B. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified according to ASTM E 2190, and complying with other requirements specified.
1. Sealing System: Dual seal, with manufacturer's standard primary and secondary.
 2. Spacer: Manufacturer's standard spacer material and construction.
 3. Desiccant: Molecular sieve or silica gel, or blend of both.
- C. Glass: Comply with applicable requirements in "Glass Products" Article as indicated by designations in "Insulating-Glass Types" Article.

2.4 FIRE-PROTECTION-RATED GLAZING

- A. Fire-Protection-Rated Glazing, General: Listed and labeled by a testing agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 252 for door assemblies.
- B. Monolithic Ceramic Glazing: Clear, ceramic flat glass; 3/16-inch nominal thickness.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Nippon Electric Glass Co., Ltd. (distributed by Technical Glass Products); Premium FireLite.
 - b. Safti First; SuperLite C/P.
 - c. Vetrotech Saint-Gobain; SGG Keralite FR-R.

2.5 GLAZING GASKETS

- A. Dense Compression Gaskets: Molded or extruded gaskets of profile and hardness required to maintain watertight seal, made from one of the following:
1. Neoprene complying with ASTM C 864.
 2. EPDM complying with ASTM C 864.
 3. Silicone complying with ASTM C 1115.
 4. Thermoplastic polyolefin rubber complying with ASTM C 1115.

2.6 GLAZING SEALANTS

- A. General:
1. Compatibility: Provide glazing sealants that are compatible with one another and with other materials they will contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
 2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
 3. VOC Content: For sealants used inside of the weatherproofing system, not more than 250 g/L when calculated according to 40 CFR 59, Subpart D.
 4. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range.
- B. Glazing Sealant: Neutral-curing silicone glazing sealant complying with ASTM C 920, Type S, Grade NS, Class 100/50, Use NT.

1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Dow Corning Corporation; 790.
 - b. GE Advanced Materials - Silicones; SilPruf LM SCS2700.
 - c. Pecora Corporation; 890.
 - d. Tremco Incorporated; Spectrem 1.
 - C. Glazing Sealant: Neutral-curing silicone glazing sealant complying with ASTM C 920, Type S, Grade NS, Class 50, Use NT.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Dow Corning Corporation; 795.
 - b. GE Advanced Materials - Silicones; SilGlaze II SCS2800.
 - c. Pecora Corporation; 864.
 - d. Tremco Incorporated; Spectrem 2.
 - D. Glazing Sealants for Fire-Rated Glazing Products: Products that are approved by testing agencies that listed and labeled fire-resistant glazing products with which they are used for applications and fire-protection ratings indicated.
- 2.7 GLAZING TAPES
- A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; non-staining and non-migrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; and complying with ASTM C 1281 and AAMA 800 for products indicated below:
 1. AAMA 804.3 tape, where indicated.
 2. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
 3. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.
- 2.8 MISCELLANEOUS GLAZING MATERIALS
- A. General: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.
 - B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.
 - C. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.
 - D. Spacers: Elastomeric blocks or continuous extrusions of hardness required by glass manufacturer to maintain glass lites in place for installation indicated.
 - E. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).
 - F. Cylindrical Glazing Sealant Backing: ASTM C 1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.
 - G. Perimeter Insulation for Fire-Resistive Glazing: Product that is approved by testing agency that listed and labeled fire-resistant glazing product with which it is used for application and fire-protection rating indicated.
- 2.9 FABRICATION OF GLAZING UNITS
- A. Fabricate glazing units in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.
 - B. Clean-cut or flat-grind vertical edges of butt-glazed monolithic lites to produce square edges with slight chamfers at junctions of edges and faces.
 - C. Grind smooth and polish exposed glass edges and corners.
- 2.10 MONOLITHIC-GLASS TYPES
- A. Glass Type GL-B: Clear float glass fully tempered float glass.
 1. Overall Unit Thickness: 1 inch.
 2. Provide safety glazing labeling.
 - B. Glass Type GL-C: Clear float glass fully tempered float glass.
 1. Overall Unit Thickness: 1/4 inch.
 2. Provide safety glazing labeling.
- 2.11 INSULATING-GLASS TYPES
- A. Glass Type GL-A: Low-e-coated, clear insulating glass.
 1. Overall Unit Thickness: 1 inch.
 2. Thickness of Each Glass Lite: 6.0 mm.
 3. Outdoor Lite: Heat-strengthened float glass OR Fully tempered float glass, as required by code.
 4. Interspace Content: Air.

5. Indoor Lite: Heat-strengthened float glass OR Fully tempered float glass, as required by code.
6. Low-E Coating: Sputtered on second surface.
7. Visible Light Transmittance: As required.
8. Winter Nighttime U-Factor: As required.
9. Solar Heat Gain Coefficient: As required.
10. Provide safety glazing labeling.

2.12 FIRE-PROTECTION-RATED GLAZING TYPES

- A. Glass Type: 20-minute fire-rated glazing without hose-stream test; monolithic ceramic glazing.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine framing, glazing channels, and stops, with Installer present, for compliance with the following:
 1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
 2. Presence and functioning of weep systems.
 3. Minimum required face and edge clearances.
 4. Effective sealing between joints of glass-framing members.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.
- B. Examine glazing units to locate exterior and interior surfaces. Label or mark units as needed so that exterior and interior surfaces are readily identifiable. Do not use materials that will leave visible marks in the completed work.

3.3 GLAZING, GENERAL

- A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.
- B. Adjust glazing channel dimensions as required by Project conditions during installation to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.
- C. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.
- D. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.
- E. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.
- F. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.
- G. Provide spacers for glass lites where length plus width is larger than 50 inches.
 1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
 2. Provide 1/8-inch minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.
- H. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.
- I. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.
- J. Set glass lites with proper orientation so that coatings face exterior or interior as specified.
- K. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.
- L. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended by gasket manufacturer.

3.4 TAPE GLAZING

- A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.
- B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.
- C. Cover vertical framing joints by applying tapes to heads and sills first and then to jambs. Cover horizontal framing joints by applying tapes to jambs and then to heads and sills.
- D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.
- E. Do not remove release paper from tape until right before each glazing unit is installed.
- F. Apply heel bead of elastomeric sealant.
- G. 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.
- H. Apply cap bead of elastomeric sealant over exposed edge of tape.

3.5 GASKET GLAZING (DRY)

- A. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.
- B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.
- C. Installation with Drive-in Wedge Gaskets: Center glass lites in openings on setting blocks and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.
- D. Installation with Pressure-Glazing Stops: Center glass lites in openings on setting blocks and press firmly against soft compression gasket. Install dense compression gaskets and pressure-glazing stops, applying pressure uniformly to compression gaskets. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.
- E. Install gaskets so they protrude past face of glazing stops.

3.6 SEALANT GLAZING (WET)

- A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.
- B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.
- C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

3.7 CLEANING AND PROTECTION

- A. Protect exterior glass from damage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels and clean surfaces.
- B. Protect glass from contact with contaminating substances resulting from construction operations. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended in writing by glass manufacturer.
- C. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains; remove as recommended in writing by glass manufacturer.
- D. Remove and replace glass that is broken, chipped, cracked, or abraded or that is damaged from natural causes, accidents, and vandalism, during construction period.
- E. Wash glass on both exposed surfaces in each area of Project not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

END OF SECTION

SECTION 088300**MIRRORS****PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

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

1.2 SUMMARY

- A. Section includes the following types of silvered flat glass mirrors:
 1. Film-backed Tempered glass mirrors qualifying as safety glazing.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
 1. Mirrors. Include description of materials and process used to produce each type of silvered flat glass mirror specified that indicates sources of glass, glass coating components, edge sealer, and quality-control provisions.
- B. Shop Drawings: Include mirror elevations, edge details, mirror hardware, and attachments to other work.
- C. Product Certificates: For each type of mirror and mirror mastic, from manufacturer.
- D. Maintenance Data: For mirrors to include in maintenance manuals.
- E. Warranty: Sample of special warranty.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer who employs glass installers for this Project who are certified under the National Glass Association's Certified Glass Installer Program.
- B. Source Limitations for Mirrors: Obtain mirrors from single source from single manufacturer.
- C. Source Limitations for Mirror Accessories: Obtain mirror glazing accessories from single source.
- D. Glazing Publications: Comply with the following published recommendations:
 1. GANA's "Glazing Manual" unless more stringent requirements are indicated. Refer to this publication for definitions of glass and glazing terms not otherwise defined in this Section or in referenced standards.
 2. GANA Mirror Division's "Mirrors, Handle with Extreme Care: Tips for the Professional on the Care and Handling of Mirrors."
- E. Safety Glazing Products: For film-backed tempered mirrors, provide products complying with testing requirements in 16 CFR 1201 for Category II materials.
- F. Preconstruction Mirror Mastic Compatibility Test: Submit mirror mastic products to mirror manufacturer for testing to determine compatibility of mastic with mirror backing film and substrates on which mirrors are installed.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Protect mirrors according to mirror manufacturer's written instructions and as needed to prevent damage to mirrors from moisture, condensation, temperature changes, direct exposure to sun, or other causes.
- B. Comply with mirror manufacturer's written instructions for shipping, storing, and handling mirrors as needed to prevent deterioration of silvering, damage to edges, and abrasion of glass surfaces and applied coatings. Store indoors.

1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install mirrors until ambient temperature and humidity conditions are maintained at levels indicated for final occupancy.

1.7 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which mirror manufacturer agrees to replace mirrors that deteriorate within specified warranty period. Deterioration of mirrors is defined as defects developed from normal use that are not attributed to mirror breakage or to maintaining and cleaning mirrors contrary to manufacturer's written instructions. Defects include discoloration, black spots, and clouding of the silver film.
 1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS**2.1 SILVERED FLAT GLASS MIRRORS**

- A. Glass Mirrors, General: ASTM C 1503; manufactured using copper-free, low-lead mirror coating process.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Arch Aluminum & Glass Co., Inc.
 - b. Avalon Glass and Mirror Company.
 - c. Binswanger Mirror; a division of Vitro America, Inc.
 - d. Guardian Industries.
 - e. Virginia Mirror Company, Inc.
- B. Tempered Clear Glass: Mirror Glazing Quality, for blemish requirements; and comply with ASTM C 1048 for Kind FT, Condition A, tempered float glass before silver coating is applied.
 - 1. Nominal Thickness: 6.0 mm.

2.2 MISCELLANEOUS MATERIALS

- A. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.
- B. 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. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. OSI Sealants, Inc.
 - b. Palmer Products Corporation.
 - c. Pecora Corporation.
- C. Film Backing for Safety Mirrors: Film backing and pressure-sensitive adhesive; both compatible with mirror backing paint as certified by mirror manufacturer.

2.3 FABRICATION

- A. Mirror Sizes: To suit Project conditions, and before tempering, cut mirrors to final sizes and shapes.
- B. Cutouts: Fabricate cutouts before tempering for notches and holes in mirrors without marring visible surfaces. Locate and size cutouts so they fit closely around penetrations in mirrors.
- C. Mirror Edge Treatment: Flat polished.
 - 1. Seal edges of mirrors with edge sealer after edge treatment to prevent chemical or atmospheric penetration of glass coating.
 - 2. Require mirror manufacturer to perform edge treatment and sealing in factory immediately after cutting to final sizes.
- D. Film-Backed Safety Mirrors: Apply film backing with adhesive coating over mirror backing paint as recommended in writing by film-backing manufacturer to produce a surface free of bubbles, blisters, and other imperfections.

PART 3 - EXECUTION**3.1 EXAMINATION**

- A. Examine substrates, over which mirrors are to be mounted, with Installer present, for compliance with installation tolerances, substrate preparation, and other conditions affecting performance of the Work.
- B. Verify compatibility with and suitability of substrates, including compatibility of mirror mastic with existing finishes or primers.
- C. Proceed with installation only after unsatisfactory conditions have been corrected and surfaces are dry.

3.2 PREPARATION

- A. Comply with mastic manufacturer's written installation instructions for preparation of substrates, including coating substrates with mastic manufacturer's special bond coating where applicable.

3.3 INSTALLATION

- A. General: Install mirrors to comply with mirror manufacturer's written instructions and with referenced GANA publications. Mount mirrors accurately in place in a manner that avoids distorting reflected images.
- B. Provide a minimum air space of 1/8 inch between back of mirrors and mounting surface for air circulation between back of mirrors and face of mounting surface.
 - 1. Wall-Mounted Mirrors: Install mirrors with mastic.
 - 2. Install mastic as follows:
 - a. Apply barrier coat to mirror backing where approved in writing by manufacturers of mirrors and backing material.

- b. Apply mastic to comply with mastic manufacturer's written instructions for coverage and to allow air circulation between back of mirrors and face of mounting surface.
- c. After mastic is applied, align mirrors and press into place while maintaining a minimum air space of 1/8 inch between back of mirrors and mounting surface.

3.4 CLEANING AND PROTECTION

- A. Protect mirrors from breakage and contaminating substances resulting from construction operations.
- B. Do not permit edges of mirrors to be exposed to standing water.
- C. Maintain environmental conditions that will prevent mirrors from being exposed to moisture from condensation or other sources for continuous periods of time.
- D. Wash exposed surface of mirrors not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash mirrors as recommended in writing by mirror manufacturer.

END OF SECTION

SECTION 092900
GYPSUM BOARD

PART 1 - GENERAL

- 1.1 RELATED DOCUMENTS
- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
 - B. Refer to Section 092216 for metal support framing.
- 1.2 SUMMARY
- A. Section Includes:
 - 1. Interior gypsum board.
 - 2. Tile backing panels.
 - 3. Texture finishes.
- 1.3 ACTION SUBMITTALS
- A. Product Data: For each type of product.
 - B. Sustainable Submittals:
 - 1. Product data for products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating cost for each product having recycled content.
 - C. Samples: For the following products:
 - 1. Trim Accessories: Full-size Sample in 12-inch- long length for each trim accessory indicated.
 - D. Shop Drawings: Indicating location of fire rated partitions, smoke partitions, sound rated partitions, insulated partitions, and proposed location of control joints.
- 1.4 DELIVERY, STORAGE AND HANDLING
- A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.
- 1.5 FIELD CONDITIONS
- A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.
 - B. Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned. At Contractor's request, Owner and Architect may consider use of moisture and mold resistant gypsum board panel products without additional cost to Owner.
 - C. Do not install panels that are wet, those that are moisture damaged, and those that are mold damaged.
 - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

- 2.1 PERFORMANCE REQUIREMENTS
- A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119, UL, or by an independent testing agency as indicated on Drawings.
 - 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 as indicated on Drawings.
- 2.2 GYPSUM BOARD, GENERAL
- A. Recycled Content of Gypsum Panel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
 - B. Size: Provide maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

2.3 INTERIOR GYPSUM BOARD

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. American Gypsum.
 - 2. CertainTeed Corp.
 - 3. Georgia-Pacific Gypsum LLC.
 - 4. National Gypsum Company.
 - 5. Temple-Inland.
 - 6. USG Corporation.
- B. Gypsum Board, Type X: ASTM C 1396.
 - 1. Thickness: 5/8 inch.
 - 2. Long Edges: Tapered.
- C. 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 or as otherwise indicated on partition type Drawings.
 - 2. Long edges tapered.
 - 3. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274

2.4 BACKING PANELS

- A. Cementitious Backer Units: ANSI A118.9 and ASTM C 1288 or 1325, with manufacturer's standard edges
 - 1. Subject to compliance with requirements, provide one of the following:
 - a. C-Cure; C-Cure Board 990
 - b. CertainTeed Corp.; FiberCement.
 - c. Custom Building Products; Wonderboard.
 - d. James Hardie Building Products, Inc.; Hardiebacker.
 - e. National Gypsum Company, Permabase Cement Board.
 - f. USG Corporation; DUROCK Cement Board.
 - 2. Thickness: 5/8 inch.
 - 3. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274

2.5 TRIM ACCESSORIES

- A. Interior Trim: ASTM C 1047.
 - 1. Material: Galvanized or aluminum-coated steel sheet or rolled zinc.
 - 2. Shapes:
 - a. Cornerbead.
 - b. Bullnose bead.
 - c. LC-Bead: J-shaped; exposed long flange receives joint compound.
 - d. L-Bead: L-shaped; exposed long flange receives joint compound.
 - e. U-Bead: J-shaped; exposed short flange does not receive joint compound.
 - f. Expansion (control) joint.
 - g. Curved-Edge Cornerbead: With notched or flexible flanges.
- B. Exterior Trim: ASTM C 1047.
 - 1. Material: Hot-dip galvanized steel sheet, plastic, or rolled zinc.
 - 2. Shapes:
 - a. Cornerbead.
 - b. LC-Bead: J-shaped; exposed long flange receives joint compound.
 - c. Expansion (Control) Joint: One-piece, rolled zinc with V-shaped slot and removable strip covering slot opening.
- C. Specialty Aluminum Trim: Extruded accessories of profiles and dimensions indicated.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Fry Reglet Corp.
 - b. Gordon, Inc.
 - c. Softforms.
 - 2. Basis of Design: Refer to Schedule.
 - 3. Aluminum: Alloy and temper with not less than the strength and durability properties of ASTM B 221, Alloy 6063-T5.

2.6 JOINT TREATMENT MATERIALS

- A. General: Comply with ASTM C 475.
- B. Joint Tape:
 - 1. Interior Gypsum Board: Paper.
 - 2. Exterior Gypsum Soffit Board: Paper.
 - 3. Glass-Mat Gypsum Sheathing Board: 10-by-10 glass mesh.

4. Tile Backing Panels: As recommended by panel manufacturer.
 - C. Joint Compound for Interior Gypsum Board: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.
 1. Prefilling: At open joints, rounded or beveled panel edges, and damaged surface areas, use setting-type taping compound.
 2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use drying-type, all-purpose compound.
 - a. Use setting-type compound for installing paper-faced metal trim accessories.
 3. Fill Coat: For second coat, use drying-type, all-purpose compound.
 4. Finish Coat: For third coat, use drying-type, all-purpose compound.
 5. Skim Coat: For final coat of Level 5 finish, use drying-type, all-purpose compound.
 - D. Joint Compound for Tile Backing Panels:
 1. Glass-Mat, Water-Resistant Backing Panel: As recommended by backing panel manufacturer.
 2. Cementitious Backer Units: As recommended by backer unit manufacturer.
- 2.7 AUXILIARY MATERIALS
- A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.
 - B. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.
 1. Laminating adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - C. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.
 1. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch thick.
 2. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.
 - D. Sound Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.
 1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.
 2. Recycled Content of Blankets: Total recycled content not less than 30 percent.
 - E. Acoustical Joint Sealant: Manufacturer's standard non-sag, paintable, non-staining latex sealant complying with ASTM C 834. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Accumetric LLC; BOSS 824 Acoustical Sound Sealant.
 - b. Pecora Corporation; AC-20 FTR AIS-919.
 - c. Specified Technologies, Inc; Smoke N Sound Acoustical Sealant.
 - d. USG Corporation; SHEETROCK Acoustical Sealant.
 2. Acoustical joint sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

PART 3 - EXECUTION

- 3.1 EXAMINATION
 - A. Examine areas and substrates including welded hollow-metal frames and framing, with Installer present, for compliance with requirements and other conditions affecting performance.
 - B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.
 - C. Proceed with installation only after unsatisfactory conditions have been corrected.
- 3.2 APPLYING AND FINISHING PANELS, GENERAL
 - A. Comply with ASTM C 840.
 - B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.
 - C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.
 - D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.

- E. Form control and expansion joints with space between edges of adjoining gypsum panels.
- F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc., except in chases braced internally).
 - 1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. in area.
 - 2. Fit gypsum panels around ducts, pipes, and conduits.
 - 3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch- wide joints to install sealant.
- G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments, except floors. Provide 1/4- to 1/2-inch- wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.
- H. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.
- I. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and with manufacturer's written recommendations for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.
- J. Install sound attenuation blankets before installing gypsum panels unless blankets are readily installed after panels have been installed on one side.

3.3 APPLYING INTERIOR GYPSUM BOARD

- A. Install interior gypsum board in the following locations:
 - 1. Type X: Vertical surfaces unless otherwise indicated.
 - 2. Moisture- and Mold-Resistant Type: At damp/wet locations where tile backer board is not used.
 - 3. Cement Backer Board: At critical areas of high humidity, as indicated.
- B. Single-Layer Application:
 - 1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing unless otherwise indicated.
 - 2. On partitions/walls, apply gypsum panels vertically (parallel to framing) unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.
 - a. Stagger abutting end joints not less than one framing member in alternate courses of panels.
 - 3. On Z-furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.
 - 4. Fastening Methods: Apply gypsum panels to supports with steel drill screws.
- C. Multi-layer Application:
 - 1. On ceilings, apply gypsum board indicated for base layers before applying base layers on walls/partitions; apply face layers in same sequence. Apply base layers at right angles to framing members and offset face-layer joints one framing member, 16 inches minimum, from parallel base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly.
 - 2. On partitions/walls, apply gypsum board indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face-layer joints offset at least one stud or furring member with base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.
 - 3. On Z-furring members, apply base layer vertically (parallel to framing) and face layer either vertically (parallel to framing) or horizontally (perpendicular to framing) with vertical joints offset at least one furring member. Locate edge joints of base layer over furring members.
 - 4. Fastening Methods: Fasten base layers and face layers separately to supports with screws.
- D. Laminating to Substrate: Where gypsum panels are indicated as directly adhered to a substrate (other than studs, joists, furring members, or base layer of gypsum board), comply with gypsum board manufacturer's written recommendations and temporarily brace or fasten gypsum panels until fastening adhesive has set.

3.4 APPLYING BACKING PANELS

- A. Cementitious Backer Units: ANSI A108.11.
- B. Where tile backing panels about other types of panels in same plane, shim surfaces to produce a uniform plane across panel surfaces.

3.5 INSTALLING TRIM ACCESSORIES

- A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for

- panels. Otherwise, attach trim according to manufacturer's written instructions.
- B. Control Joints: Install control joints at locations indicated on Drawings, and according to ASTM C 840 and in specific locations approved by Architect for visual effect, and as follows:
 - 1. Wall: Control joints shall be installed where a wall or partition runs in an uninterrupted straight plane exceeding 30 linear feet, or 900 sq ft.
 - 2. Ceiling with Perimeter relief: Control joints in interior ceilings with perimeter relief shall be installed so that linear dimensions between control joints do not exceed 50 ft or 2500 sq. ft
 - 3. Ceiling, without perimeter relief: Control joints in interior ceilings without perimeter relief shall be installed so that linear dimensions between control joints do not exceed 30 ft
 - 4. Exterior: Control joints in exterior ceilings and soffits shall be installed so that linear dimensions between control joints do not exceed 30 ft. at acoustical or fire-rated walls: Where a control joint occurs in an acoustical or fire rated system, blocking shall be provided behind the control joint by using a backing material such as 5/8 in. type X gypsum panel products, mineral fiber, or other tested equivalent
 - C. Interior Trim: Install in the following locations:
 - 1. Cornerbead: Use at outside corners.
 - 2. LC-Bead: Use at exposed panel edges.
 - 3. L-Bead: Use where indicated.
 - 4. Curved-Edge Cornerbead: Use at curved openings.
 - D. Aluminum Trim: Install in locations indicated on Drawings.
- 3.6 FINISHING GYPSUM BOARD
- A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.
 - B. Prefill open joints, rounded or beveled edges, and damaged surface areas.
 - C. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.
 - D. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C 840:
 - 1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
 - 2. Level 2: Warehouse storage areas.
 - 3. Level 3: Beneath wall covering.
 - 4. Level 4: At panel surfaces that will be exposed to view unless otherwise indicated.
 - a. Primer and its application to surfaces are specified in other Division 09 Sections.
 - 5. Level 5: Where indicated on Drawings.
 - a. Primer and its application to surfaces are specified in other Division 09 Sections.
 - E. Glass-Mat Gypsum Sheathing Board: Finish according to manufacturer's written instructions for use as exposed soffit board.
 - F. Cementitious Backer Units: Finish according to manufacturer's written instructions.
- 3.7 PROTECTION
- A. Protect adjacent surfaces from drywall compound and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.
 - B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.
 - C. Remove and replace panels that are wet, moisture damaged, and mold damaged.
 - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION

**SECTION 093013
CERAMIC TILING**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
1. Ceramic and Quarry tile.
 2. Thresholds.
 3. Waterproof membrane.
 4. Crack isolation membrane.
 5. Metal edge strips.

1.3 DEFINITIONS

- A. General: Definitions in the ANSI A108 series of tile installation standards and in ANSI A137.1 apply to Work of this Section unless otherwise specified.
- B. ANSI A108 Series: ANSI A108.01, ANSI A108.02, ANSI A108.1A, ANSI A108.1B, ANSI A108.1C, ANSI A108.4, ANSI A108.5, ANSI A108.6, ANSI A108.8, ANSI A108.9, ANSI A108.10, ANSI A108.11, ANSI A108.12, ANSI A108.13, ANSI A108.14, ANSI A108.15, ANSI A108.16, and ANSI A108.17, which are contained in "American National Standard Specifications for Installation of Ceramic Tile."
- C. Module Size: Actual tile size plus joint width indicated.
- D. Face Size: Actual tile size, excluding spacer lugs.

1.4 PERFORMANCE REQUIREMENTS

- A. Static Coefficient of Friction: For tile installed on walkway surfaces, provide products with the following values as determined by testing identical products per ASTM C 1028:
1. Level Surfaces: Minimum 0.60.
 2. Step Treads: Minimum 0.60.
 3. Ramp Surfaces: Minimum 0.80.

1.5 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Show locations of each type of tile and tile pattern. Show widths, details, and locations of expansion, contraction, control, and isolation joints in tile substrates and finished tile surfaces.
- C. Samples for Initial Selection: For each type of tile and grout indicated. Include Samples of accessories involving color selection.
- D. Product Certificates: For each type of product, signed by product manufacturer.
- E. Material Test Reports: For each tile-setting and -grouting product.
- F. Sustainable Submittals:
1. Product data for products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content

1.6 QUALITY ASSURANCE

- A. Source Limitations for Tile: Obtain tile of each type and color or finish from one source or producer.
1. Obtain tile of each type and color or finish from same production run and of consistent quality in appearance and physical properties for each contiguous area.
- B. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from one manufacturer and each aggregate from one source or producer.
- C. Source Limitations for Other Products: Obtain each of the following products specified in this Section from a single manufacturer for each product:
1. Thresholds.
 2. Waterproof membrane.
 3. Crack isolation membrane.
 4. Joint sealants.
 5. Metal edge strips.

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 requirements in ANSI A137.1 for labeling tile packages.
- B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.
- C. Store aggregates where grading and other required characteristics can be maintained and contamination can be avoided.
- D. Store liquid materials in unopened containers and protected from freezing.
- E. Handle tile that has temporary protective coating on exposed surfaces to prevent coated surfaces from contacting backs or edges of other units. If coating does contact bonding surfaces of tile, remove coating from bonding surfaces before setting tile.

1.8 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 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. Tile and Trim Units: Furnish quantity of full-size units equal to 5-8 percent of amount installed for each type, composition, color, pattern, and size indicated.

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

- A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1 for types, compositions, and other characteristics indicated.
 - 1. Provide tile complying with Standard grade requirements unless otherwise indicated.
- B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI A108.02, ANSI standards referenced in other Part 2 articles, ANSI standards referenced by TCA installation methods specified in tile installation schedules, and other requirements specified.
- C. Factory Blending: For tile exhibiting color variations within ranges, blend tile in factory and package so tile units taken from one package show same range in colors as those taken from other packages and match approved Samples.
- D. Mounting: For factory-mounted tile, provide back- or edge-mounted tile assemblies as standard with manufacturer unless otherwise indicated.
 - 1. Where tile is indicated for installation in wet areas, do not use back- or edge-mounted tile assemblies unless tile manufacturer specifies in writing that this type of mounting is suitable for installation indicated and has a record of successful in-service performance.
- E. SEU Standards for Ceramic Tile: All tile to be sealed.

2.2 CERAMIC TILE PRODUCTS

- A. Basis of Design Products: Refer to Finish Schedule.
- B. Additional Acceptable Manufacturers:
 - 1. Daltile.
 - 2. Crossville Ceramics.
 - 3. Inteceramic.
 - 4. Caesar.
 - 5. Walker Zanger.
- C. For substitution request, refer to Section "012500 – Substitution Procedures".

2.3 QUARRY TILE

- A. Basis of Design Products: Refer to Finish Schedule.
- B. Additional Acceptable Manufacturers:
 - 1. AmeriCraft Tile, Florida Brick and Clay Co., Inc., Plant City, FL 33567.
 - 2. Ironrock, Metropolitan Ceramics, Canton, OH 44711.
 - 3. Quarry Tile, Summitville Tiles Inc., Summitville, OH 43962.
- C. For substitution request, refer to Section "012500 – Substitution Procedures".

2.4 THRESHOLDS

- A. General: Fabricate to sizes and profiles indicated or required to provide transition between adjacent floor finishes.
 - 1. Bevel edges at 1:2 slope, with lower edge of bevel aligned with or up to 1/16 inch above adjacent floor surface. Finish bevel to match top surface of threshold. Limit height of threshold to 1/2 inch or less above adjacent floor surface.
- B. Thresholds: Minimum abrasion resistance of 10 per ASTM C 1353 or ASTM C 241 and with honed finish.
 - 1. Color: As selected by Architect from manufacturer's full available range.
 - 2. Size: 2-inch, double bevel, thickness to match height of adjacent flooring material.

2.5 WATERPROOF MEMBRANE

- A. General: Manufacturer's standard product, selected from the following, that complies with ANSI A118.10 and is recommended by the manufacturer for the application indicated. Include reinforcement and accessories recommended by manufacturer.
- B. Chlorinated Polyethylene Sheet: Non-plasticized, chlorinated polyethylene faced on both sides with non-woven polyester fabric; 0.030-inch nominal thickness.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Noble Company (The); Nobleseal TS.
- C. Polyethylene Sheet: Polyethylene faced on both sides with fleece webbing; 0.008-inch nominal thickness:
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Schluter Systems L.P.; KERDI.
- D. Fabric-Reinforced, Fluid-Applied Membrane: System consisting of liquid-latex rubber or elastomeric polymer and continuous fabric reinforcement:
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Laticrete International; 9235 Waterproofing and Anti-Fracture Membrane.

2.6 CRACK ISOLATION MEMBRANE

- A. General: Manufacturer's standard product, selected from the following, that complies with ANSI A118.12 for high performance and is recommended by the manufacturer for the application indicated. Include reinforcement and accessories recommended by manufacturer.
- B. Chlorinated Polyethylene Sheet: Non-plasticized, chlorinated polyethylene faced on both sides with non-woven polyester fabric; 0.030-inch nominal thickness.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Noble Company (The); Nobleseal CIS.
 - b. Schuler; Ditra.

2.7 SETTING MATERIALS

- A. Portland Cement Mortar (Thickset) Installation Materials: ANSI A108.02.
 - 1. Reinforcing Wire Fabric: Galvanized, welded wire fabric, 2 by 2 inches by 0.062-inch diameter; comply with ASTM A 185 and ASTM A 82 except for minimum wire size.
 - 2. Latex Additive: Manufacturer's standard water emulsion, serving as replacement for part or all of gaging water, of type specifically recommended by latex-additive manufacturer for use with field-mixed portland cement and aggregate mortar bed.
- B. Latex-Portland Cement Mortar (Thin Set): ANSI A118.4.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Bonsal American; an Oldcastle company.
 - b. Custom Building Products.
 - c. Laticrete International, Inc.
 - d. MAPEI Corporation.
 - 2. Provide prepackaged, dry-mortar mix containing dry, redispersible, vinyl acetate or acrylic additive to which only water must be added at Project site.
 - 3. Provide prepackaged, dry-mortar mix combined with acrylic resin or styrene-butadiene-rubber liquid-latex additive at Project site.
 - 4. For wall applications, provide mortar that complies with requirements for non-sagging mortar in addition to the other requirements in ANSI A118.4.
 - 5. Behind glass mosaic tile, provide white mortar.

2.8 GROUT MATERIALS

- A. Water-Cleanable Epoxy Grout: ANSI A118.3.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Bostik, Inc.
 - b. Custom Building Products.

- c. Laticrete International, Inc.
 - d. MAPEI Corporation.
 - e. Tex-Rite.
- 2. Basis of Design:
 - a. GRT-4: (Wall / Floor Tile - High Performance Stain Resistant) Laticrete SpectraLOCK PRO (Part AB Liquid) with Laticrete SpectraLOCK Powder (Part C).
 - b. For substitution request, refer to Section "012500 – Substitution Procedures".
- 2.9 ELASTOMERIC SEALANTS
 - A. General: Provide sealants, primers, backer rods, and other sealant accessories that comply with the following requirements and with the applicable requirements in Division 07 Section "Joint Sealants."
 - 1. Use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 2. Refer to Section 079500 for specific acceptable sealants.
- 2.10 MISCELLANEOUS MATERIALS
 - A. Trowelable Underlayments and Patching Compounds: Latex-modified, portland cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.
 - B. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.
- 2.11 MIXING MORTARS AND GROUT
 - A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.
 - B. Add materials, water, and additives in accurate proportions.
 - C. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

PART 3 - EXECUTION

- 3.1 EXAMINATION
 - A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of installed tile.
 - 1. Verify that substrates for setting tile are firm, dry, clean, free of coatings that are incompatible with tile-setting materials including curing compounds and other substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated.
 - 2. Verify that concrete substrates for tile floors installed with thin-set mortar comply with surface finish requirements in ANSI A108.01 for installations indicated.
 - a. Verify that surfaces that received a steel trowel finish have been mechanically scarified.
 - b. Verify that protrusions, bumps, and ridges have been removed by sanding or grinding.
 - 3. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed.
 - 4. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Architect.
 - B. Proceed with installation only after unsatisfactory conditions have been corrected.
- 3.2 PREPARATION
 - A. Fill cracks, holes, and depressions in concrete substrates for tile floors installed with thin-set mortar with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer.
 - B. Where indicated, prepare substrates to receive waterproofing by applying a reinforced mortar bed that complies with ANSI A108.1A and is sloped 1/4 inch per foot toward drains.
 - C. Blending: For tile exhibiting color variations, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.
- 3.3 TILE INSTALLATION
 - A. Comply with TCA's "Handbook for Ceramic Tile Installation" for TCA installation methods specified in tile

installation schedules. Comply with parts of the ANSI A108 Series "Specifications for Installation of Ceramic Tile" that are referenced in TCA installation methods, specified in tile installation schedules, and apply to types of setting and grouting materials used.

1. For the following installations, follow procedures in the ANSI A108 Series of tile installation standards for providing 95 percent mortar coverage:
 - a. Exterior tile floors.
 - b. Tile floors in wet areas.
 - c. Tile swimming pool decks.
 - d. Tile floors in laundries.
 - e. Tile floors composed of tiles 8 by 8 inches or larger.
 - f. Tile floors composed of rib-backed tiles.
 - B. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.
 - C. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.
 - D. Jointing Pattern: Lay tile in pattern as indicated on Drawings. Lay out tile work and center tile fields in both directions in each space or on each wall area. Lay out tile work to minimize the use of pieces that are less than half of a tile, or as otherwise indicated on Drawings. Provide uniform joint widths unless otherwise indicated.
 1. For tile mounted in sheets, make joints between tile sheets same width as joints within tile sheets so joints between sheets are not apparent in finished work.
 2. Where adjoining tiles on floor, base, walls, or trim are specified or indicated to be same size, align joints.
 3. Where tiles are specified or indicated to be whole integer multiples of adjoining tiles on floor, base, walls, or trim, align joints unless otherwise indicated.
 - E. Joint Widths: Refer to Schedule.
 - F. Lay out tile wainscots to dimensions indicated or to next full tile beyond dimensions indicated.
 - G. Expansion Joints: Provide expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated. Form joints during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.
 1. Where joints occur in concrete substrates, locate joints in tile surfaces directly above them.
 2. Prepare joints and apply sealants to comply with requirements in Division 07 Section "Joint Sealants."
 - H. Metal Edge Strips: Install in locations indicated or where exposed edge of tile flooring meets carpet, wood, or other flooring that finishes flush with top of tile.
 - I. Grout Sealer: Apply grout sealer to cementitious grout joints in tile floors according to grout-sealer manufacturer's written instructions. As soon as grout sealer has penetrated grout joints, remove excess sealer and sealer from tile faces by wiping with soft cloth.
- 3.4 WATERPROOFING INSTALLATION
- A. Install waterproofing to comply with ANSI A108.13 and manufacturer's written instructions to produce waterproof membrane of uniform thickness and bonded securely to substrate.
 - B. Do not install tile or setting materials over waterproofing until waterproofing has cured and been tested to determine that it is watertight.
- 3.5 CRACK ISOLATION MEMBRANE INSTALLATION
- A. Install crack isolation membrane to comply with ANSI A108.17 and manufacturer's written instructions to produce membrane of uniform thickness and bonded securely to substrate.
 - B. Do not install tile or setting materials over crack isolation membrane until membrane has cured.

3.6 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 latex-portland cement grout residue from tile as soon as possible.
 - 2. Clean grout smears and haze from tile according to tile and grout manufacturer's written instructions but no sooner than 10 days after installation. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.
 - 3. Remove temporary protective coating by method recommended by coating manufacturer and that is acceptable to tile and grout manufacturer. Trap and remove coating to prevent drain clogging.
- B. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear. If recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors.
- C. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed.
- D. Before final inspection, remove protective coverings and rinse neutral protective cleaner from tile surfaces.

3.7 TILE INSTALLATION SCHEDULE

- A. Exterior Wall Installation, masonry or Concrete:
 - 1. Tile Installation W202: Thin-set mortar; TCS W202.
 - 2. Grout: Water-cleanable epoxy grout.
- B. Interior Floor Installations, Concrete Subfloor:
 - 1. Tile Installation F113: Thin-set mortar; TCA F113.
 - a. Thin-Set Mortar: Latex- portland cement mortar.
 - b. Grout: Water-cleanable epoxy grout.
 - 2. Tile Installation F115: Thin-set mortar; epoxy grout; TCA F115.
 - a. Thin-Set Mortar: Latex- portland cement mortar.
 - b. Grout: Water-cleanable epoxy grout.
 - 3. Tile Installation F121: Cement mortar bed (thickset) on waterproof membrane; TCA F121 and ANSI A108.1A, B, C.
 - a. Thin-Set Mortar for Cured-Bed Method: Latex- portland cement mortar.
 - b. Grout: Water-cleanable epoxy grout.
 - 4. Tile Installation F122: Thin-set mortar on waterproof membrane; TCA F122.
 - a. Thin-Set Mortar: Latex- portland cement mortar.
 - b. Grout: Water-cleanable epoxy grout.
 - 5. Tile Installation F125A: Thin-set mortar on crack isolation membrane; TCA F125A.
 - a. Thin-Set Mortar: Latex- portland cement mortar.
 - b. Grout: Water-cleanable epoxy grout.
- C. Interior Wall Installations, on Studs or Furring:
 - 1. Tile Installation W243: Thin-set mortar on gypsum board; TCA W243.
 - a. Thin-Set Mortar: Latex- portland cement mortar.
 - b. Grout: Water-cleanable epoxy grout.
 - 2. Tile Installation W245: Thin-set mortar on coated glass-mat, water-resistant gypsum backer board; TCA W245.
 - a. Thin-Set Mortar: Latex- portland cement mortar.
 - b. Grout: Water-cleanable epoxy grout.

END OF SECTION

SECTION 095113
ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

- 1.1 RELATED DOCUMENTS
- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- 1.2 SUMMARY
- A. This Section includes acoustical panels and exposed suspension systems for ceilings.
- 1.3 DEFINITIONS
- A. AC: Articulation Class.
 B. CAC: Ceiling Attenuation Class.
 C. LR: Light Reflectance coefficient.
 D. NRC: Noise Reduction Coefficient.
- 1.4 SUBMITTALS
- A. Product Data: For each type of product indicated.
 B. 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.
 2. Method of attaching hangers to building structure.
 - a. 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
- C. Research/Evaluation Reports: For each acoustical panel ceiling and components and anchor and fastener type.
 D. Maintenance Data: For finishes to include in maintenance manuals.
 E. Sustainable Submittals:
1. Product data for products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content.
 - a. Include statement indicating costs for each product having recycled content.
- 1.5 QUALITY ASSURANCE
- A. Acoustical Testing Agency Qualifications: An independent testing laboratory, or an NVLAP-accredited laboratory, with the experience and capability to conduct the testing indicated. NVLAP-accredited laboratories must document accreditation, based on a "Certificate of Accreditation" and a "Scope of Accreditation" listing the test methods specified.
 B. Source Limitations:
1. Acoustical Ceiling Panel: Obtain each type through one source from a single manufacturer.
 2. Suspension System: Obtain each type through one source from a single manufacturer.
- C. Source Limitations: Obtain each type of acoustical ceiling panel and supporting suspension system through one source from a single manufacturer.
 D. Fire-Test-Response Characteristics: Provide acoustical panel ceilings that comply with the following requirements:
1. Surface-Burning Characteristics: Provide acoustical panels with the following surface-burning characteristics complying with ASTM E 1264 for Class A materials as determined by testing identical products per ASTM E 84:
 - a. Smoke-Developed Index: 450 or less.
- 1.6 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.
- 1.7 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. Pressurized Plenums: Operate ventilation system for not less than 48 hours before beginning acoustical panel ceiling installation.
- 1.8 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.
- 1.9 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. Acoustical Ceiling Panels: Full-size panels equal to 3.0 percent of quantity installed.
 2. Suspension System Components: Quantity of each exposed component equal to 3.0 percent of quantity installed.
 3. Hold-Down Clips: Equal to 3.0 percent of quantity installed.

PART 2 - PRODUCTS

- 2.1 ACOUSTICAL PANELS, GENERAL
- A. Recycled Content: Provide acoustical panels with recycled content such that post consumer recycled content plus one-half pre-consumer recycled content constitutes a minimum of 30 percent.
- B. Acoustical Panel Standard: Provide manufacturer's standard panels of configuration indicated that comply with ASTM E 1264 classifications as designated by types, patterns, acoustical ratings, and light reflectances, unless otherwise indicated.
1. Mounting Method for Measuring NRC: Type E-400; plenum mounting in which face of test specimen is 15-3/4 inches away from test surface per ASTM E 795.
- C. Acoustical Panel Colors and Patterns: Match appearance characteristics indicated for each product type.
1. Where appearance characteristics of acoustical panels are indicated by referencing pattern designations in ASTM E 1264 and not manufacturers' proprietary product designations, provide products selected by Architect from each manufacturer's full range that comply with requirements indicated for type, pattern, color, light reflectance, acoustical performance, edge detail, and size.
- 2.2 ACOUSTICAL PANELS FOR ACOUSTICAL PANEL CEILING
- 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. Armstrong World Industries, Inc.
 2. Cetainteed.
 3. Chicago Metallic Corporation.
 4. USG Interiors, Inc.
- B. Basis-of-Design Product: Refer to Finish Schedule.
- 2.3 METAL SUSPENSION SYSTEMS, GENERAL
- A. Recycled Content: Provide products made from sheet steel with an average recycled content such that post consumer recycled content plus one-half pre-consumer recycled content constitutes a minimum of 25 percent.
- B. Metal Suspension System Standard: Provide manufacturer's standard direct-hung metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable requirements in ASTM C 635.
- C. Finishes and Colors, General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes. Provide manufacturer's standard factory-applied finish for type of system indicated.
- D. Attachment Devices: Size for five times the design load indicated in ASTM C 635, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.
- E. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:

1. Zinc-Coated, Carbon-Steel Wire: ASTM A 64, Class 1 zinc coating, soft temper.
 2. Size: Select wire diameter so its stress at 3 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-inch-diameter wire.
- F. Hold-Down Clips: Where indicated, and at exterior locations, and with 10 feet of an exterior door, provide manufacturer's standard hold-down clips spaced 24 inches o.c. on all cross tees.
- 2.4 METAL SUSPENSION SYSTEM FOR ACOUSTICAL PANEL CEILING
- 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. Armstrong World Industries, Inc.
 2. Certainteed.
 3. Chicago Metallic Corporation.
 4. USG Interiors, Inc.
- B. Unless noted otherwise in schedule, provide Wide-Face, Double-Web, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet, prepainted, electrolytically zinc coated, or hot-dip galvanized according to ASTM A 653, not less than G30 coating designation, with prefinished 15/16-inch-wide metal caps on flanges.
1. Structural Classification: Intermediate -duty system.
 2. End Condition of Cross Runners: Override (stepped) or butt-edge type.
 3. Face Design: Flat, flush.
- 2.5 METAL EDGE MOLDINGS AND TRIM
- 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. Armstrong World Industries, Inc.
 2. Certainteed
 3. Chicago Metallic Corporation.
 4. Fry Reglet Corporation.
 5. Gordon, Inc.
 6. USG Interiors, Inc.
- B. Basis of Design: Refer to Finish Schedule.
- C. Roll-Formed, Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that comply with seismic design requirements; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension system runners.
1. Provide manufacturer's standard edge moldings that fit acoustical panel edge details and suspension systems indicated and that match width and configuration of exposed runners, unless otherwise indicated.
 2. For 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.
 3. For circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.
- 2.6 ACOUSTICAL SEALANT
- 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. Acoustical Sealant for Exposed and Concealed Joints:
 - a. Pecora Corporation; AC-20 FTR Acoustical and Insulation Sealant.
 - b. USG Corporation; SHEETROCK Acoustical Sealant.
- B. Acoustical Sealant for Exposed and Concealed Joints: Manufacturer's standard non-sag, paintable, non-staining latex sealant, with a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24), complying with ASTM C 834 and effective in reducing airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.
- C. Acoustical Sealant for Concealed Joints: Manufacturer's standard nondrying, non-hardening, non-skinning, non-staining, gunnable, synthetic-rubber sealant, with a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24), recommended for sealing interior concealed joints to reduce airborne sound transmission.

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.
1. 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 and seismic design requirements indicated, 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.
 4. Secure wire hangers to ceiling suspension members and to supports above with a minimum of three tight turns. Connect hangers directly either to structures or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
 5. Secure flat, angle, channel, and rod hangers to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices that are secure and appropriate for both structure to which hangers are attached and type of hanger involved. Install hangers in a manner that will not cause them to deteriorate or fail due to age, corrosion, or elevated temperatures.
 6. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, post-installed mechanical or adhesive anchors, or power-actuated fasteners that extend through forms into concrete.
 7. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
 8. Do not attach hangers to steel deck tabs.
 9. Do not attach hangers to steel roof deck. Attach hangers to structural members.
 10. Space hangers not more than 48 inches o.c. along each member supported directly from hangers, unless otherwise indicated; provide hangers not more than 8 inches from ends of each member.
 11. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.
- C. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers, without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast-in-place or post-installed anchors.
- D. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.
1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
 2. Screw attach moldings to substrate at intervals not more than 16 inches o.c. and not more than 3 inches from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet. Miter corners accurately and connect securely.
 3. Do not use exposed fasteners, including pop rivets, on moldings and trim.
- E. Install suspension system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.
- F. Install acoustical panels with undamaged edges and fit accurately into suspension system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide a neat, precise fit.
1. Arrange directionally patterned acoustical panels as follows:
 - a. As indicated on reflected ceiling plans.

2. For square-edged panels, install panels with edges fully hidden from view by flanges of suspension system runners and moldings.
3. For reveal-edged panels on suspension system runners, install panels with bottom of reveal in firm contact with top surface of runner flanges.
4. For reveal-edged panels on suspension system members with box-shaped flanges, install panels with reveal surfaces in firm contact with suspension system surfaces and panel faces flush with bottom face of runners.
5. 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.
6. 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.
7. Protect lighting fixtures and air ducts to comply with requirements indicated for fire-resistance-rated assembly.

3.4 CLEANING

- A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION

SECTION 099100**PAINTING****PART 1 - GENERAL****1.1 SUMMARY**

- A. Related Documents: General and Supplementary Conditions of the Contract, Division 01 General Requirements, and Drawings are applicable to this Section.
- B. Section Includes:
 - 1. Complete surface preparation and finishing for field application of coatings and requirements for field finishing mechanical and electrical equipment.
 - 2. Examine specifications for various other trades and their provisions regarding their painting. Surfaces that are left unfinished by other sections of the specifications shall be painted or finished as a part of this Section.
 - 3. Colors, including deep tones, will be selected by the Architect. Number of colors to be used on job will be determined by Architect.

1.2 SURFACES NOT TO RECEIVE FIELD FINISHING

- A. Do not paint copper, bronze, chrome plated items, nickel, stainless steel, Monel metal, lead, face brick, prefinished wall, ceiling, and floor coverings, items with factory applied final finish (except where exposed on roofs and in finished spaces), elevator shafts, crawl spaces, chases, and plenums above suspended ceilings unless otherwise specified or scheduled.

1.3 DEFINITIONS

- A. Conform to ASTM D16 for interpretation of terms used in this Section.

1.4 QUALITY ASSURANCE

- A. Product Manufacturer: Company specializing in manufacturing quality paint and finish products with 3 years' experience.
- B. Applicator: Company specializing in commercial painting and finishing with 2 years' experience.
- C. Product Labels: Include manufacturer's name, type of paint, stock number, color and label analysis on label of containers.

1.5 REGULATORY REQUIREMENTS

- A. Conform to applicable building code for flame spread/fuel contribution/smoke development rating requirements for finishes.
- B. Comply with applicable city, county, state, and federal requirements and ordinances regarding maximum VOC (Volatile Organic Compound) content of all coatings.

1.6 TESTS

- A. Provide periodic testing with Wet Film Thickness gage to verify that proper thickness of finish coatings are being applied.

1.7 SUBMITTALS

- A. Provide product data describing physical performance criteria and composition on all finishing products.
- B. Submit 2 samples, 12 by 12 inches in size illustrating range of colors and textures selected for each surface finishing product scheduled.
- C. Submit certification from manufacturer of coatings listing all products proposed for each. Certify that each product meets current applicable regulations and ordinances regarding maximum VOC content.

1.8 FIELD SAMPLES

- A. Provide field sample panel, 96 inches long by 96 inches wide, illustrating each coating color, texture, and finish intended for use.
- B. Locate where directed.
- C. Accepted sample may remain as part of the Work.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and protect products under provisions of Division 01 section "Product Requirements"
- B. Deliver products to site in sealed and labeled containers; inspect to verify acceptance.

- C. Container labeling to include manufacturer's name, type of paint, brand name, brand code, coverage, surface preparation, drying time, cleanup, color designation, and instructions for mixing and reducing.
 - D. Store paint materials at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in well-ventilated area, unless required otherwise by manufacturer's instructions.
 - E. Take precautionary measures to prevent fire hazards and spontaneous combustion.
- 1.10 ENVIRONMENTAL REQUIREMENTS
- A. Do not apply materials when surface and ambient temperatures are outside the ranges required by paint manufacturer.
 - B. Provide continuous ventilation and heating facilities to maintain surface and ambient temperatures above 45 degrees F for 24 hours before, during, and 48 hours after application of finishes, unless required otherwise by manufacturer's instructions.
 - C. Do not apply exterior coatings during rain or snow, or when relative humidity is above 75 percent, unless required otherwise by manufacturer's instructions.
 - D. Minimum Application Temperatures for Latex Paints: 45 degrees F for interiors; 50 degrees F for exterior; unless required otherwise by manufacturer's instructions.
 - E. Minimum Application Temperature for Varnish and Finishes: 65 degrees F for interior or exterior, unless required otherwise by manufacturer's instructions.
 - F. Provide lighting level of 80 ft candles measured mid- height at substrate surface.
- 1.11 EXTRA STOCK
- A. Provide a 5 gallon container of each color to Owner.
 - B. Label each container with color, color number, texture, and room locations, in addition to the manufacturer's label.
 - C. Furnish under provisions of Section 017800.
- 1.12 SCAFFOLDS AND PROTECTION
- A. Provide adequate safe ladders, scaffolds, and stages necessary to complete work.
 - B. Protect completed finish and paint work, and protect adjacent finish surfaces from paint splatter, spills and stains. Use adequate drop cloths and masking procedures during progress of work.
- 1.13 PRECAUTIONS
- A. Do not store paints, oils, thinners and other flammable items inside the building and shall be stored in approved containers when not in actual use during the painting job. The fire hazard shall be kept at a minimum.
 - B. Precaution shall be taken to protect the public and construction workers during the progress of the work.
 - C. Furnish a temporary fire extinguisher of suitable chemicals and capacity, located near flammable materials.

PART 2 - PRODUCTS

- 2.1 MANUFACTURERS
- A. Acceptable Manufacturers: Subject to compliance with requirements indicated, provide products of one of the following:
 1. Sherwin-Williams.
 2. P.P.G. Industries.
 3. Behr Process Corporation (Behr).
 - B. Materials selected for coating systems for each type surface shall be product of a single manufacturer unless otherwise specified. Secondary products such as linseed oil, turpentine and shellacs shall be first quality products of a reputable manufacturer.
 - C. Products specified in Schedule are those of Glidden Professional as a standard of quality unless otherwise noted.
- 2.2 MATERIALS
- A. VOC Limits: any adhesives, sealants, paints, or coatings shall meet the VOC limits indicated in Section 018113 "Sustainable Design Requirements."
 - B. Coatings: Ready mixed. Process pigments to a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating with good flow and brushing properties; capable of drying or curing free of streaks or sags.
 - C. Accessory Materials: Linseed oil, shellac, turpentine, paint thinners and other materials not specifically indicated but required to achieve the finishes specified, of commercial quality.

- D. Patching Materials: Latex filler.
- 2.3 FINISHES
- A. Color and Sheen: As scheduled.
- 2.1 INTERIOR PAINT SCHEDULE
- A. Drywall (Gypsum):
 - 1. Acrylic Latex:
 - a. PPG Paints: 1 coat PPG Paints Speedhide Zero VOC Primer 6-4900XI, 2 coats PPG Paints Speedhide Zero VOC. Sheen as indicated.
 - b. Sherwin-Williams: 1 coat High Build Latex Primer B28W8601, 2 coats Sherwin-Williams ProMar 200 Zero VOC. Sheen as indicated.
 - c. Behr: 1 coat Behr Premium Plus Interior Drywall Primer 73, 2 coats Behr Pro i300 Interior Paint. Sheen as indicated.
 - 2. Latex:
 - a. PPG Paints: 1 coat PPG Paints Speedhide Max Prime 6-4 primer, 2 coats PPG Paints Speedhide Pro-EV Low VOC. Sheen as indicated.
 - b. Sherwin-Williams: 1 coat High Build Latex Primer B28W8601, 2 coats Sherwin-Williams ProMar 400 Zero VOC. Sheen as indicated.
 - c. Behr: 1 coat Behr Premium Plus Interior Drywall Primer 73, 2 coats Behr Pro i300 Interior Paint. Sheen as indicated.
 - B. Wood Paneling, Trim, Doors, Cabinets:
 - 1. Acrylic Latex:
 - a. PPG Paints: 1 coat Speedhide Interior Latex Sealer 6-2, 2 coats PPG Paints Speedhide Zero VOC. Sheen as indicated.
 - b. Sherwin-Williams: 1 coat Premium Wall & Wood Primer B28W8111, 2 coats Sherwin-Williams ProMar 200 Zero VOC. Sheen as indicated.
 - c. Behr: Behr Premium Plus All-In-One Primer & Sealer 75, 2 coats Behr Pro i300 Interior Paint. Sheen as indicated.
 - 2. Latex:
 - a. PPG Paints: 1 coat Speedhide Interior Latex Sealer 6-2, 2 coats PPG Paints Speedhide Pro-EV Low VOC.
 - b. Sherwin-Williams: 1 coat Premium Wall & Wood Primer B28W8111, 2 coats Sherwin-Williams ProMar 400 Zero VOC. Sheen as indicated.
 - c. Behr: Behr Premium Plus All-In-One Primer & Sealer 75, 2 coats Behr Pro i300 Interior Paint. Sheen as indicated.
 - 3. Alkyd:
 - a. PPG Paints: 1 coat Speedhide Interior Latex Sealer 6-2, 2 coats Speedhide Waterbased Satin or Semi-Gloss Alkyd 6-1410/1510.
 - b. Sherwin-Williams: 1 coat Premium Wall & Wood Primer B28W8111, 2 coats Sherwin-Williams ProMar 200 Waterbased Acrylic-Alkyd Semi-Gloss, B34-8200 Series.
 - c. Behr: Behr Premium Plus All-In-One Primer & Sealer 75, 2 coats Behr Alkyd Semi-Gloss Enamel 3900.
 - 4. Water-Based Varnish:
 - a. PPG Paints: 1 coat DEFT Interior Oil Stain DFT400, 2 coats Deft Interior Polyurethane Water Based Acrylic DFT159.
 - b. Sherwin-Williams: 1 coat Wood Classics Oil Stain A49-200 Series, 2 coats Sherwin-Williams Wood Classics Waterborne Polyurethane Varnish A68 Series.
 - c. Behr: 1 coat of Minwax Wood Finish Oil Stain 250 Formula, 2 coats Minwax Water-Based Polyurethane, Satin.
 - 5. Polyurethane Varnish:
 - a. PPG Paints: 1 coat DEFT Interior Oil Stain DFT400, 2 coats DEFT Interior Polyurethane Satin 450 DFT226.
 - b. Sherwin-Williams: 1 coat Wood Classics Oil Stain A49-200 Series, 2 coats Sherwin-Williams Wood Classics Fast Dry Oil Varnish A66-300 Series.
 - c. Behr: 1 coat Minwax Wood Finish Oil Stain 250 Formula, 2 coats Minwax Fast Drying Polyurethane, Satin.
 - C. Shop Primed Ferrous Metal:
 - 1. High Performance Coating, Water-Based Acrylic:
 - a. PPG Paints: Eggshell: 2 topcoats DEVFLEX High Performance WB Acrylic Eggshell 4212 over prepared substrate. Test for adhesion.
 - b. 2 topcoats Sherwin-Williams Pro Industrial Eg-Shel B66-660 Series.

- c. Behr: Eggshell: 1 coat Premium Plus Multi-Surface Primer & Sealer, 2 coats Premium Plus Ultra Eggshell 2750 topcoat.
- 2. Acrylic Latex
 - a. PPG Paints: 1 coat DEVFLEX Direct-to-Metal 4020 primer, 2 coats Speedhide Zero VOC Eggshell 6-4310XI.
 - b. Sherwin-Williams: 1 coat Sherwin-William Pro-Cryl Universal Primer B66-310 Series, 2 coats Sherwin-Williams ProMar 200 Zero VOC Eg-Shel B20-2600 Series.
 - c. Behr: 1 coat Behr Premium Plus Multi-Surface Primer & Sealer 436, 2 coats Behr Pro i300 Interior Eggshell 330.
- D. Machinery, Equipment and Fixtures (Shop Primed):
 - 1. High Performance Coating, Water-Based Acrylic:
 - a. PPG Paints: 2 topcoats DEVFLEX High Performance WB Acrylic 4216 Semi-Gloss over prepared substrate.
 - b. Sherwin-Williams: 2 coats Pro Industrial Acrylic Semi-Gloss B66-650 Series over prepared substrate.
 - c. Behr: 2 coats Behr Direct to Metal Semi-Gloss 3200 over prepared surface.
 - 2. High Performance Coating, Alkyd Industrial Enamel:
 - a. PPG Paints: 2 topcoats 7 Line Interior/Exterior Industrial Gloss Oil 7-282over prepared substrate.
 - b. Sherwin-Williams: 2 coats Sherwin-Williams Industrial Enamel B54 Series over prepared substrate.

2.2 EXTERIOR PAINT SCHEDULE

- A. Poured, Pre-Cast or Tilt-up Concrete, Stucco, Brick:
 - 1. 100 Percent Acrylic Latex:
 - a. PPG Paints: 1 coat Perma-Crete Int/Ext Alkali Resistant Primer 4-603
 - 1) Flat: 2 coats Speedhide Exterior 100% Acrylic Latex Flat 6-610XI topcoat.
 - 2) Satin: 2 coats Speedhide Exterior 100% Acrylic Latex Satin 6-2045XI topcoat.
 - 3) Semi-Gloss: 2 coats Speedhide Exterior 100% Acrylic Latex Semi-Gloss 6-900XI topcoat.
 - 4) Gloss: 2 coats Speedhide Int/Ext 100% Acrylic Gloss 6-8534 topcoat.
 - b. Sherwin-Williams: 1 coat Loxon Acrylic Concrete & Masonry Primer A24W8300
 - 1) Flat: 2 coats Sherwin-Williams A-100 Flat A6-100 Series topcoat.
 - 2) Satin: 2 coats of Sherwin- Williams A-100 Satin A82-100 Series topcoat.
 - 3) Gloss: 2 coats of Sherwin-Williams Solo Gloss A77W51 topcoat.
 - c. Behr: 1 coat Behr Premium Plus Multi-Surface Primer & Sealer 436
 - 1) Flat: 2 coats Behr Pro e600 Exterior Flat 610 topcoat.
 - 2) Satin: 2 coats Behr Pro e600 Exterior Satin 640 topcoat.
 - 3) Semi-Gloss: Behr Pro e600 Exterior Semi-Gloss 670 topcoat.
 - 4) Gloss: 2 coats Behr Premium Plus Hi-Gloss Enamel 8050 topcoat.
 - 2. 100 Percent Acrylic Latex:
 - a. PPG Paints: 1 coat Perma-Crete Int/Ext Alkali Resistant Primer 4-603.
 - 1) Flat: 2 coats Speed Cryl Exterior Latex Flat 56-110 topcoat.
 - 2) Satin: 2 coats Speed Cryl Exterior Latex Satin 56-410 topcoat.
 - 3) Gloss: 2 coats Ultra-Hide 150 3038 topcoat.
 - b. Sherwin-Williams: 1 coat Loxon Acrylic Concrete & Masonry Primer A24W8300
 - 1) Flat: 2 coats Sherwin-Williams DuraCraft Flat C1 Series topcoat.
 - 2) Satin: 2 coats of Sherwin- Williams DuraCraft Satin C7Series topcoat.
 - 3) Gloss: 2 coats of Sherwin-Williams Solo Gloss A77W51 topcoat.
 - c. Behr: 1 coat Behr Premium Plus Multi-Surface Primer & Sealer 436
 - 1) Flat: 2 coats Behr Pro e600 Exterior Flat 610 topcoat.
 - 2) Satin: 2 coats Behr Pro e600 Exterior Satin 640 topcoat.
 - 3) Gloss: 2 coats Behr Premium Plus Hi-Gloss Enamel 8050 topcoat.
- B. Cementitious Siding, Flexboard, Transite and Shingles:
 - 1. 100 Percent Acrylic Latex:
 - a. PPG Paints: 1 coat Perma-Crete Concrete and Stucco Primer 4-503
 - 1) Flat: 2 coats Speedhide Exterior 100% Acrylic Latex Flat 6-610XI topcoat.
 - 2) Satin: 2 coats Speedhide Exterior 100% Acrylic Latex Satin 6-2045XI topcoat.
 - 3) Semi-Gloss: 2 coats Speedhide Exterior 100% Acrylic Latex Semi-Gloss 6-900XI topcoat.
 - 4) Gloss: 2 coats Speedhide Int/Ext 100% Acrylic Gloss 6-8534 topcoat.

- b. Sherwin-Williams: 1 coat Multi-Purpose Latex Primer B51- 450 Series
 - 1) Flat: 2 coats Sherwin-Williams A-100 Flat A6-100 Series topcoat.
 - 2) Satin: 2 coats of Sherwin- Williams A-100 Satin A82-100 Series topcoat.
 - 3) Gloss: 2 coats of Sherwin-Williams Solo Gloss A77W51 topcoat.
 - c. Behr: 1 coat Behr Premium Plus Multi-Surface Primer & Sealer 436.
 - 1) Flat: 2 coats Behr Pro e600 Exterior Flat 610 topcoat.
 - 2) Satin: 2 coats Behr Pro e600 Exterior Satin 640 topcoat.
 - 3) Semi-Gloss: Behr Pro e600 Semi-Gloss 670 topcoat.
 - 4) Gloss: Behr Premium Plus Hi-Gloss Enamel 8050 topcoat.
- C. Structural Iron and Ferrous Steel (Including Tanks and Water Towers):
1. High Performance Coating, Water-Based Acrylic:
 - a. PPG Paints: Flat: 1 coat DEVFLEX Direct-to-Metal 4020 primer, 2 coats DEVFLEX Direct-to-Metal 4020 Primer/Finish topcoat.
 - b. Sherwin-Williams: 2 coats Sherwin-Williams DTM Primer/Finish B66W1.
 - c. PPG Paints: Eggshell: 1 coat DEVFLEX Direct-to-Metal 4020 primer, 2 coats DEVFLEX High Performance WB Acrylic Satin 4212 topcoat.
 - d. Sherwin-Williams: 1 coat Pro-Cryl Universal Primer B66-310 Series, 2 coats Sherwin-Williams Pro Industrial Acrylic Eg-Shel B66-660 Series.
 - e. PPG Paints: Semi-Gloss: 1 coat DEVFLEX Direct-to-Metal 4020 primer, 2 coats DEVFLEX High Performance WB Semi-Gloss Acrylic 4216 topcoat.
 - f. Sherwin-Williams: 1 coat Pro-Cryl Universal Primer B66-310 Series, 2 coats Sherwin-Williams Pro Industrial Acrylic Semi-Gloss B66-650 Series.
 - g. Behr: Semi-Gloss: 1 coat Behr Premium Plus Multi-Surface Primer & Sealer 436, 2 coats Behr Direct to Metal Semi-Gloss 3200 topcoat.
 2. 100 Percent Acrylic Latex:
 - a. PPG Paints: 1 coat DEVFLEX Direct-to-Metal 4020 primer.
 - 1) Flat: 2 coats Speedhide Exterior 100% Acrylic Latex Flat 6-610XI topcoat.
 - 2) Satin: 2 coats Speedhide Exterior 100% Acrylic Latex Satin 6-2045XI topcoat.
 - 3) Semi-Gloss: 2 coats Speedhide Exterior 100% Acrylic Latex Semi-Gloss 6-900XI topcoat.
 - 4) Gloss 2 coats Speedhide Int/Ext 100% Acrylic Gloss 6-8534 topcoat.
 - b. Sherwin-Williams: 1 coat Pro-Cryl Universal Primer B66-310 Series, 2 coats Sherwin-Williams.
 - 1) Flat: 2 coats Sherwin-Williams A-100 Flat A6-100 Series topcoat.
 - 2) Satin: 2 coats of Sherwin- Williams A-100 Satin A82-100 Series topcoat.
 - 3) Gloss: 2 coats of Sherwin-Williams Solo Gloss A77W51 topcoat.
 - c. Behr: 1 coat Behr Premium Plus Multi-Surface Primer & Sealer 436.
 - 1) Flat: 2 coats Behr Pro e600 Exterior Flat 610 topcoat.
 - 2) Satin: 2 coats Behr Pro e600 Exterior Satin 640 topcoat.
 - 3) Semi-Gloss: Behr Pro e600 Exterior Semi-Gloss 670 topcoat.
 - 4) Gloss: Behr Premium Plus Hi-Gloss Enamel 8050 topcoat.
 3. High Performance Coating, Alkyd Industrial Enamel:
 - a. PPG Paints: Gloss: 1 coat DEVGUARD Multipurpose Tank and Structural 4160 primer, 2 coats DEVGUARD Industrial Enamel 4308 topcoat.
 - b. Sherwin-Williams: 1 coat Kem Kromik Universal Metal Primer B50WZ1, 2 coats Sherwin-Williams Industrial Enamel B54 Series topcoat.
 4. Urethane High Performance Coating:
 - a. PPG Paints: 1 coat Pitt-Guard Direct-To-Rust Epoxy Mastic Coatings 97-145, 2 coats Pitthane High Build Semi Gloss Urethane Enamel 95-8800.
 - b. Sherwin-Williams: 1 coat Macropoxy 646 Fast Cure Epoxy B58-600 Series, 2 coats Sherwin-Williams Acrolon 218 HS Acrylic Polyurethane B65-650 topcoat.
 - c. Behr: 1 coat US Coatings EpoxyGrip 2000 Epoxy Mastic, 2 coats US Coatings UreGrip 3300 High Build Aliphatic Urethane Semi-Gloss topcoat.
- D. Shop Primed Metal Doors, Trim, Panels and Miscellaneous Surfaces:
1. High Performance Coating, Urethane:
 - a. PPG Paints: Gloss: 1 coat Pitt-Guard Direct-To-Rust Epoxy Mastic Coatings 97-145, 2 coats Pitthane Ultra Gloss Urethane 95 Series.
 - b. Sherwin-Williams: 1 coat Macropoxy 646 Fast Cure Epoxy B58-600 Series, 2 coats Acrolon 218 HS Acrylic Polyurethane B65-650 topcoat.
 - c. Behr: 1 coat US Coatings EpoxyGrip 2000 Epoxy Mastic, 2 coats US Coatings UreGrip 3000 Aliphatic Acrylic Urethane Gloss topcoat.
 2. High Performance Coating, Water-Based Acrylic:

- a. PPG Paints: Eggshell: 2 topcoats DEVFLEX High Performance WB Satin Acrylic 4212 over prepared substrate.
- b. Sherwin-Williams: Eg-Shel: 2 coats Sherwin-Williams Pro Industrial Acrylic Eg-Shel B66-660 Series over prepared substrate.
- c. PPG Paints: Semi-Gloss: 2 topcoats DEVFLEX High Performance WB Semi-Gloss Acrylic 4216 over prepared substrate.
- d. Sherwin-Williams: Semi-Gloss: 2 coats Sherwin-Williams Pro Industrial Acrylic Semi-Gloss B66-650 Series over prepared substrate.
- e. Behr: Semi-Gloss: 2 coats Behr Direct To Metal Semi-Gloss 3200 over prepared substrate.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that surfaces and substrate conditions are ready to receive work as instructed by the product manufacturer.
- B. Examine surfaces scheduled to be finished prior to commencement of work. Report to Architect any condition that may potentially affect proper application.
- C. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums
 1. Plaster and Gypsum Wallboard: 12 percent.
 2. Masonry, Concrete, and Concrete Unit Masonry: 12 percent.
 3. Interior Located Wood: 15 percent, measured in accordance with ASTM D2016.
 4. Exterior Located Wood: 15 percent, measured in accordance with ASTM D2016.
 5. Concrete Floors: 8 percent.
- D. Test shop applied primers for compatibility with subsequent cover materials.
- E. Beginning of installation means acceptance of existing surfaces and substrate.

3.2 PREPARATION

- A. Remove electrical plates, hardware, light fixture trim, and fittings prior to preparing surfaces or finishing.
- B. Correct minor defects and clean surfaces which affect work of this Section. Remove existing coatings which exhibit loose surface defects.
- C. Shellac and seal marks which may bleed through surface finishes.
- D. Impervious Surfaces: Remove mildew by scrubbing with solution of tri-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.
- E. Aluminum Surfaces Scheduled for Paint Finish: Remove surface contamination by steam or high pressure water. Remove oxidation with acid etch and solvent washing. Apply etching primer immediately following cleaning.
- F. Insulated Coverings: Remove dirt, grease, and oil from canvas and cotton.
- G. Concrete Floors: Remove contamination, acid etch, and rinse floors with clear water. Verify required acid-alkali balance is achieved. Allow to dry.
- H. Gypsum Board Surfaces: Latex fill minor defects. Spot prime defects after repair.
- I. Galvanized Surfaces: Remove surface contamination and oils and wash with solvent. Apply coat of etching primer.
- J. Concrete and Unit Masonry Surfaces Scheduled to Receive Paint Finish: Remove dirt, loose mortar, scale, salt or alkali powder, and other foreign matter. Remove oil and grease with a solution of tri-sodium phosphate; rinse well and allow to dry. Remove stains caused by weathering of corroding metals with a solution of sodium metasilicate after thoroughly wetting with water. Allow to dry.
- K. Plaster Surfaces: Fill hairline cracks, small holes, and imperfections with latex patching plaster. Make smooth and flush with adjacent surfaces. Wash and neutralize high alkali surfaces.
- L. Uncoated Steel and Iron Surfaces: Remove grease, scale, dirt, and rust. Where heavy coatings of scale are evident, remove by wire brushing or sandblasting; clean by washing with solvent. Apply a treatment of phosphoric acid solution, ensuring weld joints, bolts, and nuts are similarly cleaned. Spot prime paint after repairs.
- M. Shop Primed Steel Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces.
- N. Aluminum with Alodine Finish: Clean by lightly scuff with sandpaper. Remove all dust.
- O. Interior Wood Items Scheduled to Receive Paint Finish: Wipe off dust and grit prior to priming. Seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after primer has dried; sand between coats.
- P. Interior Wood Items Schedule to Receive Transparent Finish: Wipe off dust and grit prior to sealing, seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after sealer has dried; sand lightly between coats.

- Q. Exterior Wood Scheduled to receive Paint Finish: Remove dust, grit, and foreign matter. Seal knots, pitch streaks, and sappy sections. Fill nail holes with tinted exterior caulking compound after prime coat has been applied.
- R. Exterior Wood Scheduled to Receive Transparent Finish: Remove dust, grit, and foreign matter; seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes with tinted exterior caulking compound after sealer has been applied.
- S. Shop Finished Items: Finish in accordance with AWI standards and guide lines.
- T. Glue-Laminated Beams: Prior to finishing, wash surfaces with solvent, remove grease and dirt.
- U. Wood and Metal Doors Scheduled for Painting: Seal top and bottom edges with primer.

3.3 SURFACE PREPARATION OF PREVIOUSLY COATED SURFACES

- A. General:
 1. Remove cracked and deteriorated sealants and calking.
 2. Remove chalk deposits and loose, blistered, peeling, scaling, or crazed finish to bare base material or sound substrate by scraping and sanding.
 3. Wash surfaces with solution of TSP to remove wax, oil, grease, and other foreign material; rinse, and allow to dry. Exercise caution that TSP solution does not soften existing coating.
 4. Abrade glossy surfaces by sanding or wiping with liquid de-glosser.
 5. Remove mildew as specified above.
 6. Test compatibility of existing coatings by applying new coating to small, inconspicuous area. If new coatings lift or blister existing coatings, request recommendation from Architect.
 7. Apply specified primer to surfaces scheduled to receive coatings.
- B. Gypsum Wallboard:
 1. Fill cracks and voids with spackling compound.
 2. Apply primer over bare surfaces and newly applied texture coatings.
- C. Metal:
 1. Remove rust from surfaces to bare metal in accordance with SP3 "Power Tool Cleaning".
 2. Exercise care not to remove galvanizing.
 3. Complete preparation as specified for new work.
- D. Wood:
 1. Fill cracks, crevices and nail holes with putty or wood filler.
 2. Apply primer over bare surfaces and filler material.

3.4 PROTECTION

- A. Protect elements surrounding the work of this Section from damage or disfiguration.
- B. Repair damage to other surfaces caused by work of this Section.
- C. Furnish drop cloths, shields, and protective methods to prevent spray or droppings from disfiguring other surfaces.
- D. Remove empty paint containers from site.

3.5 APPLICATION

- A. The intent of these Specifications is to produce the highest quality appearance of paint and finish surfaces. Employ skilled mechanics only. The proper preparation of all surfaces will be strictly enforced and wherever finished surfaces show any defects due to improper preparation, workmanship, etc., the defects shall be removed and the work refinished at the expense of the Contractor.
- B. Apply products in accordance with manufacturer's instructions. Final finish coats shall have visual evidence of solid hiding and uniform appearance, and shall be free and smooth of brush marks, streaks, sags, runs, laps, or skipped areas.
- C. Do not apply finishes to surfaces that are not dry.
- D. Apply each coat to uniform finish and thickness.
- E. Apply each coat of paint slightly darker than preceding coat unless otherwise approved.
- F. Sand lightly between coats on wood and metal items to achieve required finish.
- G. Allow applied coat to dry before next coat is applied.
- H. Where clear finishes are required, tint fillers to match wood. Work fillers into the grain before set. Wipe excess from surface.
- I. Prime back surfaces of interior and exterior woodwork scheduled to be painted with primer paint.
- J. Prime back surfaces of interior woodwork scheduled to receive stain or varnish finish with gloss varnish reduced 25 percent with mineral spirits.
- K. Edges of paint adjoining other materials or colors shall be sharp and clean with no overlapping.

3.6 FINISHING MECHANICAL AND ELECTRICAL EQUIPMENT

- A. Paint all shop primed equipment. Paint shop prefinished items where exposed to view in finished spaces. In mechanical rooms, repair shop pre-finished coatings which have been scratched or otherwise damaged with identical touch-up paint. Sand prior to touching up as required.
- B. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.
- C. Paint all grilles, registers, diffusers, and speaker grilles to match adjacent wall and ceiling surfaces, except that factory pre-finished items need not be painted if installed in a suspended acoustical ceiling system where the acoustical panels match the mechanical or electrical item color.
- D. In all finished spaces, prime and paint exposed pipes, conduit, boxes, ducts, hangers, brackets, collars and supports. Paint to match adjacent surfaces.
- E. Repair or replace identification markings on mechanical or electrical equipment when painted accidentally.
- F. Paint interior surfaces of air ducts and convectors that are visible through grilles and louvers with one coat of flat black paint, to limit of sight line. Paint dampers exposed behind louvers, grilles, and convector to match face panels.
- G. Paint all surfaces of plywood backboards for electrical and telephone equipment before installing equipment.
- H. Replace electrical plates, hardware, light fixture trim, and fittings removed prior to finishing.
- I. Paint exposed air handlers, roof ventilators, goose necks, exhaust fans and other items on the roof with 2 coats exterior enamel. Prepare surfaces in accordance with the base metal or primer as specified herein.
- J. Paint concrete support bases with gray floor deck enamel.
- K. Pipe hangers and other supports need not be painted except where installed in crawl spaces, where they shall be painted with a thick coat of asphaltic paint.

3.7 CLEANING/TOUCH-UP

- A. As Work proceeds, promptly remove paint where spilled, splashed, or spattered.
- B. During progress of Work maintain premises free of unnecessary accumulation of tools, equipment, surplus materials, and debris.
- C. Collect cotton waste, cloths, and material which may constitute a fire hazard, place in closed metal containers and remove daily from site.
- D. Spot painting will be allowed to correct soiled or damaged paint surfaces only when touch-up spot will blend into surrounding finish and is invisible to normal viewing (as determined by the Architect). Otherwise, re-coat entire section to corners or to a visible stopping point.

3.8 V.O.C. (VOLATILE ORGANIC COMPOUND) COMPLIANCE

- A. Products listed in following schedule and/or substitutes proposed for use by Contractor must be formulated to meet all applicable ordinances and regulations regarding maximum V.O.C. content. Utilize products which have been specially formulated to meet such requirements.

END OF SECTION

SECTION 101400**SIGNAGE****PART 1 - GENERAL**

1.1 SUMMARY

- A. Related Documents: Provisions established in Conditions of the Contract, Division 01 - General Requirements, and the Drawings are collectively applicable to this Section.
- B. Section Includes
 - 1. Identifying devices where shown on the Drawings complete and as specified including the following:
 - a. Parking signs indicating accessible spaces.
 - b. Directional and traffic signs.
 - c. Pin mounted building identification signs.
 - d. Interior code required signs.
 - 2. Coordination for installation of signage provided by others.

1.2 SUBMITTALS

- A. Product Data: Include manufacturer's construction details relative to materials, dimensions of individual components, profiles, and finishes for each type of sign required.
- B. Shop Drawings: Provide shop drawings for fabrication and erection of signs. Include plans, elevations, and large-scale sections of typical members and other components. Show anchors, accessories, layout, and installation details.
- C. Samples for Verification:
 - 1. Physical: Submit samples of one completed sign for review and approval. Approved sample may be incorporated into Project.
 - 2. Color: Submit manufacturer's standard color selection chart. Do not proceed until colors have been selected.

1.3 QUALITY ASSURANCE

- A. Single-Source Responsibility: For each separate type of sign required, obtain signs from one source from a single manufacturer.
- B. Manufacturer shall have a minimum of five years experience in the manufacturing of signs specified.
- C. Codes and Standards:
 - 1. Panel signs shall have 1/32-inch raised copy and grade 2 Braille, and shall comply with all existing federal, state, and local accessibility standards.
 - 2. Code and Standards: Comply with American with Disabilities Act of 1990, Title 3 Provisions, Public Accommodations and Commercial Facilities. Updated March 15, 2012.
 - 3. Comply with the State of Texas Accessibility Standards, 2012 edition, as administered by the Texas Department of Licensing and Regulation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis-of-Design: Subject to compliance with requirements, provide products as indicated on Drawings, or comparable products by one of the following:
 - 1. Best Manufacturing Company, Montrose, Colorado.
 - 2. Mohawk Sign Systems, Schenectady, New York.
 - 3. Nelson-Harkins, Chicago, Illinois.
 - 4. ASI Signs, Dallas, Texas.
- B. For substitution request, refer to Section "012500 – Substitution Procedures".

2.2 HANDICAPPED PARKING

- A. Screen Printed Signs:
 - 1. 18 gauge bonderized steel with blue baked enamel finish and white screen printed copy.
 - 2. Copy and Size:
 - a. "Handicapped Parking Only" - 12 inches by 18 inches.
 - 3. Acceptable Product: Best Traffic Signs No. SS04 with SS52 as required.
- B. Post: Galvanized pipe column as indicated.

2.3 DIRECTIONAL SIGNS

- A. Screen Printed Signs:
1. Extruded aluminum panels with anodic finish and white screen printed copy.
 2. Size and Configuration: As indicated on Drawings.
 3. Copy: As indicated on Drawings.
 4. Acceptable Product: Best Post and Plank as detailed on Drawings.

2.4 BUILDING IDENTIFICATION SIGNAGE

- A. Basis-of-Design: Subject to compliance with requirements, provide products as indicated on Drawings, or comparable products by the following:
1. ASI Sign Systems, 3890 W. Northwest Highway, Suite 102, Dallas, TX 75220; (214) 352 9140 telephone; (214) 352 9741 facsimile; (800) ASI-SPEC (274-7446).
 2. For substitution request, refer to Section "012500 – Substitution Procedures".
- B. Material:
1. As indicated.
- C. Fabricated Letters:
1. Letter Style: Refer to Drawings.
 2. Letter Cap Height: Refer to Drawings.
 3. Letter Depth: 1 inch.
- D. Mounting Method: Projected Mount.

PART 3 - EXECUTION**3.1 DELIVERY AND STORAGE**

- A. Deliver and store identifying devices in protective wrappings until ready for installation. Install letters in protective wrappings and remove wrappings just prior to substantial completion.

3.2 INSTALLATION

- A. Install signs plumb, level and square and in proper planes with other work, at heights required by accessibility codes and standards.
- B. Anchor each plastic laminate sign with adhesive.
- C. Install signs with sufficient amount of foam tape for proper installation.
- D. Attach as recommended by sign manufacturer.
- E. Anchor each sign with adhesive.
- F. Coordinate arrival and installation of graphic signs with hardware installation. Graphic signs function as and are coordinated with the hardware as shown on the Drawings.
- G. Room name signs shall be placed on the public side of the door except where noted otherwise.
- H. Single Door Sign: Provide one sign as specified above, mounted to wall adjacent to door on knob side.
- I. Pair of Doors: Provide one sign as specified above, mounted to adjacent wall closest to active leaf of door. Do not install sign where it will be obstructed by door when door is in the 'open' position.
- J. Attachment: Mounting to surfaces shall be done by pressure sensitive frame double-faced tape. Signs shall be delivered to the project site with the tape in place and trimmed on each sign, but with the protective paper layer not removed. Paper layer shall be removed just prior to installation of signs.

3.3 EXTERIOR INSTALLATION - PARKING AND DIRECTIONAL SIGNS

- A. Mount posts as indicated on Drawings.
- B. Handicapped Signs: Mount signs at height to comply with accessibility codes.

3.4 COORDINATION

- A. Coordinate the installation of the identifying devices with the hardware manufacturer for lockset and knob leave outs as detailed and scheduled.

3.5 DAMAGE

- A. Any identifying device which is scratched or defaced will be rejected.

3.6 CLEANING

- A. Remove protective materials and clean all signs. Clean surfaces with plain water or water with soap or household detergent.

END OF SECTION

SECTION 102600
WALL AND DOOR PROTECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
1. Bumper rails.
 2. Corner guards.
 3. Protective wall coverings.

1.3 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide handrails capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
1. Uniform load of 50 lbf/ft. applied in any direction.
 2. Concentrated load of 200 lbf applied in any direction.
 3. Uniform and concentrated loads need not be assumed to act concurrently.

1.4 SUBMITTALS

- A. Product Data: Include construction details, material descriptions, impact strength, dimensions of individual components and profiles, and finishes for each impact-resistant wall protection unit.
- B. Shop Drawings: For each impact-resistant wall protection unit showing locations and extent. Include 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.
- C. Samples for Initial Selection: For each type of impact-resistant wall protection unit indicated.
- D. Material Certificates: For each impact-resistant plastic material, from manufacturer.
- E. Warranty: Sample of special warranty.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An employer of workers trained and approved by manufacturer.
- B. Source Limitations: Obtain impact-resistant wall protection units from single source from single manufacturer.
- C. Product Options: Drawings indicate size, profiles, and dimensional requirements of impact-resistant wall protection units and are based on the specific system indicated. Refer to Division 01 Section "Quality Requirements."
1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.
- D. Surface-Burning Characteristics: Provide impact-resistant, plastic wall protection units with surface-burning characteristics as determined by testing identical products per ASTM E 84, NFPA 255, or UL 723 by UL or another qualified testing agency.
- E. Regulatory Requirements:
1. Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines.
 2. State of Texas, Texas Accessibility Standards, 2012 edition.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store impact-resistant wall protection units in original undamaged packages and containers inside well-ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity.
1. Maintain room temperature within storage area at not less than 70 deg F during the period plastic materials are stored.
 2. Keep plastic sheet material out of direct sunlight.
 3. Store plastic wall protection components for a minimum of 72 hours, or until plastic material attains a minimum room temperature of 70 deg F.
 - a. Store corner-guard covers in a vertical position.

- b. Store other devices in a horizontal position.

1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install impact-resistant wall protection units until building is enclosed and weatherproof, wet work is complete and dry, and HVAC system is operating and maintaining temperature at 70 deg F for not less than 72 hours before beginning installation and for the remainder of the construction period.

1.8 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of impact-resistant wall protection units that fail in materials or workmanship within specified warranty period.
 1. Failures include, but are not limited to, the following:
 - a. Structural failures.
 - b. Deterioration of plastic and other materials beyond normal use.
 2. Warranty Period: Five years from date of Substantial Completion.

1.9 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. Corner-Guard Covers: Full-size plastic covers of maximum length equal to 3 percent of each type, color, and texture of units installed, but no fewer than two, 4-foot- long units.
- B. Include mounting and accessory components. Replacement materials shall be from same production run as installed units.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Stainless-Steel Sheet: ASTM A 240.
- B. Particleboard: ANSI A208.1, Grade M-2; made with binder containing no urea formaldehyde.
- C. Fasteners: Aluminum, nonmagnetic stainless-steel, or other non-corrosive metal screws, bolts, and other fasteners compatible with items being fastened. Use security-type fasteners where exposed to view.
- D. Adhesive: As recommended by impact-resistant plastic wall protection manufacturer and with a VOC content of 70 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.2 WALL GUARDS

- A. Bumper Rail: Heavy-duty assembly consisting of continuous snap-on plastic cover installed over concealed retainer system; designed to withstand impacts.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Balco, Inc.
 - b. Construction Specialties, Inc.
 - c. IPC Door and Wall Protection Systems; Division of InPro Corporation.
 - d. Korogard Wall Protection Systems; a division of RJF International Corporation.
 - e. Pawling Corporation.
 2. Cover: Extruded rigid plastic, minimum 0.100-inch wall thickness; as follows:
 - a. Profile Refer to Finish Schedule.
 - b. Color and Texture: Refer to Finish Schedule.
 3. Retainer Clips: Manufacturer's standard impact-absorbing clips designed for heavy-duty performance.
 4. Bumper: Continuous rubber or vinyl bumper cushion(s).
 5. End Caps and Corners: Prefabricated, injection-molded plastic; matching color; field adjustable for close alignment with snap-on cover.
 6. Accessories: Concealed splices and mounting hardware.
 7. Mounting: Extended mounting on injection-molded plastic mounting brackets.

2.3 CORNER AND WALL GUARDS

- A. Surface-Mounted, Metal Guards: Fabricated from one-piece, formed or extruded metal with formed edges; with 90- or 135-degree turn to match wall condition.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Arden Architectural Specialties, Inc.
 - b. Balco, Inc.

- c. Construction Specialties, Inc.
- d. IPC Door and Wall Protection Systems; Division of InPro Corporation.
- e. Korogard Wall Protection Systems; a division of RJF International Corporation.
- f. Pawling Corporation.
- 2. Material: Stainless steel, Type 304.
 - a. Thickness: Minimum 0.0500 inch.
 - b. Finish: As indicated on Drawings.
- 3. Wing Size: Refer to Finish Legend.
- 4. Corner Radius: 1/8 inch.
- 5. Mounting: Flat-head, countersunk screws through factory-drilled mounting holes.

2.4 IMPACT-RESISTANT WALL COVERINGS

- A. Impact-Resistant Sheet Wall Covering: Fabricated from plastic sheet wall-covering material.
 - 1. Basis-of-Design: Subject to compliance with requirements, provide products as scheduled on Drawings, or comparable products by one of the following:
 - a. Arden Architectural Specialties, Inc.
 - b. Balco, Inc.
 - c. Construction Specialties, Inc.
 - d. IPC Door and Wall Protection Systems; Division of InPro Corporation.
 - e. Korogard Wall Protection Systems; a division of RJF International Corporation.
 - f. Pawling Corporation.
 - g. For substitution request, refer to Section "012500 – Substitution Procedures".
 - 2. Size: Per product designations.
 - 3. Sheet Thickness: 0.060 inch.
 - 4. Color and Texture: Refer to Finish Schedule.
 - 5. Height: As indicated.
 - 6. Trim and Joint Moldings: Extruded rigid plastic that matches sheet wall covering color.
 - 7. Mounting: Adhesive.

2.5 FABRICATION

- A. Fabricate impact-resistant wall protection units to comply with requirements indicated for design, dimensions, and member sizes, including thicknesses of components.
- B. Assemble components in factory to greatest extent possible to minimize field assembly. Disassemble only as necessary for shipping and handling.
- C. Fabricate components with tight seams and joints with exposed edges rolled. Provide surfaces free of wrinkles, chips, dents, uneven coloration, and other imperfections. Fabricate members and fittings to produce flush, smooth, and rigid hairline joints.
- D. Miter corners and ends of wood handrails for returns.

2.6 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 finish, free of cross scratches.
 - 3. Run grain of directional finishes with long dimension of each piece.
 - 4. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.
- B. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and wall areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.
- B. Examine walls to which impact-resistant wall protection will be attached for blocking, grounds, and other solid backing that have been installed in the locations required for secure attachment of support fasteners.
 - 1. For impact-resistant wall protection units attached with adhesive or foam tape, verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Complete finishing operations, including painting, before installing impact-resistant wall protection system components.
 - B. Before installation, clean substrate to remove dust, debris, and loose particles.
- 3.3 INSTALLATION
- A. General: Install impact-resistant wall protection units level, plumb, and true to line without distortions. Do not use materials with chips, cracks, voids, stains, or other defects that might be visible in the finished Work.
 - 1. Install impact-resistant wall protection units in locations and at mounting heights indicated on Drawings.
 - 2. Provide splices, mounting hardware, anchors, and other accessories required for a complete installation.
 - a. Provide anchoring devices to withstand imposed loads.
 - b. Where splices occur in horizontal runs of more than 20 feet, splice aluminum retainers and plastic covers at different locations along the run, but no closer than 12 inches.
 - c. Adjust end and top caps as required to ensure tight seams.
 - B. Impact-Resistant Wall Covering: Install top and edge moldings, corners, and divider bars as required for a complete installation.
- 3.4 CLEANING
- A. Immediately after completion of installation, clean plastic covers and accessories using a standard, ammonia-based, household cleaning agent.
 - B. Remove excess adhesive using methods and materials recommended in writing by manufacturer.

END OF SECTION

SECTION 102800
TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Private-use bathroom accessories.
 - 2. Childcare accessories.
 - 3. Underlavatory guards.
 - 4. Custodial accessories.

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, sizes, and installation locations by room of each accessory required.
 - 1. Identify locations using room designations indicated.
 - 2. Identify products using designations indicated.

1.4 QUALITY ASSURANCE

- A. Source Limitations: For products listed together in the same Part 2 articles, obtain products from single source from single manufacturer.

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.

1.6 WARRANTY

- A. Special Mirror Warranty: Manufacturer's standard form in which manufacturer agrees to replace mirrors that develop visible silver spoilage defects and that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: 15 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Stainless Steel: ASTM A 666, Type 304, 0.031-inch minimum nominal thickness unless otherwise indicated.
- B. Steel Sheet: ASTM A 1008/, Designation CS (cold rolled, commercial steel), 0.036-inch minimum nominal thickness.
- C. Galvanized-Steel Sheet: ASTM A 653, with G60 hot-dip zinc coating.
- D. Galvanized-Steel Mounting Devices: ASTM A 153, hot-dip galvanized after fabrication.
- E. 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.
- F. Chrome Plating: ASTM B 456, Service Condition Number SC 2 (moderate service).

2.2 PRIVATE-USE BATHROOM ACCESSORIES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Bobrick Washroom Equipment, Inc.
 2. Franklin Brass by Liberty Hardware Manufacturing Corporation; a Masco company.
 3. GAMCO Specialty Accessories; a division of Bobrick Washroom Equipment, Inc.
 4. Tubular Specialties Manufacturing, Inc.
- B. Accessories: Refer to accessory schedule on Drawings].

2.3 CHILDCARE ACCESSORIES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. American Specialties, Inc.
 2. Brocar Products, Inc.
 3. GAMCO Specialty Accessories; a division of Bobrick Washroom Equipment, Inc.
 4. Koala Kare Products; a division of Bobrick Washroom Equipment, Inc.
 5. Tubular Specialties Manufacturing, Inc.
- B. Accessories: Refer to accessory schedule on Drawings].
- C. Diaper-Changing Station:
 1. Description: Unit that opens by folding down from stored position and with child-protection strap.
 - a. Engineered to support a minimum of 250-lb static load when opened.
 2. Mounting: Surface mounted, with unit projecting not more than 4 inches from wall when closed.
 3. Operation: By pneumatic shock-absorbing mechanism.
 4. Material and Finish: Stainless steel, No. 4 finish (satin), with replaceable insulated polystyrene tray liner and rounded plastic corners.

2.4 UNDERLAVATORY GUARDS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 1. Plumberex Specialty Products, Inc.
 2. Truebro by IPS Corporation.
- B. Underlavatory Guard:
 1. Material and Finish: Stainless steel, No. 4 finish (satin)

2.5 CUSTODIAL ACCESSORIES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. American Specialties, Inc.
 2. Bobrick Washroom Equipment, Inc.
 3. Bradley Corporation.
 4. GAMCO Specialty Accessories; a division of Bobrick Washroom Equipment, Inc.
- B. Accessories: Refer to accessory schedule on Drawings.

2.6 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 re-supplying. Provide minimum of six keys to Owner's representative.

PART 3 - EXECUTION**3.1 INSTALLATION**

- A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.
- B. Grab Bars and Baby Changing Stations: Install to withstand a downward load of at least 250 lbf, when tested according to ASTM F 446.

3.2 ADJUSTING AND CLEANING

- A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.
- B. Remove temporary labels and protective coatings.
- C. Clean and polish exposed surfaces according to manufacturer's written recommendations.

END OF SECTION

SECTION 104413
FIRE PROTECTION CABINETS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
1. Fire protection cabinets for the following:
 - a. Portable fire extinguishers.

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 fire protection cabinets.
1. 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.
 2. Show location of knockouts for hose valves.
- B. Shop Drawings: For fire protection cabinets. Include plans, elevations, sections, details, and attachments to other work.
- C. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below:
1. Size: 6 by 6 inches square.

1.4 QUALITY ASSURANCE

- A. Fire-Rated, Fire Protection Cabinets: Listed and labeled to comply with requirements in ASTM E 814 for fire-resistance rating of walls where they are installed.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.5 COORDINATION

- A. Coordinate size of fire protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.
- B. Coordinate size of fire protection cabinets to ensure that type and capacity of fire hoses, hose valves, and hose racks indicated are accommodated.
- C. Coordinate sizes and locations of fire protection cabinets with wall depths.

1.6 SEQUENCING

- A. Apply vinyl lettering on field-painted, fire protection cabinets after painting is complete.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B.
- B. Aluminum: Alloy and temper recommended by aluminum producer and manufacturer for type of use and finish indicated, and as follows:
1. Sheet: ASTM B 209.
- C. Stainless-Steel Sheet: ASTM A 666, Type 304.
- D. Tempered Float Glass: ASTM C 1048, Kind FT, Condition A, Type I, Quality q3, 3 mm thick, Class 1 (clear).

2.2 FIRE EXTINGUISHER CABINET

- A. Cabinet Type: Suitable for fire extinguisher.
1. Manufacturer: Subject to compliance with requirements, provide products by one of the following:
 - a. J. L. Industries, Inc., a division of Activar Construction Products Group.
 - b. Larsen's Manufacturing Company.

- c. Potter Roemer LLC.
 - 2. Basis of Design: Larsen's Cabinet Architectural Series, 2409-R7
- B. Cabinet Construction: Non-rated in non-rated walls; 1-or- 2-hour fire rated in rated walls to match rating of wall.
 - 1. Fire-Rated Cabinets: 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. Provide factory-drilled mounting holes.
- C. Cabinet Material: Steel sheet.
 - 1. Shelf: Same metal and finish as cabinet.
- D. Semi-recessed Cabinet: Cabinet box partially recessed in walls of sufficient depth to suit style of trim indicated; with one-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend). Provide where walls are of insufficient depth for recessed cabinets but are of sufficient depth to accommodate semi-recessed cabinet installation.
 - 1. Rolled-Edge Trim: 2-1/2-inch backbend depth.
- E. Cabinet Trim Material: Stainless-steel sheet.
- F. Door Material: Stainless-steel sheet.
- G. Door Style: Manufacturer standard door style.
- H. Door Glazing: Tempered float glass (clear).
- I. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.
 - 1. Provide projecting lever handle with cam-action latch.
 - 2. Provide continuous hinge, of same material and finish as trim, permitting door to open 180 degrees.
- 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] [as directed by Architect] [Insert location].
 - a. Identify fire extinguisher in fire protection cabinet with the words "FIRE EXTINGUISHER."
 - 1) Location: Applied to cabinet door.
 - 2) Application Process: Decals.
 - 3) Lettering Color: Black.
 - 4) Orientation: Vertical.
- K. Finishes:
 - 1. Exterior of cabinet, door, and trim except for those surfaces indicated to receive another finish:
 - a. No. 4 stainless steel.
 - 2. Interior of cabinet and door: Baked enamel.

2.3 FABRICATION

- A. Fire Protection Cabinets: Provide manufacturer's standard box (tub) with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated.
 - 1. Weld joints and grind smooth.
 - 2. Provide factory-drilled mounting holes.
 - 3. Prepare doors and frames to receive locks.
 - 4. Install door locks at factory.
- B. Cabinet Doors: Fabricate doors according to manufacturer's standards, from materials indicated and coordinated with cabinet types and trim styles 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.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine roughing-in for cabinets to verify actual locations of piping connections before cabinet installation.
- B. Examine walls and partitions for suitable framing depth and blocking where [semi-recessed] [and] [recessed] cabinets will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prepare recesses for semi-recessed fire protection cabinets as required by type and size of cabinet and trim style.

3.3 INSTALLATION

- A. General: Install fire protection cabinets in locations and at mounting heights indicated or, if not indicated, at heights acceptable to authorities having jurisdiction.
 - 1. Fire Protection Cabinets: Mount such that top of fire extinguisher inside is not more than 48 inches above finished floor.
- B. Fire Protection Cabinets: Fasten 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 semi-recessed fire protection cabinets.
 - 2. Provide inside latch and lock for break-glass panels.
 - 3. Fasten mounting brackets to inside surface of fire protection cabinets, square and plumb.
 - 4. 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 Division 07 Section "Penetration Firestopping."
- C. Identification: Apply vinyl lettering at locations indicated.

3.4 ADJUSTING AND CLEANING

- A. Remove temporary protective coverings and strippable films, if any, as fire protection cabinets are installed unless otherwise indicated in manufacturer's written installation instructions.
- B. Adjust fire protection cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.
- C. On completion of fire protection cabinet installation, clean interior and exterior surfaces as recommended by manufacturer.
- D. Touch up marred finishes, or replace fire protection cabinets that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by fire protection cabinet and mounting bracket manufacturers.
- E. Replace fire protection cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

**SECTION 104416
FIRE EXTINGUISHERS**

PART 1 - GENERAL

- 1.1 RELATED DOCUMENTS
- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- 1.2 SUMMARY
- A. Section includes portable, hand-carried fire extinguishers and mounting brackets for fire extinguishers.
- 1.3 SUBMITTALS
- A. Product Data: For each type of product indicated. Include rating and classification, material descriptions, dimensions of individual components and profiles, and finishes for fire extinguisher and mounting brackets.
- B. Warranty: Sample of special warranty.
- 1.4 QUALITY ASSURANCE
- A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."
- B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.
1. Provide fire extinguishers approved, listed, and labeled by FMG.
- 1.5 COORDINATION
- A. Coordinate type and capacity of fire extinguishers with fire protection cabinets to ensure fit and function.
- 1.6 WARRANTY
- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace fire extinguishers that fail in materials or workmanship within specified warranty period.
1. Failures include, but are not limited to, the following:
 2. Failure of hydrostatic test according to NFPA 10.
 - a. Faulty operation of valves or release levers.
 3. Warranty Period: Six years from date of Substantial Completion.

PART 2 - PRODUCTS

- 2.1 PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS (Drawing Designation FE)
- A. Fire Extinguishers: Type, size, and capacity for each mounting bracket indicated.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. J. L. Industries, Inc.; a division of Activar Construction Products Group.
 - b. Larsen's Manufacturing Company.
 - c. Potter Roemer LLC.
 2. Valves: Manufacturer's standard.
 3. Handles and Levers: Manufacturer's standard.
 4. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B and bar coding for documenting fire extinguisher location, inspections, maintenance, and recharging.
- 2.2 MOUNTING BRACKETS
- A. Location: For all extinguishers not placed in fire extinguisher cabinet, provide mounting bracket.
- B. Mounting Brackets: Manufacturer's standard galvanized steel, designed to secure fire extinguisher to wall or structure, of sizes required for types and capacities of fire extinguishers indicated, with plated or red baked-enamel finish.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. J. L. Industries, Inc.; a division of Activar Construction Products Group.
 - b. Larsen's Manufacturing Company.
 - c. Potter Roemer LLC.
- C. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location.

1. Identify bracket-mounted fire extinguishers with the words "FIRE EXTINGUISHER" in red letter decals applied to mounting surface.
 - a. Orientation: Vertical.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine fire extinguishers for proper charging and tagging.
 1. Remove and replace damaged, defective, or undercharged fire extinguishers.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Install fire extinguishers and mounting brackets in locations indicated and in compliance with requirements of authorities having jurisdiction.
- B. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated.

END OF SECTION

SECTION 109900
MISCELLANEOUS SPECIALTIES

PART 1 - GENERAL

- 1.1 RELATED DOCUMENTS
 - A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- 1.2 SUMMARY
 - A. Section Includes:
 - 1. Miscellaneous specialty items as listed herein.
- 1.3 ACTION SUBMITTALS
 - A. Product Data: Including all pertinent performance characteristics and criteria.
 - B. Shop Drawings: Indicate materials, construction, sizes, quantities, finishes, and installation details.
- 1.4 INFORMATIONAL SUBMITTALS
 - A. Manufacturer's Instructions: For installation, maintenance, and repair.

PART 2 - PRODUCTS

- 2.1 PRODUCTS
 - A. Fire Control Key Box: Provide fire department key control box complete with alarm tamper switch at location near main entrance to be determined.
 - 1. Acceptable Product: Model 3200 by Knox Box.

PART 3 - EXECUTION

- 3.1 EXAMINATION
 - A. Verify that surfaces and conditions are ready to receive work of this Section.
 - B. Notify Architect of any existing conditions which will adversely affect execution.
 - C. Beginning of execution will constitute acceptance of existing conditions.
- 3.2 PREPARATION
 - A. Prepare substrate surfaces as recommended by manufacturer.
- 3.3 INSTALLATION
 - A. Install using skilled workers in accordance with manufacturer's published instructions and recommendations.
- 3.4 ADJUSTING
 - A. Adjust and fit items to be flush with adjacent construction.
 - B. Fasten or adhere for tight connections and joints.

END OF SECTION

SECTION 123662
ENGINEERED SURFACINGS

PART 1 - GENERAL

- 1.1 RELATED DOCUMENTS
- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- 1.2 SUMMARY
- A. Drawing Designation: SS
- B. This Section includes solid surfacing for the following:
1. Counter tops.
- 1.3 ACTION SUBMITTALS
- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Show thickness, finish, layout, and anchorage details. Indicate attachment methods, seams, joint treatments, and supports.
1. Show locations and sizes of cutouts and holes for plumbing fixtures, faucets, soap dispensers, and other items installed in countertops for architectural woodwork
 2. Show seam locations.
 3. Full-size details, edge details, attachments, etc
 4. Locations and sizes of furring, blocking, including concealed blocking and reinforcement specified in other Sections
- C. Samples for Verification: For the following:
1. Solid stone surfacing materials, 6 inches (150 mm) square.
 2. Cut sample and seam together for representation of seaming techniques.
 3. Indicate full range of color and pattern variation.
- 1.4 CLOSEOUT SUBMITTALS
- A. Maintenance Data: Submit manufacturer's recommended cleaning and maintenance procedures.
- 1.5 QUALITY ASSURANCE
- A. Fabricator Qualifications: Company specializing in fabricating engineered stone surfacing material with minimum 5 years experience.
- B. Fire-Test-Response Characteristics: Provide surfacing material with the following surface-burning characteristics (if required by code) as determined by testing identical products per ASTM E 84 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:
1. Class I per ASTM E-84 including:
 - a. Flame Spread: 25 or less.
- 1.6 PROJECT CONDITIONS
- A. Field Measurements: Where surfacing 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.
- 1.7 WARRANTY
- A. Manufacturer's 10-year warranty against defects in materials. Warranty shall provide material and labor to repair or replace defective materials. Damage caused by physical or chemical abuse or damage from excessive heat will not be warranted.

PART 2 - PRODUCTS

- 2.1 SOLID SURFACING
- A. Basis-of-Design: Subject to compliance with requirements, provide products as scheduled on Drawings, or comparable products by one of the following:
1. Dupont, Corian.
 2. Formica Corporation, Formica Solid Surfacing.
 3. Wilsonart International, Wilsonart Solid Surface.

4. For substitution request, refer to Section "012500 – Substitution Procedures".

2.2 MATERIALS

- A. Solid Surfacing: Nonporous surfacing material composed of a unique blend of natural minerals and high-performance acrylic meeting the following criteria:
 1. Wear and Cleanability: Passes per ASI Z124.3.
 2. Abrasion Resistance: No loss of pattern per NEMA LD3-3.01 and ANSI Z 124.3; weight loss, 1,000 cycles, 0.2 gm; wear, 10,000 cycles, 0.008 inches.
 3. Boiling Water Surface Resistance: No change per NEMA LD3-3.05.
 4. High Temperature Resistance: No change per NEMA LD3-3.06.
 5. Conductive Heat Resistance: No change per NEMA LD3-3.08.
 6. Impact Resistance, Notched Izod: 0.28 ft-lbs/in of notch per ASTM D 256, Method A.
 7. Impact Resistance, Ball Drop: 3/4 inch thick sheet, 36 inches with 1/2 pound ball, no failure per NEMA LD3-3.03.
 8. Stain Resistance: Passes, Rating-41, modified with additional stains used, per ANSI Z124.3.
 9. Weatherability: No change, 1000 hours, per ASTM D 1499.
 10. Fungi and Bacteria: No attack per ASTM G 21, G 22.
 11. Water Absorption: 3/4 inch sheet, 0.04 percent after 24 hours, 0.94 percent long term, per ASTM D 570.
 12. Flammability: Solid colors per ASTM E 84.
 - a. Flame Spread: Less than 5.
 - b. Smoke Developed: Less than 15.
 - c. Class Rating: 1.
 13. Thickness: 1/2 inch (12 mm) unless noted or scheduled otherwise.
 14. Colors and Sheen: Refer to Finish Schedule.

2.3 MISCELLANEOUS MATERIALS

- A. Adhesives and Cements: Non-staining, type as recommended by engineered stone manufacturer.
 1. Waterproof, permanent material which will not induce mildew and fungus growth.
- B. Joint Sealants: Two part color matched polyester knife grade adhesive.
- C. Special Features: Provide edge treatments as detailed in Drawings.

2.4 FABRICATION

- A. Assemble work at shop and deliver to job ready for installation. Manufacture in largest practical lengths with seams in least conspicuous locations.
- B. Fabricate work square and to required lines.
- C. Recess and conceal fasteners, connections, and reinforcing.
- D. Design construction and installation details to allow for expansion and contraction of materials. Properly frame material with tight, hairline joints held rigidly in place.
- E. Comply with adhesive manufacturer's recommendations for adhesive shelf life, pot life, working life, mixing, spreading, assembly time, time under pressure and ambient temperatures.
- F. Fabricate countertops with backsplash and side splashes to profiles indicated or detailed.
- G. Fabricate items to profiles shown with connections and supports as detailed or as required for proper installation per manufacturer's recommendations.
- H. Provide cut-outs for plumbing fixtures and trim, washroom accessories, appliances, and related items. Confirm layout with manufacturer's cut-outs templates before beginning work. Round corners of cut-outs and sand edges smooth.
- I. Do not exceed manufacturer's recommended unsupported overhang distances.
- J. Finish exposed surfaces smooth and polish to a sheen indicated.
- K. Radius corners and edges.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install in accordance with manufacturer's printed instructions and approved shop drawings. Provide templates and rough-in measurements.
- B. Install surfacing true in line and plane, level, rigid and solidly adhered to substrate.
- C. Pre-fit items: Adjust supports to make fit. Align joints over support framing.
 1. Provide intermediate supports to that material will not span more than 3 feet in any direction.
 2. Cantilevers shall not exceed 12 inches without supplementary support.
- D. Apply dabs of mastic on supports; place items on supports and attach.

- E. Install with minimum number of joints practical, using full-length pieces from maximum lengths available. Cope at returns and square at corners to produce tight-fitting joints with full-surface contact throughout length of joint. Radius cutouts with minimum 3/8 inch corner radius.
- F. Install splashes using adhesive. Apply adhesive to back surface only. Place thin bead of seam adhesive along edge where splashes seat.

3.2 TOLERANCES

- A. Variation in Component Size: Plus or minus 1/8 inch over 10'-0" length.
- B. Location of Openings: Plus or minus 1/8 inch from indicated location.
- C. Install countertops level to within 1/8 inch in 10 feet.
- D. Allow minimum 1/16 inch clearance between edges of countertops and adjacent walls.
- E. Maximum Offset from True Position: 1/8 inch.

3.3 CLEANING

- A. Clean work under provisions of Section 017700.
- B. Clean and polish fabrications in accordance with manufacturer's instructions.

END OF SECTION

SECTION 129313
BICYCLE RACKS

PART 1 - GENERAL

- 1.1 RELATED DOCUMENTS
- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- 1.2 SUMMARY
- A. Section Includes: Providing metal bicycle racks where indicated.
- 1.3 SUBMITTALS
- A. Product Data: Manufacturer's data for each type of bicycle rack indicated. Include construction details, material descriptions, dimensions of individual components and profiles, finishes, field-assembly requirements, and installation details.
- B. Manufacturer's installation instructions, for information only.
- 1.4 QUALITY ASSURANCE
- A. Manufacturer shall have a minimum of five years experience in the manufacturing of metal bicycle racks of the type specified for this Project.
- B. Source Limitations: Obtain each type of bicycle rack through one source from a single manufacturer.
- C. Codes and Standards: Comply with the City of Denton Building Code, latest edition.
- 1.5 PRODUCT DELIVERY
- A. Deliver materials in factory packages with factory labels attached.
- B. Cover and protect material in transit and at job site. Damaged or defaced material will be rejected and replaced at no cost to the Owner.

PART 2 - PRODUCTS

- 2.1 MANUFACTURER
- A. Basis of Design for Bicycle Racks: Provide Model No. RB-07-I-S Ribbon bicycle racks as manufactured by AAA Ribbon Rack Co., Inc.
- B. Substitutions: Submit in accordance with Section 012500.
- 2.2 MATERIALS
- A. Stainless Steel: Free from surface blemishes and complying with the following:
1. Pipe: Schedule 40 steel pipe complying with ASTM A 312.
 2. 2.375-inch OD pipe, with No. 4 satin finish.
- B. Concrete for foundations: 2500 psi minimum, complying with Section 033000.
- 2.3 FABRICATION
- A. Metal Components: Form to required shapes and sizes with true, consistent curves, lines, and angles. Separate metals from dissimilar materials to prevent electrolytic action.
- B. Pipes and Tubes: Form simple and compound curves by bending members in jigs to produce uniform curvature for each repetitive configuration required; maintain cylindrical cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.
- C. Fabricate bicycle racks with the following attributes and features:
1. Style: Serpentine or Ribbon.
 2. Overall Length: Nominal 5 feet.
 3. Capacity: Seven bicycles.
 4. Security: Designed to lock wheel and frame.
 5. Installation: Cast in concrete footing.

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. Do not proceed until unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Foundation Excavation: Excavate to neat clean lines in undisturbed soil. Remove loose soil and foreign matter from excavation and moisten earth before placing concrete.
- B. Provide forms where required due to unstable soil conditions and for perimeter of pipe base at grade. Secure and brace forms and bicycle rack in position, to prevent displacement during concreting. Protect portion of posts above footing from concrete splatter
- C. Place concrete immediately after mixing. Consolidate concrete in place by using vibrators. Moist-cure exposed concrete for not less than seven days or use non-staining curing compound.
- D. Trowel exposed concrete surfaces to a smooth, dense finish, free of trowel marks, and uniform in texture and appearance. Provide positive slope for water runoff to perimeter of concrete base.

3.3 INSTALLATION

- A. Comply with manufacturer's written installation instructions, shop drawings, and specifications unless more stringent requirements are indicated.
- B. Install bicycle rack posts plumb, level, and square with other work, and at the height recommended by the manufacturer.

3.4 FIELD QUALITY CONTROL

- A. Verify that bicycle racks are installed in accordance with manufacturer's instructions.
- B. Tolerances:
 - 1. Out of level: $\pm 1/4$ ".
 - 2. Out of plumb: $\pm 1/8$ ".

3.5 CLEANING AND PROTECTION

- A. After installation, clean soiled surfaces according to manufacturer's written instructions. Protect bicycle racks from damage until acceptance by Owner.

END OF SECTION

SECTION 220000
BASIC PLUMBING REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.
- B. This section is a Division 22 **Basic Materials and Methods Section** and is a part of each Division 22 section making reference to plumbing related work specified herein.

1.2 DESCRIPTION OF WORK:

- A. Furnish all labor, equipment, supplies, and materials for complete plumbing. All work shall be in strict accordance with the specifications and drawings.

1.3 WORK SPECIFIED IN OTHER SECTIONS:

- A. Concrete pads for plumbing work.
- B. Excavation and backfill for plumbing work.
- C. Painting for plumbing work, except as specified in this section.

1.4 COORDINATION OF WORK:

- A. Coordinate all work with other trades and existing conditions to prevent conflicts. When conflicts arise, remove and relocate items causing such conflicts at no additional cost to the owner.
- B. Provide a job site representative whenever necessary to coordinate work with others.
- C. Refer to other discipline's drawings, relevant equipment drawings, and shop drawings to determine available clearances and possible obstructions. Make necessary offsets or transitions as required to clear structural members and existing equipment.
- D. Division 22 contractors shall be responsible for all resultant costs incurred for changes required to accommodate actual equipment furnished when the equipment has characteristics differing from that specified or shown on the drawings.
- E. Electrical work: Furnish all electrical devices in association with plumbing equipment including but not limited to motors, relays, pressure and temperature control devices, and all motor starters, controls, or protective devices factory wired and installed as an integral part of the equipment. Division 26 shall furnish and install all disconnect switches, start-stop stations and motor starters which are not furnished as an integral part of the equipment and which are not specified or indicated to be furnished by Division 22. Division 26 shall also install all power wiring, miscellaneous controls, control wiring, and interlock wiring when specifically shown on the electrical drawings.

1.5 QUALITY ASSURANCE:

- A. All work shall be performed by craftsman normally engaged in the respective craft required for each installation.
- B. Qualify welding and brazing processes and operators for piping systems in accordance with ASME Boiler and Pressure Vessel Code, Section IX "Welding & Brazing Qualification". Qualify welding processes and welding operators for miscellaneous supports in accordance with AWS D1.1 "Structural Welding Code-Steel". Each welder shall have satisfactorily passed AWS qualification test for welding processes involved and their certification shall be current.

1.6 FEES, PERMITS, AND INSPECTIONS:

- A. Provide all fees and permits that are required in connection with this work.
- B. Secure all inspections as required by the authorities having jurisdiction.
- C. Where applications are required for procuring of services for the building, prepare and file such application. Furnish all information required in connection with the application in the form required by the utility company and/or municipal department.

1.7 APPLICABLE CODES AND STANDARDS:

- A. All work shall comply with all applicable laws, codes, recommendations, regulations, and interim amendments of the governmental bodies having jurisdiction.
- B. All work shall be performed in compliance with all applicable and governing regulations, including OSHA regulations.
- C. A reference to technical society, organization, or body in the specification is in accordance with the following abbreviations, and all work shall be performed, as a minimum, in accordance with the latest edition of their publications:
 - 1. ANSI American National Standards Institute
 - 2. ASTM American Society for Testing and Materials
 - 3. ASHRAE American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc.
 - 4. ASME American Society of Mechanical Engineers
 - 5. BOCA Building Officials & Code Administrators International, Inc.
 - 6. CISPI Cast Iron Soil Pipe Institute
 - 7. ETL Environmental Testing Labs
 - 8. FIA Factory Insurance Association
 - 9. FM Factory Mutual Laboratories
 - 10. IAPMO International Association of Plumbing and Mechanical Officials
 - 11. IEEE Institute of Electrical and Electronics Engineers, Inc.
 - 12. MSS Manufacturers Standardization Society of the Valve and Fittings Industry, Inc.
 - 13. NEMA National Electrical Manufacturer's Association
 - 14. NFPA National Fire Protection Association
 - 15. NRCA National Roofing Contractors Association
 - 16. NSF National Sanitation Foundation
 - 17. OSHA Occupational Safety & Health Administration
 - 18. SSPMA Sump and Sewage Pump Manufacturer's Association
 - 19. UBC International Conference of Building Officials
 - 20. UL Underwriters' Laboratories, Inc.

- D. All work shall comply with rules and regulations of utilities and/or municipal departments affected by connections of services.
- E. Should these specifications and/or drawings conflict with the building codes, standards, laws, ordinances, utility company rules and regulations, etc., the more stringent requirements shall take precedence. Notify the Architect/Engineer immediately with all conflicts.

1.8 GLOSSARY OF TERMS

A. Terms:

- Contractor - The particular sub-contractor who is directly responsible for the work specified herein.
- Shall - Action that is required without option or qualification.
- May - Action that is desirable or is at the contractor choice or option.
- Should - Recommendation for the contractor to follow as an aid in performing the required work.
- Provide - Contractor shall furnish and install specified item(s).
- Furnish - Contractor shall be responsible for obtaining specified items.
- Install - Contractor shall be responsible for all labor and construction equipment necessary to set in place, connect, calibrate and/or test the specified items furnished by him or others.
- Or Equal - Item should possess the same performance qualities and characteristics as the one specified, and fulfill the function without any decrease in quality, durability or longevity.

1.9 SUBSTITUTIONS:

- A. The materials, products, and equipment described in the specifications or on the drawings establish a standard of required function, dimension, appearance, and quality to be met by any proposed substitution.
- B. Reference to any article, device, product, material, fixture, form, or type of construction by name, make, or catalog number, shall be interpreted as having established a standard of quality and shall not be construed as limiting competition. Articles, fixtures, etc. of equal quality by manufacturers listed in this specification for the applicable use, shall be acceptable, subject to spatial, structural and electrical constraints of the project design.
- C. No substitution will be considered unless written request for approval has been received by the Architect/Engineer at least five working days prior to the date for receipt of Bids. Each request shall include the name of the material or equipment for which it is to be substituted and complete description of the proposed substitute including shop drawings, performance and test data, and other information necessary for an evaluation. Include a statement setting forth changes in other materials, equipment, or work that incorporation of the proposed substitute would require. The burden of proof of the merit of the proposed substitute is on the proposer. The engineer's approval or disapproval of a proposed substitution shall be final.

- D. Approval of a proposed substitution prior to receipt of bids shall be set forth in an addendum. Approvals made in all other manner shall not be considered binding.

1.10 SUBMITTALS:

- A. Submit shop drawings and product data as specified in Division 1. Engineer shall retain one copy of each submittal.
- B. Each submittal shall include a letter indicating all deviations from the drawings and specifications.
- C. Checking of shop drawings is a gratuitous assistance by the engineer and shall not relieve the contractor of responsibility for deviations, errors, or omissions that may exist in the shop drawings. Shop drawings submitted and rejected more than two times due to incomplete data or unacceptable material shall be reviewed by the engineer as an additional cost to Division 22 contractors at \$75.00 per hour, two hours minimum.
- D. Shop drawing submittals shall include the following for each piece of equipment and material, as applicable:
 - 1. Product data listing manufacturer, model number, materials, accessories, and miscellaneous data as required to describe the equipment.
 - 2. Capacity, pressure drops, rpm, motor horsepower, and other miscellaneous data to quantify size of equipment.
 - 3. Dimensional drawings showing layout, connection points and sizes, weights, etc.
 - 4. Wiring diagrams, including power and control wiring. Distinguish between factory and field wiring.
 - 5. Parts list.
 - 6. Installation and maintenance manuals
 - 7. Warranty statement.
- E. The following information shall be submitted in accordance with this section.
 - 1. Detailed drawings of fabrication and installation for metal fabrications, supports, and anchorage for plumbing materials and equipment.
 - 2. Coordination schedule for access door locations, sizes, and types.
 - 3. Welder certifications.
- F. At contractor's option, piping shop drawings may be prepared electronically. Engineer shall prepare electronic background drawings for the contractor at contractor's request. A charge of \$150.00 per sheet requested shall be paid by contractor prior to receiving electronic files. Contractor shall coordinate shop drawings with other trade's shop drawings, and indicate all required offsets or changes. On completion of the project, the contractor shall furnish the edited electronic shop drawings to the engineer.
- G. Refer to individual Division 22 sections for additional requirements.

1.11 WARRANTIES:

- A. Materials and equipment furnished shall operate and perform as designed with respect to efficiencies, capacities and quietness, for one year from substantial completion. Provide all services required to repair or replace, at no additional cost, defective parts of the installation resulting from the supply of faulty workmanship or material. These services shall be furnished within 24 hours of initial report of the defect. Lack of maintenance, accidents, or carelessness on the part of the owner shall not be included in this warranty.

- B. Provide additional warranties and warranty extensions as identified in individual Division 22 sections.

1.12 RECORD DRAWINGS:

- A. Record drawings shall be kept and prepared in accordance with Division 1 and as specified herein.
 - 1. A complete "Record" set of blue-line prints shall be kept at the project site and shall be corrected daily to show all changes in layout from the original drawings and specifications. This "Record" set shall be used for this purpose only. On completion of the project, two new sets of blue-line prints shall be obtained and all changes noted on the field record set shall be neatly transferred (in red pencil) to the two new sets of prints.
 - 2. At contractor's option, record drawings may be prepared electronically. Engineer shall prepare electronic background drawings for the contractor at contractor's request. A charge of \$150.00 per sheet requested shall be paid by contractor prior to receiving electronic files. Electronic record drawings shall be maintained at the project site and shall be updated daily to show all changes in layout from the original drawings. On completion of the project, the contractor shall furnish the edited electronic record drawings to the engineer.
- B. Indicate actual locations of installed equipment, and actual routing of piping.
- C. Indicate locations of all capped pipes by two dimensions and depth below grade.
- D. Indicate actual manufacturers and model numbers of installed equipment on equipment schedules.

1.13 OPERATION AND MAINTENANCE MANUALS:

- A. During the course of construction, collect and compile three (3) sets of operating instructions, wiring diagrams, catalog cuts, lubrication and preventive maintenance instructions, parts lists, etc. for all equipment furnished under this contract. All literature including warranties shall be included in the Operation and Maintenance Manuals.
- B. All literature and instructions shipped with the equipment shall be included in the Operation and Maintenance Manuals.
- C. At completion of work, and prior to request for final inspection, submit Operation and Maintenance Manuals to architect in accordance with Division 1 and as specified herein. Manuals shall be bound in heavy duty, three-ring, vinyl covered, hard-backed binder, with clear plastic pocket on spine and cover. Use pocket folders for folded sheet information. Spine and cover of each binder shall have the following typewritten lettering inserted:

**Operation and Maintenance Manual
for Plumbing Systems of
(Project Name)**

- D. Operation and Maintenance Manuals shall include the following:
 - 1. Provide a master index at beginning of manual listing all items included.
 - a. Use plastic tab indexes for each section of manual.
 - 2. Provide a directory, listing the name, address, and phone number of Architect, Mechanical, Plumbing and Electrical Engineers, General Contractor, and all Subcontractors.

3. Provide a directory, listing all equipment installed, and indicating the name, address, and phone number of each supplier.
4. Provide a section for each system, which shall include the following:
 - a. General description of each system.
 - b. Schematic diagrams for each system.
 - 1) Each diagram shall indicate locations of starters, thermostats, thermometers, pressure gauges, valves, etc.
 - 2) Correct setting for each control instrument shall be indicated on these diagrams.
5. Provide a section for each piece of equipment which shall include the following:
 - a. Manufacturer's catalog data indicating capacity, size, etc., by underlining the applicable data.
 - b. Manufacturer's installation and maintenance manuals.
 - c. Performance curves for pumps, etc.
 - d. Lubrication schedule, indicating type and frequency of lubrication required.
 - e. Recommended list of spare parts to be stocked for preventive maintenance.
 - f. Equipment parts identification list for repair and replacement purposes.
 - g. Wiring diagram for the specific piece of equipment.
 - 1) Generalized wiring diagrams are not acceptable.
 - h. Copies of completed warranty certificates.
6. Provide a copy of each approved shop drawing.

1.14 SYSTEM DEMONSTRATIONS:

- A. After systems have been tested, balanced, and placed in proper working order, but before final acceptance of the plumbing systems, demonstrate the systems to the owner. All features and functions of all systems shall be explained and the owner shall be instructed in proper operation and maintenance of the equipment and systems.
- B. Instruct owner in the maintenance procedures to drain and protect water systems from freezing during winter conditions.
- C. Coordinate the dates and times for performing the demonstrations with the owner.
- D. Upon completion of demonstrations, submit a certificate certifying the demonstrations have been completed.
 1. Certificate shall list each system demonstrated, dates demonstrations were performed, and names of personnel in attendance.
 2. Certificate shall be signed by the contractor and the owner.

1.15 MAINTENANCE MATERIALS:

- A. All special tools provided by the manufacturer for installation or maintenance of the equipment shall be delivered to the owner before final acceptance.

PART 2 - PRODUCTS

2.1 MATERIALS:

- A. Unless otherwise approved in writing, all materials furnished under this specification shall be new and shall be standard products of manufacturers regularly engaged in the production of such equipment, and shall be the manufacturer's latest design.

- B. Equipment of any one type shall be by one manufacturer unless specifically indicated otherwise.

2.2 PLUMBING EQUIPMENT NAME PLATES:

- A. General: For each piece of plumbing equipment, provide a permanent operational data name plate indicating manufacturer, product name, model number, serial number, capacity, operating and power characteristics, labels of testing agencies, and similar essential data.
- B. Location: Locate nameplates in an accessible location.

2.3 MISCELLANEOUS METALS:

- A. Steel plates, shapes, bars, and bar grating: ASTM A 36.
- B. Cold-Formed Steel Tubing: ASTM A 500.
- C. Hot-Rolled Steel Tubing: ASTM A 501.
- D. Steel Pipe: ASTM A 53, Schedule 40, welded.
- E. Fasteners: Zinc-coated or cadmium plated, type, grade, and class as required.

2.4 MISCELLANEOUS LUMBER:

- A. Framing materials: Standard grade, light-framing-size lumber of any species. Number 3 common or standard grade boards complying with Western Wood Products Association (WWPA) or West Coast Lumber Inspection Bureau (WCLIB) rules. Lumber shall be preservative pressure treated in accordance with American Wood Preservers Bureau (AWPB) LP-2, and kiln dried to a moisture content of not more than 19 percent.

2.5 CONCRETE:

- A. Portland cement shall conform to ASTM C-150, Type I or II as specified in Division 3.
- B. Non-shrink, Nonmetallic Grout: Premixed, factory-packaged, non-staining, non-corrosive, nongaseous grout, recommended for interior and exterior applications, and as specified in Division 3.

2.6 ACCESS DOORS:

- A. Manufacturers: Subject to compliance with requirements, provide access doors by one of the following:
 - 1. J.L. Industries.
 - 2. Karp Associates, Inc.
 - 3. Milcor Div. Inryco, Inc.
- B. Steel access doors and frames: Factory-fabricated and assembled units complete with attachment devices and fasteners ready for installation. Joints and seams shall be continuously welded steel, with welds ground smooth and flush with adjacent surfaces.
- C. Frames: 16-gage steel, with suitable means of anchoring frame to wall construction. Provide a 1" wide exposed perimeter flange for units installed in unit masonry, pre-cast concrete, cast-in-

place concrete, ceramic tile, or wood paneling. Provide units with perforated flanges and wallboard bead for installation in gypsum wallboard or plaster.

- D. Doors: Flush panel, 14-gage sheet steel, with concealed spring hinges or concealed continuous piano hinge set to open 175 degrees. Provide screwdriver activated locking device. Finish shall be factory applied prime cost.
- E. Fire-Rated Units: Self-closing mechanism and UL rated for the installation encountered. Provide UL label on each fire-rated access door.

2.7 FIRE STOP MATERIALS

- A. Manufacturers: Subject to compliance with requirements, provide fire stop materials by one of the following:
 - 1. International Protective Coatings Corp.
 - 2. Specified Technologies, Inc.
 - 3. 3M Company, Inc.
- B. Fire Resistant Sealants: One-part elastomeric sealant or two-part foamed-in-place silicone sealant, formulated for use in through-penetration fire-stopping around cables, conduits and pipes penetrations through fire-rated walls and floors. Sealants and accessories shall have fire resistance ratings as required for the installation. Fire ratings for the sealants shall be as established by testing identical assemblies in accordance with ASTM E 814, by UL, or other testing and inspection agency acceptable to authorities having jurisdiction.
- C. Fire Safing: Mineral wool or ceramic fiber material manufactured for the specific purpose of fire safing.

PART 3 - EXECUTION

3.1 WORKMANSHIP:

- A. All work shall be performed by experienced mechanics in accordance with first class practice, and the work shall be neat in appearance and complete to perform the intended function.

3.2 INSPECTION:

- A. Examine areas and conditions under which the plumbing systems and equipment are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected.

3.3 ROUGH-IN:

- A. Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected.
- B. Refer to equipment specifications in all Divisions for rough-in requirements.

3.4 SAFETY:

- A. Provide warning lights, signs, and guards for safety as required.

- B. Safety of personnel on the project site shall be the responsibility of all divisions. Comply with all local, state, and federal regulations for safety.

3.5 HOUSEKEEPING:

- A. The premises shall be kept broom clean at all times.
- B. Stocks of material and equipment stored on the premises shall be stored in a neat and orderly manner in their shipping containers. Material and equipment shall be protected as recommended by the manufacturer.
- C. Remove all waste material present as a result of plumbing work from the premises.
- D. Exposed surfaces of piping and equipment shall be cleaned of all dirt, plaster, labels, fabrication marks, concrete, etc. before final acceptance of the work.
- E. Finish and cleaning: At the completion of the work, the following shall be completed:
 - 1. The entire system of piping and equipment shall be cleaned internally. Open all dirt pockets and strainers, and clean strainer screens of all accumulated debris. Replace all filters with new filters at time of final acceptance.
 - 2. All tanks, fixtures, and pumps shall be drained and proven free of sludge and accumulated matter.
 - 3. All temporary labels, stickers, etc., shall be removed from all fixtures and equipment. (Permanent name plates, equipment model numbers, ratings, etc. shall not be removed).
 - 4. Clean all material and equipment installed. Dirt, dust, plaster, stains, and foreign matter shall be removed from all surfaces. Damaged finishes shall be touched-up and restored to original condition.

3.6 SCAFFOLDING AND HOISTING:

- A. Furnish all scaffolding and hoisting required for the work of Division 22.

3.7 CUTTING AND PATCHING:

- A. Cutting and patching shall be performed in accordance with Division 1 and as specified herein.
- B. No structural members shall be cut, drilled, or penetrated without prior approval from the architect.
- C. Coordinate the placing of the openings in new structures as required for the installation of plumbing work.
- D. Furnish accurate locations and sizes of required openings for the plumbing systems to the appropriate personnel. This shall not relieve the Division 22 contractor of the responsibility of checking to assure that proper size openings are provided. When additional patching is required due to failure to inspect this work, the Division 22 contractor shall be responsible for the patching required to properly close the openings.
- E. When cutting and patching of the structure is made necessary due to failure to install piping, sleeves, or equipment on schedule or due to the failure to furnish, on schedule, the information required for the leaving of openings, then the Division 22 contractor shall be responsible for the cutting and patching required.
- F. All roofing work in new structures shall be performed under Division 7. Coordinate as required.

3.8 PROTECTION OF WORK:

- A. All pipe openings shall be kept closed by means of plugs or caps to prevent the entrance of foreign matter.
- B. Special care shall be taken for the protection of equipment. All equipment and material shall be completely protected from weather, moisture, dust, paint, plaster, etc. until the project is completed. Damage from rust, paint, scratches, etc. shall be repaired as required to restore equipment to original condition.
- C. Protection of equipment during plastering and painting shall be the responsibility of others, but this shall not relieve the Division 22 contractor from the responsibility of checking to assure that adequate protection is provided.
- D. Where the installation or connection of equipment requires work in areas previously finished, Division 22 contractor shall be responsible that such areas are protected and are not marred, soiled, or otherwise damaged. Repairing and refinishing damaged areas shall be the responsibility of Division 22 contractor and shall be approved by the architect.
- E. Provide and maintain temporary partitions or dust barriers adequate to prevent the spread of dust and dirt to adjacent finished areas.
- F. All trenches and pits shall be maintained on a continuous basis, free of water for protection of work.
- G. Protect floor drains during construction and cleaning to avoid clogging with dirt and debris.

3.9 ERECTION OF SUPPORTS AND ANCHORAGE:

- A. Metal: Cut, fit, and place miscellaneous metal fabrications accurately in location, alignment, and elevation as required to support and anchor plumbing materials and equipment.
 - 1. Field Welding: Comply with AWS "Structural Welding Code."
 - 2. Select fastener sizes that will not penetrate members where opposite side will be exposed to view, will receive finish materials, or may damage other surfaces, such as roofing. Make tight connections between members.
- B. Wood: Cut, fit, and place wood supports, nailers, and blocking accurately in location, alignment, and elevation where indicated on the drawings to support and anchor plumbing materials and equipment.
 - 1. Select fastener sizes that will not penetrate members where opposite side will be exposed to view, will receive finish materials, or may damage other surfaces, such as roofing.
 - 2. Make tight connections between members.
 - 3. Install fasteners without splitting wood members.
- C. Attach anchors and fasteners to building structure as required to support applied loads. Location and type of fasteners used shall be approved by the architect.

3.10 APPLICATION OF SEALANTS:

- A. Install sealant as required by manufacturer's printed instructions.

- B. Installation of Fire-Stopping Sealant: Install sealant, including forming, packing, and other accessory materials, to fill openings around plumbing services penetrating floors and walls, to provide fire-stops with fire-resistance ratings indicated for floor or wall assembly in which penetration occurs. Comply with installation requirements established by testing and inspecting agency.

3.11 INSTALLATION OF ACCESS DOORS:

- A. Furnish access doors as required for access to concealed equipment, valves, dampers, controls, etc.
- B. Equipment above lay-in ceilings shall not require an access door in the ceiling.

3.12 PAINTING:

- A. Equipment with damaged finishes shall be repainted to match the original factory finish.
- B. All exposed ferrous metal including exposed threads on pipe, and welds furnished by Division 22, such as hangers, struts, structural steel, etc., shall be primed as specified in Division 9.

3.13 SCHEDULE OF PRE-PURCHASED PRODUCTS:

- A. Water Heaters

END OF SECTION 220000

SECTION 220514
PLUMBING RELATED WORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.
- B. This section is a Division 22 **Basic Materials and Methods Section**, and is part of each Division 22 section making reference to plumbing related work specified herein.

1.2 DESCRIPTION OF WORK:

- A. Extent of plumbing related work required by this section is indicated on drawings and/or specified in other Division 22 sections.
- B. Plumbing related work specified in Division 2 sections, but is work of Division 22 includes the following:
 - 1. Excavating and backfill for plumbing work:
 - a. Interior piping below slabs.
 - b. Exterior underground plumbing utilities and services.
 - 2. Concrete for plumbing work:
 - a. Rough grouting in and around plumbing work.
 - b. Patching concrete cut to accommodate plumbing work.
 - c. Concrete equipment pads.

1.3 PROJECT CONDITIONS:

- A. Existing Utilities: Locate and protect existing utilities and other underground work in manner which will ensure that no damage or service interruption will result from excavating and backfill.
- B. Protect property from damage that might result from excavating and backfill.
- C. Protect persons from injury at excavations by barricades, warnings and illumination.
- D. Coordinate excavations with weather conditions to minimize possibility of washouts, settlements and other damages and hazards.
- E. Provide temporary covering or enclosure and temporary heat as necessary to protect bottoms of excavations from freezing and frost action. Do not install plumbing work on frozen excavation bases or subbases.

PART 2 - PRODUCTS

2.1 EXCAVATING AND BACKFILLING FOR PLUMBING WORK:

- A. Backfill Materials: Refer to Division 2 for excavating and backfill requirements.

2.2 MATERIALS OF CONCRETE WORK:

- A. Refer to Division 3 for concrete requirements.

PART 3 - EXECUTION

3.1 ACCESS FOR PLUMBING WORK:

- A. Coordinate with and instruct the general contractor to install the proper sized access doors in the proper location to provide access to all plumbing items requiring service or maintenance. This shall include but not be limited to valves, traps and filters.

3.2 EXCAVATION AND BACKFILLING FOR PLUMBING WORK:

- A. Refer to Division 2 sections for requirements related to the work specified herein.
- B. Do not excavate for plumbing work until work is ready to proceed without delay, so that total time lapse from excavation to completion of backfill will be minimum.
- C. Provide all excavation and backfill as necessary to install the piping systems as shown on the drawings.
- D. Care shall be taken in excavating, that walls and footings and adjacent load bearing soils are not disturbed in any way. Where pipes must cross under a wall footing, the excavation shall be kept at a minimum to accommodate the pipe.
- E. Slope sides of excavation as required for soil and local codes and ordinances. Provide shoring and bracing as required. Maintain shoring and bracing in excavation regardless of time period excavation is open. Remove shoring and bracing before backfilling.
- F. Excavation shall be kept free from water by pumping if necessary. Sewers shall not be used as drain for such water.
- G. No length of trench shall be left open for more than is absolutely necessary for installation and testing.
- H. Pipe shall be supported directly on undisturbed soil (virgin or compacted), do not excavate beyond indicated depth. If existing soil is unsuitable (soft spot or rock), excavate to solid subgrade, or 6" for rock, below bottom of work and provide subbase material as required. Hand excavate bottom cut to insure accurate elevations. Bottoms of all trenches shall be so shaped that when pipe is in place the lower fourth of the circumference for the full length of the pipe shall be supported on undisturbed soil or compacted fill, as applicable. Bell holes shall be excavated so the bell supports no part of the weight of the pipe.
- I. Protect excavation bottoms against freezing when temperature is less than 35°F.
- J. Immediately after testing, trench shall be carefully backfilled with earth free from clods, brick, etc. to a depth one-half the pipe diameter and then firmly tamped in such a manner as not to disturb alignment or joints of the pipe. Thereafter the backfill shall be tamped every vertical foot.
- K. Pavement or concrete damaged during excavation shall be restored to original condition.

- L. Locate existing underground utilities in excavation areas. Maintain and protect existing services that transit the area of an excavation trench.

3.3 PERFORMANCE AND MAINTENANCE OF EXCAVATION WORK:

- A. Subsidence: Where subsidence is measurable or observable at plumbing work excavations during general project warranty period, remove surface (pavement, lawn or other finish), add backfill material, compact, and replace surface treatment. Restore appearance, quality, and condition of surface or finish to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.4 INSTALLATION OF CONCRETE WORK:

- A. Installation shall be in accordance with the requirements of Division 3.

END OF SECTION 220514

SECTION 220518
PIPING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.
- B. This section is a Division 22 **Basic Materials and Methods Section**, and is part of each Division 22 section making reference to pipes and pipe fittings specified herein.

1.2 DESCRIPTION OF WORK:

- A. Piping specialties work required by this section is indicated on drawings and schedules and by requirements of this section.
- B. Piping specialties specified in this section include the following:
 - 1. Pipe Escutcheons.
 - 2. Pipeline Strainers.
 - 3. Dielectric Unions.
 - 4. Fire Barrier Penetration Seals.
 - 5. Fabricated Piping Specialties.
 - 6. Water Hammer Arrestors.

1.3 QUALITY ASSURANCE:

- A. Manufacturers Qualifications: Firms regularly engaged in manufacture of piping specialties of types and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.
- B. Codes and Standards:
 - 1. FCI Compliance:
 - a. Test and rate "Y" type pipeline strainers in accordance with FCI 73-1 "Pressure Rating Standard for 'Y' Type Strainers".
 - b. Test and rate other pipeline strainers in accordance with FCI 78-1 "Pressure Rating Standard for Pipeline Strainers Other than 'Y' Type".

1.4 SUBMITTALS:

- A. Product Data: Submit manufacturer's technical product data, including installation instructions, and dimensioned drawings for each type of manufactured piping specialty. Include pressure drop curve or chart for each type and size of pipeline strainer.
- B. Shop Drawings: Submit for fabricated specialties, indicating details of fabrication, materials, and method of support.

- C. Maintenance Data: Submit maintenance data and spare parts lists for each type of manufactured piping specialty.

1.5 OPERATION AND MAINTENANCE MANUALS:

- A. Include product data, shop drawings, and maintenance data in Operation and Maintenance Manuals.

PART 2 - PRODUCTS

2.1 PIPING SPECIALTIES:

- A. General: Provide factory-fabricated piping specialties recommended by manufacturer for use in service indicated. Provide piping specialties of types and pressure ratings indicated for each service, or if not indicated, provide proper selection as determined by Installer to comply with installation requirements. Provide sizes as indicated, and connections that properly mate with pipe, tube, and equipment connections.

2.2 PIPE ESCUTCHEONS:

- A. General: Provide pipe escutcheons as specified herein.
 - 1. Inside diameter of escutcheons shall closely fit outside diameter of pipe, or outside diameter of insulation for insulated pipe.
 - 2. Outside diameter of escutcheons shall completely cover pipe penetration opening in floors, walls, ceilings, or pipe sleeve extensions.
 - 3. Provide pipe escutcheons with nickel or chrome finish for occupied areas, primer paint finish for unoccupied areas.
- B. Pipe Escutcheons for Moist Areas: For waterproof floors, exterior locations, and areas where water and condensation can be expected to accumulate, provide cast brass or sheet brass escutcheons, solid or split hinged.
- C. Pipe Escutcheons for Dry Areas: Provide sheet steel escutcheons, solid or split hinged.
- D. Manufacturer: Subject to compliance with requirements, provide pipe escutcheons of one of the following:
 - 1. Chicago Specialty Mfg. Co.
 - 2. Producers Specialty & Mfg. Corp.
 - 3. Sanitary-Dash Mfg. Co.

2.3 PIPELINE STRAINERS:

- A. General: Provide strainers full line size of connecting pipe, with ends matching piping system materials. Select strainers for 125 PSI working pressure. Provide Type 304 stainless steel screens with 3/64" perforations @ 223 per square inch.
- B. Strainers 2" and smaller:
 - 1. Construction: Cast iron body, screwed screen retainer, with centered blowdown fitted with pipe plug.
 - 2. Connections: Threaded.

- C. Strainers 2-1/2" and larger:
 - 1. Construction: Cast iron body, bolted screen retainer, with off-center blowdown fitted with pipe plug.
 - 2. Connections: Flanged.

- D. Manufacturers: Subject to compliance with requirements, provide strainers of one of the following:
 - 1. Armstrong Machine Works.
 - 2. Hoffman Specialty ITT Fluid Handling Division.
 - 3. Metraflex Co.
 - 4. Spirax Sarco.
 - 5. Tyler Pipe/Gustin-Bacon Division.
 - 6. Victaulic.
 - 7. Watts Regulator.

2.4 DIELECTRIC UNIONS:

- A. General: Provide standard products recommended by manufacturer for use in service indicated, which effectively isolate ferrous from non-ferrous piping (electrical conductance), prevent galvanic action, and stop corrosion.

- B. Manufacturer: Subject to compliance with requirements, provide dielectric unions of one of the following:
 - 1. B & K Industries, Inc.
 - 2. Capital Mfg. Co., Div. of Harsco Corp.
 - 3. Eclipse, Inc.
 - 4. Epco Sales, Inc.
 - 5. Perfection Corp.
 - 6. Rockford-Eclipse Div.

2.5 FIRE BARRIER PENETRATION SEALS:

- A. Provide seals for all openings through fire-rated walls, floors or ceilings used as passage for plumbing components such as piping.

- B. Cracks, Voids or Holes less than 4" diameter: Use putty or caulking, one-piece intumescent elastomer, non-corrosive to metal, compatible with synthetic cable jackets, and capable of expanding 10 times when exposed to flame or heat, UL listed.

- C. Openings 4" or larger: Use sealing system capable of passing 3-hour fire test in accordance with ASTM E-814, consisting of wall wrap or liner, partitions, and end caps capable of expanding when exposed to temperatures of 250 to 350 F, UL listed.

- D. Manufacturer: Subject to compliance with requirements, provide fire barrier penetration seals of one of the following:
 - 1. Electro Products; Division of 3M.
 - 2. Nelson; Unit of General Signal.
 - 3. Bio-Fire.

2.6 FABRICATED PIPING SPECIALTIES:

- A. Drip Pans: Provide drip pans fabricated from G90 galvanized steel or 304 stainless steel, with watertight joints, and with edges turned up 2½". Reinforce top, either by structural angles or by rolling top over 1/4" steel rod. Provide hole, gasket, and flange at low point for watertight joint and 1" drain line connection.
- B. Pipe Sleeves: Provide pipe sleeves of one of the following:
 - 1. Sheet-Metal: Fabricate from galvanized sheet metal; round tube closing with snaplock joint, welded spiral seams, or welded longitudinal joint. Fabricate from the following gauges:
 - a. 3" and smaller 20 gauge.
 - b. 4" to 6" 16 gauge.
 - c. 6" and larger 14 gauge.
 - 2. Steel-Pipe: Fabricate from schedule 40 galvanized steel pipe. Remove burrs.
 - 3. Iron-Pipe: Fabricate from cast-iron or ductile-iron pipe. Remove burrs

2.7 WATER HAMMER ARRESTORS:

- A. General: Provide piston and o-ring type water hammer arrestors, copper construction, pressure rated for 250 PSI, tested and certified in accordance with PDI Standard WH-201.
- B. Manufacturer: Subject to compliance with requirements, provide water hammer arrestors from one of the following:
 - 1. Sioux Chief Manufacturing.
 - 2. Precision Plumbing Products.
 - 3. Watts.

PART 3 - EXECUTION

3.1 INSTALLATION OF PIPING SPECIALTIES:

- A. Pipe Escutcheons: Install pipe escutcheons on each pipe penetration through floors, walls, partitions, and ceilings where penetration is exposed to view, and on exterior of building. Secure escutcheon to pipe or insulation so escutcheon completely covers penetration hole, and is flush with adjoining surface.
- B. Dielectric Unions: Install at each joint between ferrous and non-ferrous piping. Comply with manufacturer's installation instructions.
- C. Fire Barrier Penetration Seals: Fill entire opening with sealing compound. Comply with manufacturer's installation instructions.

3.2 INSTALLATION OF FABRICATED PIPING SPECIALTIES:

- A. Drip Pans: Locate drip pans under piping passing over or within 3' horizontally of electrical or elevator equipment, and elsewhere as indicated. Hang from structure with rods and building attachments. Weld rods to sides of drip pan. Brace to prevent sagging or swaying. Connect 1" drain line to drain connection, and extend to nearest plumbing drain or elsewhere as indicated.
- B. Pipe Sleeves: Install pipe sleeves of types indicated where pipes pass through walls, floors, ceilings, and roofs. Do not install sleeves through structural members, except as detailed on drawings, or as reviewed by Architect/Engineer. Install sleeves accurately centered on pipe

runs. Size sleeves so that piping and insulation (if applicable) will have free movement in sleeve, including allowance for thermal expansion. Sleeves shall be minimum 2 pipe sizes larger than piping run. Where insulation includes vapor-barrier jacket, provide sleeve with sufficient clearance for installation. Install wall sleeves of length equal to thickness of construction penetrated, and finish flush to surface. Install floor sleeves of length to extend 1" above floor finish, and 2" above floor finish sloped to drain or equipment rooms. Provide temporary support of sleeves during placement of concrete and other work around sleeves, and provide temporary closure to prevent concrete and other materials from entering sleeves.

1. Install sheet-metal sleeves at interior partitions and ceilings that are not fire rated. Sleeves are not required at suspended ceilings.
 2. Install iron pipe sleeves at exterior penetrations, both above and below grade.
 3. Install steel pipe sleeves except as otherwise indicated.
- C. Water Hammer Arrestors: Install in upright position in locations and sizes shown in accordance with PDI Standard WH-201, and elsewhere as required to prevent water hammer.

END OF SECTION 220518

SECTION 220519
METERS AND GAUGES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.
- B. This section is a Division 22 **Basic Materials and Methods Section**, and is part of each Division 22 section making reference to pipes and pipe fittings specified herein.

1.2 DESCRIPTION OF WORK:

- A. Meters and gauges required by this section are indicated on the drawings and/or specified in other Division 22 sections.
- B. Types of meters and gauges specified in this section include the following:
 - 1. Temperature gauges and accessories.
 - 2. Temperature gauge connector plugs.
 - 3. Pressure gauges and accessories.
 - 4. Pressure gauge connector plugs.
- C. Meters and gauges furnished as part of factory fabricated equipment are specified as part of equipment assembly in other Division 22 sections.

1.3 QUALITY ASSURANCE:

- A. UL Compliance: Comply with applicable UL standards pertaining to meters and gauges.
- B. ASME and ISA Compliance: Comply with applicable portions of ASME and Instrument Society of America (ISA) standards pertaining to construction and installation of meters and gauges.

1.4 SUBMITTALS:

- A. Submit product data for each type of meter and gauge. Include scale range, ratings, and calibrated performance curves.
- B. Submit meter and gauge schedule showing manufacturer's figure number, scale range, location, and accessories for each meter and gauge.
- C. Submit product certificates signed by manufacturers of meters and gauges certifying accuracy under specified operating conditions.

1.5 OPERATION AND MAINTENANCE MANUALS:

- A. Provide maintenance data and parts list for each type of meter and gauge. Include this data, product data, and shop drawings in Operation and Maintenance Manuals.

PART 2 - PRODUCTS

2.1 TEMPERATURE GAUGES AND ACCESSORIES:

- A. Accuracy: Plus or minus 1 percent of range span, or plus or minus one scale division, to maximum of 1.5 percent of range span.

- B. Scale range: Temperature ranges for services listed as follows:
 - 1. Domestic Cold Water: 0 to 100 degrees F with 2-degree scale divisions.
 - 2. Domestic Hot Water: 30 to 240 degrees F with 2-degree scale divisions.

- C. Filled-system dial thermometers:
 - 1. Type: Vapor actuated, universal angle.
 - 2. Construction: Drawn steel or cast aluminum case, satin faced, non-reflective aluminum scale with permanently etched markings, glass lens, 4-1/2" diameter.
 - 3. Adjustable Joint: Finish to match case, 180 degree adjustment in vertical plane, 360 degree adjustment in horizontal plane, with locking device.
 - 4. Thermal Bulb: Copper.
 - 5. Movement: Brass, precision geared.
 - 6. Stem: Copper plated steel, aluminum, or brass, for separable socket, length to suit installation.

- D. Thermometer wells: Brass or stainless steel, pressure rated to match piping system design pressure. Provide 2" extension for insulated piping. Provide threaded cap nut with chain permanently fastened to well and cap.

- E. Manufacturers: Subject to compliance with requirements, provide thermometers and thermometer wells by one of the following:
 - 1. Ashcroft Dresser Industries Instrument Div.
 - 2. Marsh Instrument Co., Unit of General Signal.
 - 3. H.O. Trevice Co.
 - 4. Weiss Instruments, Inc.
 - 5. Weksler Instruments Corp.

2.2 TEMPERATURE GAUGE CONNECTOR PLUGS:

- A. Construction: Brass with nickel-plate finish. Provide 1/2" NPT fitting, with self-sealing valve core type neoprene gasketed orifice suitable for inserting 1/8" outside diameter probe assembly from insertion thermometer. Provide gasketed screw cap and chain.

- B. Rating: Provide temperature gauge connector plugs rated for 500 PSI and 200 degrees F.

- C. Extension: Provide extension for insulated piping. Length shall equal insulation thickness.

- D. Manufacturer: Subject to compliance with requirements, provide temperature gauge connector plugs by one of the following:
 - 1. Peterson Engineering Co.
 - 2. Sisco.

2.3 PRESSURE GAUGES AND ACCESSORIES:

- A. General: Provide pressure gauges and accessories designed and constructed for use in service indicated.
- B. Accuracy: Plus or minus 1 percent of range span.
- C. Scale range: Pressure ranges for services listed as follows:
 - 1. Domestic Cold Water: 0 to two times operating pressure.
 - 2. Domestic Hot Water: 0 to two times operating pressure.
- D. Pressure gauges:
 - 1. Type: General use, ASME B40.1, Grade A, phosphor bronze bourdon-tube type, bottom connection.
 - 2. Construction: Drawn steel or brass case, satin faced non-reflective aluminum scale with permanently etched markings, glass lens, 4-1/2" diameter.
 - 3. Movement: Brass or bronze.
 - 4. Connection: 1/4" NPT.
- E. Siphons: 1/4-inch NPT straight coil constructed of brass tubing with threads on each end.
- F. Snubbers: 1/4-inch NPT brass bushing with corrosion-resistant porous metal disc. Disc material shall be suitable for fluid served and rated pressure.
- G. Gauge Cocks: Brass "T" handle, with double female 1/4" NPT connections, rated for 300 PSI WOA (water, oil, air), 150 PSI SWP (steam working pressure).
- H. Manufacturers: Subject to compliance with requirements, provide pressure gauges and accessories by one of the following:
 - 1. Ametek, U.S. Gauge Div.
 - 2. Ashcroft Dresser Industries Instrument Div.
 - 3. Marsh Instrument Co., Unit of General Signal.
 - 4. Marshalltown Instruments, Inc.
 - 5. H.O. Trerice Co.
 - 6. Weiss Instruments, Inc.
 - 7. Weksler Instruments Corp.

2.4 PRESSURE GAUGE CONNECTOR PLUGS:

- A. Construction: Brass or stainless steel. Provide 1/2" NPT fitting, with self-sealing valve core type neoprene gasketed orifice suitable for inserting 1/8" outside diameter probe assembly from insertion pressure gauge. Provide gasketed screw cap and chain.
- B. Rating: Provide temperature gauge connector plugs rated for 500 PSI and 200 degrees F.
- C. Extension: Provide extension for insulated piping. Length shall equal insulation thickness.
- D. Manufacturer: Subject to compliance with requirements, provide pressure gauge connector plugs by one of the following:
 - 1. Peterson Engineering Co.
 - 2. Sisco.

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Specify either needle valves or gauge cocks, but not both.
Needle valves are more expensive, but less prone to leak.

PART 3 - EXECUTION

3.1 INSPECTION:

- A. Examine areas and conditions under which meters and gauges are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.2 INSTALLATION OF TEMPERATURE GAUGES AND ACCESSORIES:

- A. Install thermometers in vertical and tilted positions to allow reading by observer standing on floor.
- B. Install thermometers in the following locations and elsewhere as indicated:
 - 1. At outlet of each domestic water heater.
 - 2. At inlet of each domestic water recirculation pump.
 - 3. At outlet of each tempering valve.
- C. Thermometer Wells: Install in piping tee where thermometers are indicated, in vertical upright position. Fill wells with oil or graphite and secure cap.
- D. Temperature gauge connector plugs: Install in piping tee where indicated, located on pipe at most readable position. Secure cap.

3.3 INSTALLATION OF PRESSURE GAUGES AND ACCESSORIES:

- A. Install pressure gauges in piping tee with pressure gauge valve, located on pipe at most readable position.
- B. Install pressure gauges in the following locations, and elsewhere as indicated:
 - 1. At building water service entrance.
 - 2. At discharge of each pressure-reducing valve.
- C. Pressure Gage Needle Valves: Install in piping tee with snubber.

3.4 ADJUSTING AND CLEANING:

- A. Adjust faces of meters and gauges to proper angle for best visibility. Check each device for proper calibration.
- B. Clean windows and factory-finished surfaces of meters and gauges. Replace cracked or broken windows. Repair scratched or marred surfaces with manufacturer's touch-up paint.

END OF SECTION 220519

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Edit for project requirements.

SECTION 220520
PIPE AND PIPE FITTINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.
- B. The requirements as set forth in Division 22 **Basic Materials and Methods Sections** shall apply to work of this section.

1.2 DESCRIPTION OF WORK:

- A. Extent of pipe, tube, and fittings required by this section is indicated on drawings and/or specified in other Division 22 sections.
- B. Types of pipe, tube, and fittings specified in this section include the following:
 - 1. Steel Pipe and Pipe Fittings.
 - 2. Cast Iron Pipe and Pipe Fittings.
 - 3. Copper Tube and Fittings.
 - 4. Plastic Pipe and Pipe Fittings.
 - 5. Miscellaneous Piping Materials/Products.
- C. Refer to other Division 22 sections for the following:
 - 1. Piping specialties.
- D. Pipe and pipe fittings furnished as part of factory-fabricated equipment are specified as part of equipment assembly in other Division 22 sections.

1.3 QUALITY ASSURANCE:

- A. **Manufacturer's Qualifications:** Firms regularly engaged in manufacturer of pipe and pipe fittings of type and size required, whose products have been in satisfactory use in similar service for not less than 5 years.
- B. **Installer's Qualifications:** Firm with at least 3 years of successful installation experience on projects with piping work similar to that required for project.
- C. **Codes and Standards:**
 - 1. **Welding:** Qualify welding procedures, welders and operators in accordance with ASME B31.1.0 and The American Welding Society Welding Handbook, as applicable, for shop and project site welding of piping work.
 - 2. **Soldering and brazing:** Conform to ANSI B9.1 Standard Safety code for Mechanical Refrigeration.

1.4 SUBMITTALS:

- A. Product Data: Submit manufacturer's technical product data, installation instructions, and dimensioned drawings for each type of pipe and pipe fitting. Submit pipe schedule showing manufacturer, pipe or tube weight, fitting type, and joint type for each piping system.
- B. Maintenance Data: Submit maintenance data and parts lists for each type of mechanical fitting.

1.5 OPERATION AND MAINTENANCE MANUALS:

- A. Include maintenance data, product data, and record drawings in Operation and Maintenance Manuals.

1.6 RECORD DRAWINGS:

- A. Record Drawings: At project closeout, submit record drawings of installed piping and piping products, in accordance with requirements of Division 1 and 22.

1.7 DELIVERY, STORAGE, AND HANDLING:

- A. Except for hub-and-spigot, and similar units of pipe, provide factory-applied plastic end-caps on each length of pipe and tube. Maintain end-caps through shipping, storage and handling to prevent pipe-end damage and eliminate dirt and moisture from inside of pipe and tube.
- B. Where possible, store pipe and tube inside and protected from weather. Where necessary to store outside, elevate above grade and enclose with durable, waterproof wrapping. When stored inside, do not exceed structural capacity of floor. Consult project structural engineer when necessary.
- C. Protect flanges and fittings from moisture and dirt by inside storage and enclosure, or by packing with durable, waterproof wrapping.

PART 2 - PRODUCTS

2.1 GENERAL:

- A. Pipe Materials: Provide pipe and tube of type, joint type, grade, size and weight (wall thickness or Class) indicated for each service. Where type, grade or class is not indicated, provide proper selection as determined by Installer for installation requirements, and comply with governing regulations and industry standards. All below grade ferrous piping shall be coal tar varnished AWWA C203.
- B. Fittings: Provide factory-fabricated fittings of type, materials, grade, class and pressure rating indicated for each service and pipe size. Provide sizes and types matching pipe, tube, valve or equipment connection. Where not otherwise indicated, comply with governing regulations and industry standards for selections, and with pipe manufacturer's recommendations.

2.2 STEEL PIPE AND PIPE FITTINGS:

- A. Black Steel Pipe: ASTM A53 or A106, except comply with ASTM A106 where close coiling or bending is required.
- B. Malleable-Iron Threaded Fittings: ANSI B16.3, plain or galvanized as indicated.

- C. Malleable-Iron Threaded Unions: ANSI B16.39; selected by Installer for proper piping fabrication and service requirements, including style, end connections, and metal-to-metal seats (iron, bronze or brass); plain or galvanized as indicated.
- D. Threaded Pipe Plugs: ANSI B16.14.
- E. Forged-Steel Socket-Welding and Threaded Fittings: ANSI B16.11, except MSS-SP-79 for threaded reducer inserts. Provide fittings rated to match schedule of connected pipe.
- F. Wrought-Steel Butt Welding Fittings: ANSI B16.9, except ANSI B16.28 for short-radius elbows and returns. Provide fittings rated to match connected pipe.
- G. Pipe Nipples: Fabricated from same material as connected pipe, except do not use less than schedule 80 pipe where length remaining unthreaded is less than 1-1/2", and where pipe size is less than 1-1/2", and do not thread nipples full length (no close-nipples).

2.3 CAST-IRON PIPE AND PIPE FITTINGS:

- A. Hubless Cast Iron Soil Pipe: FS WW-P-401. Provide 1 mil Bituminous coating where below grade.
- B. Cast Iron Hub-and-Spigot Soil Pipe: ASTM A 74 (latest edition), Shall bear the collective trademark of CISPI & shall be NSF Certified. Provide 1 mil Bituminous coating where below grade.
- C. Hubless Cast Iron Soil Pipe Fittings: Neoprene gasket complying with CISPI 301 (latest edition), bearing the collective trademark of CISPI and be NSF certified. Type 304 stainless steel clamp holding band (above ground only) in compliance to CISPI 310 & have NSF certification.
- D. Cast Iron Hub-and-Spigot Soil Pipe Fittings: Match soil pipe units. Comply with same standards (ASTM A 74).
- E. Compression Gaskets: ASTM C 564.

2.4 COPPER TUBE AND FITTINGS:

- A. Copper Tube:
 - 1. Copper Tube: ASTM B 88, Type "K", "L", or "M" as indicated for each service, hard-drawn temper, except as otherwise indicated.
 - 2. DWV Copper Tube: ASTM B 306.
 - 3. Wrought-Copper Solder-Joint Fittings: ANSI B16.22.
 - 4. Wrought-Copper Solder-Joint Drainage Fittings: ANSI B16.29.
 - 5. Copper-Tube Unions: Provide standard products recommended by manufacturer for use in service indicated.

2.5 PLASTIC PIPE AND PIPE FITTINGS:

- A. ABS Type DWV Plastic Pipe:
 - 1. ABS Type DWV Pipe: ASTM D 2661.
 - 2. Fittings: ABS DWV Fitting Pattern: ASTM D 3311.
 - 3. Joints: Solvent welded, ASTM D 2255.

2.6 MISCELLANEOUS PIPING MATERIALS/PRODUCTS:

- A. Welding Materials: Except as otherwise indicated, provide welding materials as determined by Installer to comply with installation requirements.
 - 1. Comply with Section II, Part C, ASME Boiler and Pressure Vessel Code for welding materials.
- B. Soldering Materials: Except as otherwise indicated, provide soldering materials as determined by Installer to comply with installation requirements.
- C. Tin-Antimony Solder: ASTM B 32, Grade 95TA.
- D. Brazing Materials: Comply with SFA-5.8, Section II, ASME Boiler and Pressure Vessel Code for brazing filler materials appropriate for the materials being joined.
- E. Piping Connectors for Dissimilar Non-Pressure Pipe:
 - 1. General: Elastomeric annular ring insert, or elastomeric flexible coupling secured at each end with stainless steel clamps, sized for exact fit to pipe ends and subject to approval by plumbing code.
 - 2. Manufacturer: Subject to compliance with requirements, provide piping connectors of the following:
 - a. Fernco, Inc.
 - b. Thunderline
 - c. O-Z/Gedney

PART 3 - EXECUTION

3.1 INSTALLATION:

- A. General: Install pipes and pipe fittings in accordance with recognized industry practices which will achieve permanently leak proof piping systems, capable of performing each indicated service without piping failure. Install each run with minimum joints and couplings, but with adequate and accessible unions for disassembly and maintenance/replacement of valves and equipment. Reduce sizes (where indicated) by use of reducing fittings. Align piping accurately at connections, within 1/16" misalignment tolerance. Comply with ANSI B31 Code for Pressure Piping.
- B. Locate piping runs, except as otherwise indicated, vertically and horizontally (pitched to drain) and avoid diagonal runs wherever possible. Orient horizontal runs parallel with walls and column lines. Locate runs as shown or described by diagrams, details and notations, or if not otherwise indicated, run piping in shortest route which does not obstruct usable space or block access for servicing building and its equipment. Hold piping close to walls, overhead construction, columns and other structural and permanent enclosure elements of building; limit clearance to 1/2" where furring is shown for enclosure or concealment of piping, but allow for insulation thickness, if any. Where possible, locate insulated piping for 1" clearance outside insulation. Wherever possible in finished and occupied spaces, conceal piping from view, by locating in column enclosures, in hollow wall construction or above suspended ceilings; do not encase horizontal runs in solid partitions, except as indicated.
- C. Electrical Equipment Spaces: Do not run piping through transformer rooms and other electronic equipment spaces and enclosures unless unavoidable. Install drip pan under piping that must be run through electrical spaces. Maintain clearances required by code.

3.2 PIPING SYSTEM JOINTS:

- A. General: Provide joints of type indicated in each piping system.
- B. Thread pipe in accordance with ANSI B2.1; cut threads full and clean using sharp dies. Ream threaded ends to remove burrs and restore full inside diameter. Apply pipe joint compound, or pipe joint tape (Teflon) where recommended by pipe/fitting manufacturer, on male threads at each joint and tighten joint to leave not more than 3 threads exposed.
- C. Solder copper tube-and-fitting joints where indicated, in accordance with recognized industry practice. Cut tube ends squarely, ream to full inside diameter, and clean outside of tube ends and inside of fittings. Apply solder flux to joint areas of both tubes and fittings. Insert tube full depth into fitting, and solder in manner which will draw solder full depth and circumference of joint. Wipe excess solder from joint before it hardens.
- D. Hubless Cast Iron Joints: Comply with coupling manufacturer's installation instructions.

3.3 PIPING INSTALLATION:

- A. Install ductile iron water mains and appurtenances in accordance with AWWA C600.
- B. Refer to other Division 22 sections for specific installation requirements.

3.4 CLEANING, FLUSHING, INSPECTING:

- A. Clean exterior surfaces of installed piping systems of superfluous materials, and prepare for application of specified coatings (if any). Flush out piping systems with clean water before proceeding with required tests, or flush as required by other Division 22 sections.
- B. Inspect each run of each system for completion of joints, supports and accessory items.
- C. Inspect pressure piping in accordance with procedures of ASME B31.
- D. Disinfect water mains and water service piping in accordance with AWWA C601.

3.5 PIPING TESTS:

- A. Pressure Piping:
 - 1. General: Provide temporary equipment for testing, including pump and gauges. Test piping system before insulation is installed wherever feasible and remove control devices before testing. Test each section of each piping system independently but do not use piping system valves to isolate sections where test pressure exceeds valve pressure rating. Fill each section with water and pressurize for indicated pressure and time.
 - 2. Required test periods is 2 hours, unless otherwise indicated.
 - 3. Test each piping system at 150% of operating pressure indicated, but not less than 50 PSI test pressure or as required by authority having jurisdiction, unless otherwise indicated.
 - 4. Observe each test section for leakage at end of test period. Test fails if leakage is observed or if pressure drop exceeds 5% of test pressure.
 - 5. Repair piping systems which fail required piping test, by disassembly and re-installation, using new materials to extent required to overcome leakage. Do not use chemicals, stop-leak compounds, mastic, or other temporary repair methods.
 - 6. Drain test water from piping systems after testing and repair work has been completed.
- B. Gravity Piping:

1. Test in accordance with applicable Division 22 sections.

END OF SECTION 220520

SECTION 220523**VALVES****PART 1 - GENERAL****1.1 RELATED DOCUMENTS:**

- A. Drawings and general provisions of contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.
- B. The requirements as set forth in Division 22 **Basic Materials and Methods Sections** shall apply to work of this section.

1.2 DESCRIPTION OF WORK:

- A. Valves required by this section are indicated on the drawings and/or specified in other Division 22 sections.
- B. Types of valves specified in this section include the following:
 - 1. Ball Valves.
 - 2. Plug Valves.
 - 3. Check Valves.
 - 4. Flow Control Valves.
- C. Valves furnished as part of factory fabricated equipment are specified as part of the equipment assembly in other Division 22 sections.

1.3 QUALITY ASSURANCE:

- A. **Manufacturer's Qualifications:** Firms regularly engaged in manufacture of valves, of types and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.
- B. **Codes and Standards:**
 - 1. **Manufactures Standardization Society of the Valve and Fittings Industry (MSS) Compliance:** Mark valves in accordance with MSS-25 "Standard Marking System for Valves, Fittings, Flanges and Unions."
 - 2. **ANSI Compliance:** For face-to-face and end-to-end dimensions of flanged or welded-end valve bodies, comply with ANSI B16.10 "Face-to-face and End-to-end Dimensions of Ferrous Valves."

1.4 SUBMITTALS:

- A. **Product Data:** Submit catalog cut sheets, specifications, installation instructions, and dimensioned drawings for each type of valve. Include pressure drop curve or chart for each type and size of valve.
- B. **Valve Schedule:** Submit schedule showing manufacturer's figure number, size, location, and valve features for each required valve.

- C. Maintenance Data: Submit maintenance data and parts list for each valve.

1.5 OPERATION AND MAINTENANCE MANUALS:

- A. Include product data and maintenance data in Operation and Maintenance Manuals.

1.6 DELIVERY, STORAGE, AND HANDLING:

- A. Prepare valves for shipping as follows:
 1. Ensure valves are dry and internally protected against rust and corrosion.
 2. Protect valve ends against damage to threads, flange faces, and weld-end preps.
 3. Set valves in best position for handling.
 - a. Set ball and plug valves open to minimize exposure of functional surfaces.
 - b. Block swing check valves in either closed or open position.
- B. Storage: Valve end protectors shall not be removed, unless necessary for inspection. Reinstall valve end protectors for storage.
- C. Handling: Use a sling to handle valves whose size requires handling by crane or lift. Rig valves to avoid damage to exposed valve parts. Do not use hand wheels and stems as lifting or rigging points.

PART 2 - PRODUCTS

2.1 GENERAL:

- A. Provide factory fabricated valves recommended by manufacturer for use in service indicated. Provide connections that properly mate with pipe, tube, and equipment connections.
- B. Pressure and Temperature Ratings: Provide valves with pressure and temperature ratings as specified and required to suit system pressures and temperatures.
- C. Valve Identification: Provide valves with manufacturer's name (or trademark) and pressure rating clearly marked on valve body.
- D. Valve Types: Provide valves of same type by same manufacturer.
- E. Sizes: Unless otherwise indicated, provide valves of same size as upstream pipe size.

2.2 BALL VALVES:

- A. General: Provide standard port area except as otherwise noted. Provide blowout proof stem and vinyl covered steel handle.
- B. Extended Stems: Provide extended stems or extended stem kits on valves that are insulated. Valve shall be operable without damaging pipe insulation system.
- C. Ball Valves 2" and smaller:
 1. Construction: Two or three-piece bronze body, full ported, chrome plated brass ball, replaceable "Teflon" or "TFE" seats and seals.
 2. Rating: 150 PSI WSP, 600 PSI WOG.
 3. Connections: Soldered, threaded or press-seal ends to match piping system.

4. Standard Compliance: Bronze or Brass Valves: MSS-SP-110.

D. Ball Valves 2-1/2" and larger:

1. Construction: One piece cast iron or steel body, full ported, hard chrome plated steel ball, replaceable "Teflon" or "TFE" seats and seals.
2. Rating: Class 150.
3. Connections: Flanged.
4. Standard Compliance:
 - a. Cast Iron Valves: MSS-SP-72.
 - b. Steel Valves: ANSI B16.34

E. Service:

1. Domestic water.
2. Pumped waste.

2.3 PLUG VALVES:

A. Plug Valves 2" and smaller:

1. Construction: Bronze body, with straightaway patter, square head operator. Provide one operator wrench for every 10 plug valves installed.
2. Rating: 150 PSI WOG.
3. Connections: Threaded ends to match piping system.

2.4 CHECK VALVES:

A. Swing Check Valves, 2" and smaller:

1. Construction: Cast bronze body and cap, horizontal swing, Y-pattern, and bronze disc. Valves shall be capable of being reground while the valve remains in the line.
2. Rating: Class 125.
3. Connections: Soldered, threaded or press-seal ends to match piping system.
4. Standard Compliance: MSS-SP-80.

B. Lift Check Valves 2" and smaller:

1. Construction: Cast bronze body, in-line lift, replaceable "Teflon" or "TFE" disc and seat, stainless steel spring.
2. Rating: Class 125.
3. Connections: Soldered or threaded ends to match piping system.

C. Service:

1. Domestic water.
2. Pumped waste.

2.5 FLOW CONTROL VALVES:

A. Calibrated Balancing Valves 1/2" to 3":

1. Construction: Provide bronze body, brass ball, brass readout valves, EPDM stem "O" ring, with readout valve caps, calibrated nameplate and memory stop indicator.
2. Rating: 300 PSIG working pressure.
3. Connections: Threaded ends to match piping system.

2.6 MANUFACTURERS:

- A. Provide valves of each type by one manufacturer. Subject to compliance with requirements, provide valves from the following manufacturers:
 - 1. Bell and Gossett; ITT Fluid Handling Division.
 - 2. Conbraco.
 - 3. Crane.
 - 4. Grinnell.
 - 5. Gustin-Bacon; Division of Tyler Pipe.
 - 6. Hammond Valve Corp.
 - 7. Jenkins Bros.
 - 8. Keystone.
 - 9. Lunkenheimer Co.
 - 10. Metraflex.
 - 11. Milwaukee Valve.
 - 12. Nibco.
 - 13. Powell Co.
 - 14. Stockham Valve.
 - 15. Victaulic Company of America.
 - 16. Viega.
 - 17. Watts Regulator.
 - 18. Kitz Corporation of America

PART 3 - EXECUTION

3.1 EXAMINATION:

- A. Examine valve interior through the end ports for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials.
- B. Actuate valve through an open-close and close-open cycle. Examine functionally significant features, such as guides and seats made accessible by such actuation. Following examination, return the valve closure member to the shipping position.
- C. Examine threads on both the valve and the mating pipe for and cleanliness.
- D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Check gasket material for proper size, material composition suitable for service, and freedom from defects and damage.
- E. Prior to valve installation, examine piping for cleanliness, freedom from foreign materials, and proper alignment.
- F. Replace defective valves with new valves.

3.2 INSTALLATION OF VALVES:

- A. General Application: Use ball valves for shut-off duty. Use ball and plug valves for throttling duty. Use flow control valves where balancing valves are indicated on the drawings.
- B. Locate valves for easy access and support pipe at valve so valve does not add stress to the piping system.

- C. Install valves and unions for each fixture and item of equipment arranged to allow equipment removal without system shutdown. Unions are not required on flanged devices.
- D. Install valves in horizontal piping with stem at or above the center of the pipe.
- E. Install valves in a position to allow full stem movement.
- F. Install valves a maximum of 12" above ceiling with nothing between the access point and the valve. Install handle so it is easily seen and accessible from the access point.
- G. Installation of Check Valves: Install for proper direction of flow as follows:
 - 1. Swing Check Valves: Horizontal position with hinge pin level.
 - 2. Lift Check Valves: Stem upright and plumb.

3.3 CONNECTIONS:

- A. Soldered Connections:
 - 1. Remove cap and disc holder of swing check valves having composition discs to prevent damage.
 - 2. Avoid hot spots or overheating valve. Once solder starts cooling, remove excess amounts around joint with cloth or brush.
- B. Threaded Connections: Assemble joint wrench tight. Wrench on valve shall be on the valve end into which the pipe is being threaded.

3.4 FIELD QUALITY CONTROL:

- A. Tests: After piping systems have been tested and placed in service, but before final adjusting and balancing, inspect valves for leaks. Adjust or replace packing to stop leaks. Replace valves if leaks persist.

END OF SECTION 220523

SECTION 220529**SUPPORTS AND ANCHORS****PART 1 - GENERAL****1.1 RELATED DOCUMENTS:**

- A. Drawings and general provisions of contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.
- B. This section is a Division 22 **Basic Materials and Methods Section**, and is part of each Division 22 section making reference to pipes and pipe fittings specified herein.

1.2 DESCRIPTION OF WORK:

- A. The extent of work required by this section includes supports and anchors required for piping and equipment.
- B. Types of supports and anchors specified in this section include the following:
 - 1. Horizontal piping hangers and supports.
 - 2. Vertical piping clamps.
 - 3. Hanger rod attachments.
 - 4. Structural attachments.
 - 5. Anchors.
 - 6. Saddles and shields.
 - 7. Trapeze hangers.
- C. Refer to Division 3 for concrete housekeeping pads.
- D. Refer to Division 7 for installation of roof equipment supports.

1.3 QUALITY ASSURANCE:

- A. Manufacturer's qualifications: Firms regularly engaged in manufacturer of supports and anchors of types and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.
- B. Codes and Standards:
 - 1. Code Compliance: Comply with applicable plumbing codes pertaining to materials and installation of supports and anchors.
 - 2. UL and FM Compliance: Provide UL listed and FM approved products where required by other Division 22 sections.
 - 3. Manufacturer's Standardization Society Compliance:
 - a. Hangers and support components shall be factory fabricated of materials, design, and manufacturer complying with MSS-SP-58.
 - b. Comply with MSS-SP-69 for selection and application of pipe hangers and supports.

1.4 SUBMITTALS:

- A. Product Data: Submit manufacturer's product data and installation instructions for each type of support and anchor.

PART 2 - PRODUCTS

2.1 GENERAL:

- A. Manufacturers:
 - 1. Pipe hangers and supports: Subject to compliance with requirements, provide pipe hangers and supports from one of the following manufacturers:
 - a. B-Line Systems, Inc.
 - b. Grinnell.
 - 2. Trapeze Hangers: Subject to compliance with requirements, provide trapeze hangers from one of the following manufacturers:
 - a. B-Line Systems, Inc.
 - b. Power-strut.
 - c. Unistrut.
 - d. Field fabricated as specified.
- B. Additional pipe hangers and supports selected in accordance with MSS-SP-69 may be used with prior written approval of engineer.
- C. PVC and polypropylene pipe shall be supported with the same type hangers listed for other types of pipe, and as recommended by the pipe manufacturer.

2.2 HANGER RODS:

- A. Carbon steel rod, threaded ends, or continuous thread.
- B. Provide locknut at each connection.

2.3 HORIZONTAL PIPING HANGERS AND SUPPORTS:

- A. General: Select size of hangers and supports to exactly fit pipe size for bare piping, and to exactly fit around piping insulation with saddle or shield for insulated piping. Use only one type of hanger by one manufacturer for each piping service.
- B. Adjustable steel clevis hangers:
 - 1. MSS-SP-69 Type 1.
 - 2. Service:
 - a. Insulated steel, cast iron, or copper pipe.
 - b. Uninsulated steel or cast iron pipe.
- C. Split pipe ring hangers:
 - 1. MSS-SP-69 Type 11 with swivel turnbuckle, MSS-SP-69 type 15.
 - 2. Provide dielectric plastic insert between copper pipe and hanger.
 - 3. Service:
 - a. Uninsulated copper pipe.
- D. Adjustable roller hangers:

1. MSS-SP-69 Type 43.
 2. Service:
 - a. Insulated or uninsulated steel, cast iron, or copper pipe with axial thermal expansion in excess of 1/2".
- E. Pipe saddle supports:
1. MSS-SP-69 Type 36.
 2. Service:
 - a. Insulated or uninsulated steel, cast iron, or copper pipe.
- F. Adjustable pipe saddle supports:
1. MSS-SP-69 Type 38.
 2. Service:
 - a. Insulated or uninsulated steel, cast iron, or copper pipe.
- G. Adjustable pipe roller supports:
1. MSS-SP-69 Type 46.
 2. Service:
 - a. Insulated or uninsulated steel, cast iron, or copper pipe with axial thermal expansion in excess of 1/2".
- H. Spring cushion roll:
1. MSS-SP-69 Type 48 or 49.
 2. Service:
 - a. Pipe runs with thermal expansion in vertical dimension.
- 2.4 VERTICAL PIPING CLAMPS:
- A. General: Select size of vertical piping clamps to exactly fit pipe size of bare piping.
- B. Extension riser clamps:
1. MSS-SP-69 Type 8.
 2. Clamp shall be secured directly to pipe, under any insulation.
 3. Provide plastic coated extension riser clamps for copper pipes.
 4. Service:
 - a. Insulated or uninsulated steel, cast iron, or copper pipe.
- 2.5 HANGER ROD ATTACHMENTS:
- A. General: Select size of hanger rod attachments to suit hanger rods.
- B. Steel Turnbuckles:
1. MSS-SP-69 Type 13.
 2. Provide turnbuckles for adjustment at every hanger.
- C. Malleable Iron Sockets:
1. MSS-SP-69 Type 16.

2.6 STRUCTURAL ATTACHMENTS:

- A. Select size of structural attachments to suit hanger rods.
- B. Malleable iron concrete inserts:
 - 1. MSS-SP-69 Type 18.
 - 2. Service:
 - a. Attachment to reinforced concrete.
- C. Expansion shields and anchors:
 - 1. Self drilling expansion shields and machine bolt expansion anchors. Applied load shall not exceed 25 percent of proof test load.
 - 2. Service:
 - a. Attachment to reinforced concrete of 4" minimum thickness.
- D. C-clamps:
 - 1. MSS-SP-69 Type 23.
 - 2. Service:
 - a. Attachment to bottom flange of structural steel beam.
- E. Top beam C-clamps:
 - 1. MSS-SP-69 Type 19.
 - 2. Service:
 - a. Attachment to top flange of structural steel beam.
- F. Malleable iron beam clamp with extension piece:
 - 1. MSS-SP-69 Type 30.
 - 2. Service:
 - a. Attachment to center of structural steel beam.
- G. Side beam brackets:
 - 1. MSS-SP-69 Type 34.
 - 2. Service:
 - a. Attachment to wood structural members.
- H. Welded steel brackets: Provide one of the following for indicated loading:
 - 1. Light duty: MSS-SP-69 Type 31 (750 lbs.)
 - 2. Medium duty: MSS-SP-69 Type 32 (1500 lbs.)
 - 3. Heavy duty: MSS-SP-69 Type 33 (3000 lbs.)

2.7 ANCHORS:

- A. Anchors shall be field fabricated by welding steel shapes, plates, and bars to piping and to building structure.

2.8 SADDLES AND SHIELDS:

- A. General: Provide factory fabricated saddles or shields under piping hangers and supports for all insulated piping. Size saddles and shields for exact fit to mate with pipe insulation.

B. Steel pipe covering protection saddles:

1. MSS-SP-69 Type 39.

C. Protection shields:

1. MSS-SP-69 Type 40.

2.9 TRAPEZE HANGERS:

A. Trapeze hangers shall be manufacturer's standard products for the application intended.

2.10 EQUIPMENT SUPPORTS:

A. Roof mounted equipment support rails:

1. General: Select style as recommended by support rail manufacturer to conform with roof insulation and construction.
2. Construction: Minimum 18 gauge galvanized steel with integral base plate, continuous welded corner seams, factory installed pressure treated wood nailer, and minimum 18 gauge galvanized steel counterflashing.

2.11 MISCELLANEOUS MATERIALS:

A. Steel plates, shapes, and bars: Comply with ASTM A36.

B. Cement grout: Portland cement, ASTM C150 Type I or Type III, clean uniformly graded, natural sand, ASTM C404, Size No. 2. Mix ratio shall be 1.0 part cement to 3.0 parts sand, by volume, with minimum amount of water required for placement and hydration.

PART 3 - EXECUTION

3.1 INSPECTION:

A. Examine areas and conditions under which supports and anchors are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.2 PREPARATION:

A. Proceed with installation of hangers and supports only after required building structural work has been completed in areas where the work is to be installed.

B. Prior to installation of anchors, Installer shall meet at project site with installers of other work as required to coordinate the installation of concrete inserts.

3.3 INSTALLATION OF HANGERS AND SUPPORTS:

A. General: Provide hangers, supports, clamps and attachments to support piping properly from building structure. Arrange for grouping of parallel runs of horizontal piping supported together on heavy-duty trapeze hangers where possible. Where piping of various sizes is supported together by trapeze hangers, space hangers for smallest pipe size or install intermediate supports for smaller diameter pipe as specified for individual pipe hangers. All

components of each hanger or support shall be sized as recommended by the manufacturer, for the weight encountered.

B. Maximum Spacing:

1. Provide hangers for horizontal piping in accordance with MSS-SP-69 or with the following maximum spacing and minimum rod sizes:

Nominal Pipe Size (Inches)	Steel Pipe Span (Ft)	Copper Pipe Span (Ft)	PVC, ABS, Polypropylene Pipe Span (Ft)*	CPVC Pipe Span (Ft)*	Minimum Rod Diameter (In)
Up to 3/4	7	5	3	3	3/8
1 to 1-1/4	7	6	4	4	3/8
1-1/2 to 2	9	8	4	5	3/8
2-1/2	11	9	6	6	1/2
3	12	10	6	7	1/2
4	14	12	6	7	5/8
5	16	13	6	8	5/8
6	17	14	6	8	3/4
8	19	16	7		7/8
10	22	18	8		7/8
12	23	19	9		7/8

*Based on service temperature less than 100 degrees F.

2. Cast iron and ductile iron piping hanger maximum spacing shall be 12 ft, with at least one hanger for each pipe section. Hangers shall be located adjacent to joints, changes in direction, and branch connections.
3. Support requirements for plastic pipe varies with pipe schedule, temperature, and insulation. Use manufacturer's recommended spans where more stringent.
4. Glass piping hanger maximum spacing shall be 8 ft. If three or more couplings are used within a normal 8 ft. span, use an additional hanger.

C. Vertical Support: Support vertical pipes at each floor.

D. Accessories: Provide hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories. Except as otherwise indicated for exposed continuous pipe runs, install hangers and supports of same type and style as installed for adjacent similar piping.

E. One pipe shall not be suspended from another pipe.

F. Electrolysis prevention: Prevent electrolysis in support of copper tubing by use of hangers and supports which are copper plated, or by manufactured plastic or rubber sleeves. The fire hazard classification of plastic or rubber sleeves used in return air plenums shall not exceed flame spread 25, fuel contribution 50, and smoke developed rating of 50.

G. Provision for movement: Install hangers and supports to allow controlled 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. Provision for adjustment: All pipe hangers and supports shall secure pipe in place, prevent pipe vibration, and shall be capable of adjustment of pipe and elevation after installation. All adjustable members shall be provided with suitable locking features.

- I. Load distribution: Provide hangers and supports so that piping live and dead loading and stresses from movement will not be transmitted to connected equipment.
- J. Pipe slopes: Provide hangers and supports to provide indicated pipe slopes, and so that maximum pipe deflections allowed by ANSI B31.9 are not exceeded.
- K. Insulated piping: Comply with the following installation requirements:
 - 1. Clamps: Attach claps, including spacers, to piping with clamps projecting through insulation. Do not exceed pipe stresses allowed by ANSI B31.9.
 - 2. Protection shields: Install protection shields at each hanger supporting insulated piping.
 - 3. Steel pipe covering protection saddles: Install protection saddles or rigid insulation inserts to prevent deformation of insulation and jacket as follows:
 - a. For pipe size less than 8", install steel pipe covering protection saddle as specified below, or eliminate saddle and provide the following:
 - 1) Hot pipe: Calcium silicate insulation inserts, 180 degree pipe coverage. Maintain insulation vapor barrier.
 - 2) Cold pipe: Urethane insulation inserts, 180 degree pipe coverage. Maintain insulation vapor barrier.
 - b. For pipe size 8" and larger, install steel pipe covering protection saddles. Fill interior voids with segments of insulation matching adjoining insulation. Maintain insulation vapor barrier.

3.4 INSTALLATION OF STRUCTURAL ATTACHMENTS:

- A. Install structural attachments at required locations within concrete or on structural steel for proper piping support.
- B. Space attachments within maximum piping span length indicated in MSS-SP-69.
- C. Install additional building attachments where support is required for additional concentrated loads, including valves, flanges, guides, strainers, expansion joints, and at changes in direction of piping.
- D. Install concrete inserts before concrete is placed. Fasten inserts securely to forms. Where concrete with compressive strength less than 2500 PSI is indicated, install reinforcing bars through openings at top of inserts.

3.5 INSTALLATION OF ANCHORS:

- A. Install anchors at proper locations to prevent stresses from exceeding those permitted by ANSI B31.9, and to prevent transfer of loading and stresses to connected equipment.
- B. Fabricate anchors by welding steel shapes, plates, and bars to piping and to structure. Comply with ANSI B31.9 and with AWS Standards D1.1.

3.6 INSTALLATION OF EQUIPMENT SUPPORTS:

- A. Provide structural steel stands to support equipment not floor mounted or suspended from structure. Construct of structural steel members. Provide factory fabricated tank saddles for tanks mounted on steel stands.
- B. Coordinate with Division 3 for concrete housekeeping pads. Furnish scaled layouts of all required pads. Furnish templates, anchor bolts, and accessories necessary for pad construction.

- C. Furnish equipment supports to Division 7 Contractor for installation.

3.7 METAL FABRICATION:

- A. Cut, drill, and fit miscellaneous metal fabrications for pipe anchors and equipment supports. Install and align fabricated anchors in indicated locations.
- B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.
- C. Field Welding: Comply with AWS D1.1 for procedures of manual shielded metal-arc welding, appearance and quality of welds made, methods used in correcting welding work, 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.
 - 4. Finish welds at exposed connections so that no roughness shows after finishing, and so that contours welded surfaces to match adjacent contours.

3.8 ADJUSTING, PAINTING AND CLEANING:

- A. Hanger adjustment: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
- B. Support adjustment: Provide grout under supports to bring piping and equipment to proper level and elevations.
- C. Painting: Immediately after erection of anchors and supports, clean field welds 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 touch-up of field painted surfaces. For galvanized surfaces, clean welds, bolted connections and abraded areas and apply galvanizing repair paint to comply with ASTM A780.
- D. Cleaning: Clean factory finished surfaces. Repair marred or scratched surfaces with manufacturer's touch-up paint.

END OF SECTION 220529

SECTION 220549
SEISMIC RESTRAINTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.
- B. This section is a Division 22 **Basic Materials and Methods Section**, and is part of each Division 22 section making reference to pipes and pipe fittings specified herein.

1.2 DESCRIPTION OF WORK:

- A. All plumbing equipment and piping shall be supported and restrained in accordance with seismic codes, component manufacturer's standards, and applicable construction standards.
- B. Seismic restraint provided for this project shall keep all plumbing building system components in place during a seismic event.
- C. The work includes, but is not limited to the following:
 - 1. Seismic restraints for vibration isolated equipment.
 - 2. Seismic restraints for non-vibration isolated equipment.
 - 3. Seismic restraints for piping.
 - 4. Certification of seismic restraint designs and installation supervision.
 - 5. Certification of seismic attachment of housekeeping pads.
- D. Types of seismic restraints specified in this Section include the following:
 - 1. Seismic Cable Restraints.
 - 2. Seismic Solid Braces.
 - 3. Seismic Rod Clamps.
 - 4. Clevis Cross Bolt Braces.
 - 5. All-Directional Seismic Snubbers.
 - 6. Horizontal Thrust Restraints.

1.3 DEFINITIONS:

- A. **Positive Attachment:** Positive attachment is defined as a cast-in anchor, a drill-in wedge anchor, a double sided beam clamp loaded perpendicular to the beam, or a welded or bolted connection to structure. Single sided "C" type beam clamps for support rods of overhead piping or any other equipment are not considered to be positive attachments.
- B. **Transverse Bracing:** Restraints applied to limit motion perpendicular to the centerline of a pipe.
- C. **Longitudinal Bracing:** Restraints applied to limit motion parallel to the centerline of a pipe.

1.4 QUALITY ASSURANCE:

- A. Product Qualification: Provide each type of seismic restraint produced by specialized manufacturer, with not less than 5 years successful experience in production of units similar to those required for project.
- B. Seismic Restraint Manufacturer's Responsibility: Manufacturer of seismic control equipment shall determine seismic restraint sizes and locations, and shall provide calculations and materials for restraint of plumbing equipment.
- C. Codes and Standards:
 - 1. Provide seismic restraints in accordance with the Local Building Code, for seismic Zone.

1.5 SUBMITTALS:

- A. Product Data: Submit manufacturer's specifications, detailed drawings, performance data and installation instructions for each type of seismic restraint required.
- B. Shop Drawings: Submit shop drawings showing structural design and details of equipment bases including dimensions, structural member sizes, and support point locations. Where walls, floors, slabs, or supplementary steel work are used for seismic restraint locations, provide details of attachment methods for pipes. Restraint manufacturer's submittal shall include spacing, static loads, and seismic loads at all attachment and support points. Provide specific details of seismic restraints and anchors.
- C. Seismic Certification and Analysis: Submit seismic restraint calculations for all connections of equipment to the structure. Calculations shall be stamped by a registered professional engineer with at least five years of seismic design experience, licensed in the state of the job location.

PART 2 - PRODUCTS

2.1 GENERAL:

- A. Where possible, provide California OSHPD pre-approved seismic devices.

2.2 SEISMIC RESTRAINTS:

- A. Seismic Cable Restraints: Provide galvanized steel aircraft cables sized to resist seismic loads with a minimum safety factor of two and arranged to provide all-directional restraint. Cables shall be pre-stretched to achieve a certified minimum modulus of elasticity. Cable end connections shall be steel assemblies that swivel to final installation angle and utilize two clamping bolts to provide proper cable engagement. Cables shall not be allowed to bend across sharp edges. Cable assemblies shall have anchorage pre-approval "R" number from California OSHPD.
- B. Seismic Solid Braces: Provide steel angles or channels sized to resist seismic loads with a minimum safety factor of two and arranged to provide all directional restraint. End connectors shall be steel assemblies that swivel to the final installation angle and utilize two through bolts to provide proper attachment. Solid brace assemblies shall have anchorage pre-approval "R" number from California OSHPD.
- C. Seismic Rod Clamps: Provide steel angles, sized to prevent buckling, clamped to pipe or equipment support rods utilizing a minimum of three ductile iron clamps at each restraint

location. Rod clamp assemblies shall have an anchorage pre-approval "R" number from California OSHPD.

- D. Clevis Cross Bolt Braces: Provide preformed channels deep enough to be held in place by bolts passing over the cross bolt. Clevis cross bolt braces shall have anchorage pre-approval "R" number from California OSHPD. Provide clevis cross bolt braces at all clevis restraint locations.
- E. All-Directional Seismic Snubbers:
 - 1. Restraining Angle Type: Provide interlocking steel members restrained by a one-piece molded neoprene bushing of bridge bearing neoprene. Bushings shall be replaceable and shall have a minimum thickness of ¼ inch. Rated loadings shall not exceed 1000 PSI. Snubber design shall have a minimum air gap of 1/8 inch in all directions before contact is made between the rigid and resilient surfaces. Snubber end caps shall be removable to allow inspection of internal clearances. Snubbers shall have anchorage pre-approval "R" number from California OSHPD.
 - 2. Bracket Type: Provide interlocking steel members restrained by shock absorbent rubber materials compounded to bridge bearing specifications. Elastomeric materials shall be replaceable, and shall have a minimum thickness of ¾ inch. Rated loadings shall not exceed 1000 PSI. Snubbers shall be manufactured with minimum air gap of 1/8", and maximum air gap of ¼" between hard and resilient material. Snubbers shall have anchorage pre-approval "R" number from California OSHPD.
- F. Horizontal Thrust Restraints: Provide spring element in series with a neoprene molded cup. Spring element shall be field adjustable to allow for maximum of ¼" movement at start and stop. The assembly shall be furnished with one rod and two angle brackets for attachment.
- G. Manufacturer: Subject to compliance with requirements, provide seismic restraints from one of the following:
 - 1. Amber/Booth Company, Inc.
 - 2. Mason Industries, Inc.
 - 3. Vibration Eliminator Co., Inc.

PART 3 - EXECUTION

3.1 GENERAL:

- A. All seismic restrain systems shall be installed in strict accordance with the manufacturer's written instructions and all certified submittal data.
- B. Installation of seismic restraints shall not cause any change of position of equipment or piping that would result in stresses or misalignment.

3.2 SEISMIC RESTRAINT OF EQUIPMENT:

- A. The following equipment shall be seismically restrained:
 - 1. Water heaters.
 - 2. Pumps.

3.3 SEISMIC RESTRAINT OF PIPING:

- A. The following piping shall be seismically restrained:
 - 1. All piping 2-1/2" diameter and larger.
 - 2. Piping 1-1/4" and larger when located in boiler rooms and mechanical/plumbing equipment rooms.
- B. Transverse piping restraints shall be at 40 feet maximum spacing for all pipe sizes, except where lesser spacing is required to limit anchorage loads.
- C. Longitudinal restraints shall be at 80 feet maximum spacing for all pipe sizes, except where lesser spacing is required to limit anchorage loads.
- D. Gas piping and fuel oil piping transverse restraints shall be at 20 feet maximum spacing. Gas piping longitudinal restraints shall be at 40 feet maximum spacing.
- E. Where thermal expansion is a consideration, guides and anchors may be used as transverse and longitudinal restraints provided they have a capacity equal to or greater than the restraint loads in addition to the loads induced by expansion or contraction.
- F. Transverse restraint for one pipe section may also act as a longitudinal restraint for a pipe section of the same size connected perpendicular to it if the restraint is installed within 24 inches of the elbow or tee.
- G. Hold down clamps shall be used to attach pipes to all trapeze members before applying restraints in a manner similar to clevis supports.
- H. Branch lines shall not be used to restrain main lines.

3.4 SEISMIC RESTRAINT EXCLUSIONS:

- A. Exclude seismic restraints on the following piping:
 - 1. Gas piping less than 1" inside diameter.
 - 2. All piping suspended by individual hangers 12 inches or less in length as measured from the top of the pipe to the bottom of the support where the hanger is attached. However, if the 12 inch limit is exceeded by any hanger in the run, seismic bracing is required for the run.

END OF SECTION 220549

**SECTION 220553 –
PLUMBING IDENTIFICATION**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.
- B. This section is a Division 22 **Basic Materials and Methods Section**, and is part of each Division 22 section making reference to pipes and pipe fittings specified herein.

1.2 DESCRIPTION OF WORK:

- A. Extent of work required by this section includes labels and identification tags for plumbing equipment and systems.
- B. Types of identification devices specified in this section include the following:
 - 1. Pipe Markers.
 - 2. Pressure Sensitive Tape.
 - 3. Underground Type Plastic Line Markers.
 - 4. Engraved Plastic Laminate Signs.
 - 5. Ceiling Markers.

1.3 QUALITY ASSURANCE:

- A. Codes and Standards:
 - 1. ANSI Standards: Comply with ANSI A13.1 for lettering size, length of color field, colors, and viewing angles of identification devices.

1.4 SUBMITTALS:

- A. Submit product brochures describing the various types of identification devices required.
- B. Submit schedule of colors and wording for the signs and markers for the various systems and equipment. Terminology shall exactly match contract documents and shall be approved by engineer prior to fabrication.
- C. Submit list of equipment to be provided with ceiling markers.

PART 2 - PRODUCTS

2.1 MANUFACTURERS:

- A. Subject to compliance with requirements, provide plumbing identification products of one of the following:

1. Allen Systems, Inc.
2. W.H. Brady Co.
3. Seton Identification Products.
4. Brimar Industries, Inc.

2.2 PIPE MARKERS:

A. General:

1. Lettering: Manufacturer's standard pre-printed nomenclature that best describes each piping system, as approved by engineer.
2. Weather Resistance: Where pipe markers shall be exposed to the weather, provide products suitable for use in weather.
3. Flow Direction: Provide pipe markers with arrow indicating direction of flow, either integrally with service lettering, as a separate unit of plastic, or printed on pressure sensitive tape.

B. Snap-On Type: Provide manufacturer's standard pre-printed, semi-rigid snap-on, color-coded pipe markers, complying with ANSI A13.1.

C. Pressure-Sensitive Type: Provide manufacturer's standard pre-printed, permanent adhesive, color-coded, pressure-sensitive vinyl pipe markers, complying with ANSI A13. Each end of the marker shall be secured to the pipe with one complete wrapping of pressure-sensitive tape.

2.3 PRESSURE-SENSITIVE TAPE:

A. Provide manufacturer's standard color-coded pressure-sensitive (self-adhesive) vinyl tape, not less than 3 mils thick, minimum of 1-1/2" wide.

B. Color shall match color of pipe markers.

2.4 UNDERGROUND-TYPE PLASTIC LINE MARKERS:

A. General: Provide manufacturer's standard permanent, bright-colored, continuous-printed plastic tape, intended for direct-burial service.

B. Construction: Multi-ply tape consisting of solid aluminum foil core between 2-layers of polyethylene tape, not less than 6" wide x 4 mils thick.

C. Terminology: Provide tape with printing which most accurately indicates the type of service of buried pipe, as approved by the engineer.

2.5 ENGRAVED PLASTIC-LAMINATE SIGNS:

A. General: Provide engraving stock melamine plastic laminate, complying with Fed. Spec. L-P-387, black lettering in white field, engraver's standard letter style, 1/2" high lettering on 1-1/2" high sign (single line) and 2" high sign (two lines). Secondary lettering, when required, shall be 2/3 to 3/4 of principal lettering size. Signs shall be punched for mechanical fastening, except where adhesive mounting is required.

B. Terminology: Terminology shall exactly match contract documents and shall be approved by engineer prior to fabrication.

C. Thickness: 1/16" for units up to 20 square inches or 8" length; 1/8" for larger units.

- D. Fasteners: Self-tapping stainless steel screws.
- E. Adhesives: Plastic laminate label manufacturer's standard pressure sensitive adhesive backing.

2.6 CEILING MARKERS:

- A. Paper dot, self-adhesive, 3/4 inch diameter, yellow in color.
- B. Ceiling tacks, 7/8 inch diameter head, 1/2" steel point, yellow in color.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS:

- A. Coordination: Where identification is to be applied to surfaces which require insulation, painting or other covering or finish, install identification after completion of covering and painting.
- B. Visibility: All plumbing identification signs and markers shall be easily visible and legible. Division 22 shall relocate signs or markers that become visually blocked by work of others.

3.2 PIPING SYSTEM IDENTIFICATION:

- A. Provide pipe markers and flow arrows of one of the types specified for all systems. Provide only one type of marker for all systems.
- B. Provide piping identification wherever piping is exposed to view in mechanical/plumbing rooms, accessible maintenance spaces (shafts, tunnels, plenums) and exterior non- concealed locations. Locate pipe markers and color bands as follows:
 - 1. Near each valve and control device.
 - 2. Near each branch, excluding short take-offs for fixtures. Mark each pipe at branch, where there could be question of flow pattern.
 - 3. Near locations where pipes pass through walls, floors, ceilings, or enter non-accessible enclosures.
 - 4. At access doors, manholes and similar access points that permit view of concealed piping.
 - 5. Near major equipment items and other points of origination and termination.
 - 6. At 25 foot intervals on long runs.
 - 7. On piping above removable acoustical ceilings.
 - 8. On acoustical ceilings tile/grid for any of the above items.

3.3 UNDERGROUND PIPING IDENTIFICATION:

- A. During back-fill of each exterior underground piping system, provide continuous underground-type plastic line markers, located directly over buried line at 6" to 8" below finished grade. Where multiple small lines are buried in common trench and do not exceed overall width of 16", provide single line marker.

3.4 PLUMBING EQUIPMENT IDENTIFICATION:

- A. Provide engraved plastic laminate label on each major item of plumbing equipment, each operational device, and on all other devices required by the engineer.

B. Provide signs to inform operator of operational requirements, to indicate safety and emergency precautions, and to warn of hazards and improper operations.

C. Terminology:

1. Domestic water heaters: WH-1, WH-2, etc.
2. Domestic water boilers: B-1, B-2, etc.
3. Expansion tanks: ET-1, ET-2, etc.
4. Plumbing pumps: P-1, P-2, etc.
5. Grease interceptors: GI-1, GI-2, etc.

3.5 EQUIPMENT ABOVE CEILING:

A. Provide ceiling markers on the one lay-in ceiling tile that should be removed for access to equipment above the ceiling. Locate marker in far right corner of ceiling tile or on grid with an arrow pointing toward the equipment.

END OF SECTION 220533

**SECTION 220719
PLUMBING INSULATION**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.
- B. The requirements as set forth in Division 22 **Basic Materials and Methods Sections** shall apply to work of this section.

1.2 DESCRIPTION OF WORK:

- A. Extent of work by this section includes insulation for the various plumbing systems and equipment.
- B. Types of plumbing insulation specified in this section include the following:
 - 1. Piping System Insulation:
 - a. Fiberglass Insulation.
 - b. Flexible Unicellular Insulation.
 - c. Self-adhesive waterproofing membrane.
 - d. Underground pipe insulation protection system.
 - 2. Equipment Insulation:
 - a. Fiberglass Insulation.
 - b. Flexible Unicellular Insulation.
 - 3. Insulation accessories.
 - 4. Protective Covers:
 - a. Fitting covers.
 - b. Protective jackets.
- C. Refer to other Division 22 Sections for pipe shields and saddles.

1.3 QUALITY ASSURANCE:

- A. Installers Qualifications: Firm with at least 5 years successful installation experience on projects with plumbing insulation similar to that required for this project.
- B. Flame/Smoke Ratings: All materials used for plumbing insulation including insulation, jackets, coverings, sealers, mastics and adhesives, etc. shall have a flame-spread index of not more than 25 and a smoke-developed index not exceeding 50, as tested by ASTM E 84 (NFPA 255) method.

1.4 SUBMITTALS:

- A. Product Data: Submit manufacturer's specifications and installation instructions for each type of plumbing insulation.
- B. Submit schedule showing manufacturer's product number, thickness, and furnished accessories for each plumbing system requiring insulation.

1.5 DELIVERY, STORAGE, AND HANDLING:

- A. Deliver insulation, coverings, cements, adhesives, and coatings to site in containers with manufacturer's stamp or label affixed showing fire hazard ratings of products.
- B. Protect insulation against dirt, water, chemical and plumbing damage. Do not install damaged insulation. Remove damaged insulation from project site.

PART 2 - PRODUCTS

2.1 PIPING SYSTEM INSULATION:

- A. Fiberglass Pipe Insulation:
 - 1. Rigid, one-piece fiber glass pipe insulation, complying with requirements of ASTM C 547; with a factory applied white kraft bonded to aluminum foil, reinforced with fiberglass yarn vapor jacket with self-sealing adhesive lap longitudinal joints and butt strips for transverse joints. Jacketing shall conform to ASTM C 1136, Type I, and shall have a maximum vapor transmission rating of 0.02 perm when tested according to ASTM E 96, Procedure A. Thermal conductivity (K value) shall not exceed 0.25 BTU/in./hr. •ft²•°F at 75°F mean temperature with a minimum R-value of R4, and insulation and jacket shall be rated for operating temperatures up to 850°F. Provide insulation thickness as indicated.
 - 2. Fittings: Insulation shall be preformed for fitting or fabricated from cut to fit strips of fiberglass. Field cut strips shall be secured in place with adhesive as recommended by the manufacturer.
 - 3. Manufacturers: Subject to compliance with requirements, provide fiberglass pipe insulation from one of the following:
 - a. Certainteed Corp.
 - b. Knauf Fiber Glass.
 - c. Owens-Corning Fiberglass Corp.
 - d. Johns Manville Corp.
 - 4. Service:
 - a. Cold piping systems:
 - 1) Domestic cold water piping 1" pipe size and smaller: ½" thickness.
 - 2) Domestic cold water piping 1¼" to 2" pipe size: ¾" thickness.
 - 3) Domestic cold water piping 2½" pipe size and larger: 1" thickness.
 - 4) Plumbing vent piping within 6 lineal feet of roof outlet: 1" thickness.
 - 5) Storm drains piping: 1" thickness.
 - 6) Overflow Storm drain piping: 1" thickness.
 - 7) Condensate drains piping: ½" thickness.
 - b. Hot piping systems:
 - 1) Domestic hot water piping 2" pipe size and smaller: 1" thickness.
 - 2) Domestic hot water piping 2½" pipe size and larger: 1½" thickness.
- B. Flexible Unicellular Pipe Insulation:
 - 1. Flexible, one-piece expanded closed-cell elastomeric pipe insulation, complying with requirements of ASTM C 518, with a maximum vapor transmission rating of 0.10 perm-in. when tested in accordance with ASTM E 96. Thermal conductivity (K value) shall not exceed 0.27 BTU/in./hr. •ft²•°F at 75°F mean temperature with a minimum R-value of R3.7, and insulation and jacket shall be rated for operating temperatures from -20°F to 220°F. Provide insulation thickness as indicated.

2. Flexible, one-piece expanded closed-cell elastomeric pipe insulation, self sealing, with a maximum vapor transmission rating of 0.20 perm-in. when tested in accordance with ASTM E 96. Thermal conductivity (K value) shall not exceed 0.27 BTU/in./hr. •ft²•°F at 75°F mean temperature with a minimum R-value of R3.7, and insulation and jacket shall be rated for operating temperatures from 40°F to 180°F. Provide insulation thickness as indicated.
 3. Manufacturers: Subject to compliance with requirements, provide flexible unicellular pipe insulation from one of the following:
 - a. Armstrong World Industries, Inc.
 - b. IMCOA.
 - c. Rubatex Corporation.
 4. Service:
 - a. Cold piping systems:
 - 1) Domestic cold water piping 2" and smaller: ½" thickness, self-sealing type.
 - 2) Condensate drain piping: ½" thickness.
 - b. Hot piping systems:
 - 1) Domestic hot water piping 2" and smaller: ½" thickness, self-sealing type.
 - c. Waste and water piping beneath handicapped lavatories
 - 1) Same as 4a and 4b above.
 - 2) Sanitary piping 2" and smaller: ½" thickness.
- C. Self adhesive waterproofing membrane:
1. Rubberized bitumen adhesive laminated to minimum 0.010 inch thick polyethylene film, for total membrane thickness of 0.050 inches. Permeance shall not exceed 0.015 perms when tested in accordance with ASTM E 96 (Method B).
 2. Manufacturers: Subject to compliance with requirements, provide self adhesive waterproofing membrane materials from one of the following:
 - a. Polyguard Products, Inc. (Insulrap 50)
 3. Service:
 - a. Insulated piping buried underground.
- D. Underground pipe insulation protection system:
1. Provide high strength, highly puncture resistant synthetic fiber fabric protection system. Impact resistance shall exceed 25 inch-lbs, when tested in accordance with ASTM G 14. Penetration shall be less than 72% compression when tested in accordance with ASTM G 17. Minimum fabric weight shall be 10 oz./square yard.
 2. Manufacturers: Subject to compliance with requirements, provide underground pipe insulation protection system from one of the following:
 - a. Polyguard Products, Inc. (Insulshield)
 3. Service:
 - a. Insulated piping buried underground.

2.2 EQUIPMENT INSULATION:

- A. Rigid Fiberglass Insulation:
1. Rigid board-type insulation composed of glass fibers bonded together with a thermosetting resin, complying with requirements of ASTM C 612 and ASTM C 795, 3.0 PCF density, with factory applied kraft bonded to aluminum foil, reinforced with fiber glass yarn vapor jacket with 2" wide stapling and taping tab on one edge. Jacketing shall conform to ASTM C 1136, Type II (1.0 PCF density), and shall have a maximum vapor transmission rating of 0.02 perm when tested according to ASTM E 96, Procedure A. Provide insulation thickness as indicated.

2. Manufacturers: Subject to compliance with requirements, provide rigid fiberglass insulation from one of the following:
 - a. Certainteed Corp.
 - b. Knauf Fiber Glass.
 - c. Owens-Corning Fiberglass Corp.
 - d. Johns Manville Corp.
3. Service:
 - a. Storage tanks: 2" thickness.

2.3 INSULATION ACCESSORIES:

- A. Provide staples, bands, screws, wire, wire netting, tape, corner angles, anchors, and stud pins as recommended by insulation manufacturer for application.
- B. Provide adhesives, cement, sealers, and protective finishes as recommended by insulation manufacturer for application.
- C. Insulation Inserts: 12" long high density rigid polyurethane, 125 PSI compressive strength pipe insulation, covering bottom 180 degrees of pipe, same thickness as adjoining pipe insulation. Vapor barrier and jacket shall be maintained continuously through the hanger.

2.4 PROTECTIVE COVERS:

- A. PVC Jacket System:
 1. Jacket: Provide high impact, UV-resistant polyvinyl chloride covering, 0.030 inch thickness.
 2. Fitting Covers: Provide pre-molded one piece UV-resistant polyvinyl chloride fitting covers.
 3. Manufacturers: Subject to compliance with requirements, provide PVC jacket systems from one of the following:
 - a. Proto PVC Corporation (Proto LoSmoke PVC).
 - b. Johns Manville Corp. (Zeston 2000 PVC).
 4. Service:
 - a. Pipe fittings located indoors.
 - b. Pipe and pipe fittings located outdoors.
- B. Adhesive Backed Aluminum Jacket/Vapor Barrier System:
 1. Provide adhesive backed aluminum jacket/vapor barrier system. Jacket shall have rubberized bitumen adhesive laminated to high-density polyethylene reinforcement, with stucco embossed aluminum weathering surface. Total product thickness shall be minimum 0.060 inches. Permeance shall not exceed 0.014 perms when tested in accordance with ASTM E 96 (Method B).
 2. Manufacturers: Subject to compliance with requirements, provide adhesive backed aluminum jacket system from one of the following:
 - a. Polyguard Products, Inc. (Alumaguard 60).
 - b. MFM Building Products Corp. (Flex-Clad 400).
 3. Service:
 - a. Pipe and pipe fittings located outdoors.
- C. Aluminum Jacket System:
 1. Jacket: Manufactured from 1100, 3003, 3105, or 5005 aluminum alloy, option for 0.02" thick, integrally bonded moisture barrier of polyethylene film and 40 pound kraft paper, stucco embossed pattern.

2. Fitting Covers: Pre-molded aluminum fitting covers to match jacket.
 3. Manufacturers: Subject to compliance with requirements, provide aluminum jacket systems from one of the following:
 - a. Childers Products Company, Inc.
 - b. Pabco, Division of Fibreboard Corporation.
 4. Service:
 - a. Pipe and pipe fittings located outdoors.
- D. Jacketing Material for Equipment Insulation: Provide pre-sized glass cloth jacketing material, not less than 7.8 ounces per square yard, or aluminum jacket system.

PART 3 - EXECUTION

3.1 GENERAL:

- A. Install insulation products in accordance with manufacturer's written installation instructions, and in accordance with recognized industry practices to ensure that insulation serves its intended purpose.

3.2 INSTALLATION OF PIPING INSULATION:

- A. Insulation Omitted: Omit insulation at the following locations:
1. Exposed plumbing fixture run-outs from faces of wall or floor to fixture.
 2. Unions, flanges, strainers, flexible connections, and expansion joints, on hot piping.
- B. Install insulation on pipe systems subsequent to installation of heat tracing, testing, and acceptance of tests.
- C. Install insulation materials with smooth and even surfaces. Insulate each continuous run of piping with full-length units of insulation, with a single cut piece to complete run. Do not use cut pieces or scraps abutting each other.
- D. Clean and dry pipe surfaces prior to insulating. Butt insulation joints firmly together to ensure a complete and tight fit over surfaces to be covered.
- E. Maintain integrity of vapor-barrier jackets and protect to prevent puncture or other damage.
- F. Cover valves, fittings and similar items in each piping system with equivalent thickness and composition of insulation as applied to adjoining pipe run. Install factory molded, precut or job fabricated units as required.
- G. Extend piping insulation without interruption through walls, floors and similar piping penetrations, except where otherwise indicated.
- H. Apply wet coat of vapor barrier lap cement on exposed ends of insulation. The vapor barrier at butt joints between pieces of insulation shall be maintained by sealing with a vapor barrier tape or band, etc, as recommended by the manufacturer.
- I. Provide insulation inserts at each pipe support location, and elsewhere as required to prevent compression of insulation.
- J. Pipe supports on vertical risers that penetrate insulation shall be insulated and covered with a vapor barrier as required to match pipe insulation.

3.3 INSTALLATION OF EQUIPMENT INSULATION:

- A. Install insulation materials with smooth and even surfaces and on clean and dry surfaces. Redo poorly fitted joints. Do not use mastic or joint sealer as filler for gapping joints and excessive voids resulting from poor workmanship.
- B. Maintain integrity of vapor-barrier on equipment insulation and protect it to prevent puncture and other damage.
- C. Do not apply insulation to equipment while hot.
- D. Apply insulation using the staggered joint method for both single and double layer construction, where feasible. Apply each layer of insulation separately.
- E. Coat insulated surfaces with layer of insulating cement, leaving a smooth continuous surface. Fill in scored block, seams, chipped edges and depressions, and cover wire netting and joints with cement of sufficient thickness to remove surface irregularities.
- F. Insulated surfaces shall be covered with all-service jacket neatly fitted and firmly secured. Lap seams at least 2". Apply over vapor barrier where applicable.

3.4 INSTALLATION OF PROTECTIVE COVERS:

- A. Install over piping insulation located outdoors, in accordance with industry practice and manufacturer's instructions. Overlap joints and make watertight.

3.5 PROTECTION AND REPLACEMENT:

- A. Protection: Advise others of required protection for insulation work during remainder of construction period, to avoid damage and deterioration.
- B. Replacement: Replace damaged insulation that cannot be repaired satisfactorily, including units with vapor barrier damage and moisture saturated units.

END OF SECTION 220719

SECTION 221116
DOMESTIC WATER SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.
- B. The requirements as set forth in Division 22 **Basic Materials and Methods Sections** shall apply to work of this section.

1.2 DESCRIPTION OF WORK:

- A. Extent of domestic water systems work is indicated on drawings, and by requirements of this section.
- B. Refer to other Division 22 sections for the following work:
 - 1. Pipe and Pipe Fittings for domestic water systems.
 - 2. Piping Specialties for domestic water systems.
 - 3. Valves for domestic water systems.
 - 4. Supports and Anchors for domestic water systems.
 - 5. Plumbing Identification for domestic water systems.
 - 6. Plumbing Insulation for domestic water systems.

1.3 QUALITY ASSURANCE:

- A. **Manufacturer's Qualifications:** Firms regularly engaged in manufacture of domestic water systems products of types, materials, and size required, whose products have been in satisfactory use in similar service for not less than 5 years.
- B. **Installer's Qualifications:** Firm with at least 3 years of successful installation experience on projects with domestic water systems work similar to that required for project.
- C. **Codes and Standards:**
 - 1. **Code Compliance:** Fabricate and install domestic water systems in accordance with applicable state and local building codes.

1.4 SUBMITTALS:

- A. **Product Data:** Submit manufacturer's technical product data and installation instructions for domestic water systems materials and products.

1.5 OPERATION AND MAINTENANCE MANUALS:

- A. Include product data in Operation and Maintenance Manuals.

1.6 RECORD DRAWINGS:

- A. At project closeout, submit record drawings of installed domestic water systems, in accordance with requirements of Division 1 and 22.

PART 2 - PRODUCTS

2.1 DOMESTIC WATER PIPES AND PIPE FITTINGS:

- A. General: Provide pipe and pipe fittings complying with Division 22 **Basic Materials and Methods Sections**, in accordance with the following listing.
- B. Interior Domestic Water Piping Above Grade:
 - 1. Copper tube and fittings, Type L, hard-temper, fittings, wrought-copper solder-joints, press seal fittings, pipe sizes 4" and smaller.
- C. Interior Domestic Water Piping Below Grade:
 - 1. Copper tube and fittings, Type K, soft-annealed temper, fittings, wrought-copper, solder-joints, press seal fittings, sizes 4" and smaller.
 - 2. Ductile-iron pipe with cement-mortar lining, allowed for pipe sizes 3" and larger. Provide ductile iron fittings with rubber gasket joints, Class 50 for pipe sizes 4" and smaller, Class 51 for pipe sizes 6" and larger.

2.2 SUPPORTS AND ANCHORS:

- A. General: Provide supports and anchors complying with Division 22 **Basic Materials and Methods Sections**, in accordance with the following listing.
- B. Horizontal piping hangers and supports: Adjustable steel clevis hangers, steel pipe clamps, and pipe saddle supports.
- C. Vertical piping supports: Two-bolt riser clamps.
- D. Building attachments: Concrete inserts, C-clamps, and steel brackets.

2.3 VALVES:

- A. General: Provide valves complying with Division 22 **Basic Materials and Methods Sections**, in accordance with the following listing.
- B. Sectional and/or Shutoff Valves: Ball valves.
- C. Check Valves: Swing check valves.
- D. Drain Valves: Ball valves.

2.4 DOMESTIC WATER PIPING PRODUCTS:

- A. Balancing Cocks:
 - 1. Class 125, bronze body, bronze plug, screwdriver operated, straight or angle pattern, threaded or soldered ends.

2. Manufacturers: Subject to compliance with requirements, provide balancing cocks from one of the following:
 - a. Hammond Valve Corporation.
 - b. Milwaukee Valve Company, Inc.
 - c. Nibco, Inc.
 - d. Stockham Valves and Fittings, Inc.
- B. Hose Bibbs: Bronze body, renewable composition disc, tee handle, $\frac{3}{4}$ " NPT inlet, $\frac{3}{4}$ " hose outlet.
 1. Manufacturers: Subject to compliance with requirements, provide hose bibbs from one of the following:
 - a. Josam Manufacturing Co.
 - b. Wade/Tyler Drainage Products
 - c. Zurn Industries, Inc; Wilkins Division.
- C. Wall Hydrants: Bronze body, renewable composition disc, key operated, $\frac{3}{4}$ " NPT inlet or solder inlet, $\frac{3}{4}$ " hose outlet.
 1. Manufacturers: Subject to compliance with requirements, provide wall hydrants from one of the following:
 - a. Josam Manufacturing Co.
 - b. Wade/Tyler Drainage Products
 - c. Zurn Industries, Inc; Wilkins Division.
- D. Hose Connection Vacuum Breakers:
 1. Conform to ASSE Standard 1011, with finish to match hose connection.
 2. Manufacturers: Subject to compliance with requirements, provide hose connection vacuum breakers from one of the following:
 - a. A.W. Cash Valve Manufacturing Corporation.
 - b. Conbraco Industries, Inc.
 - c. Watts Industries, Inc.
- E. Pressure Regulating Valves:
 1. Provide single seated direct operated type, bronze body, integral strainer, complying with requirements of ASSE Standard 1003. Size for maximum flow rate and inlet and outlet pressures indicated on drawings, or as required for equipment furnished.
 2. Manufacturers: Subject to compliance with requirements, provide pressure regulating valves from one of the following:
 - a. A.W. Cash Valve Manufacturing Corporation.
 - b. Cla-Val.
 - c. Spence Engineering Co., Inc.
 - d. Watts Industries, Inc.
 - e. Zurn Industries, Inc; Wilkins Division.
- F. Combined Pressure/Temperature Relief Valves:
 1. Bronze body, test lever, thermostat, listing requirements for temperature discharge capacity. Provide temperature relief at 210°F, and pressure relief at 150 PSI.
 2. Manufacturers: Subject to compliance with requirements, provide pressure regulating valves from one of the following:
 - a. A.W. Cash Valve Manufacturing Corporation.
 - b. Conbraco Industries, Inc.
 - c. Watts Industries, Inc.

d. Zurn Industries, Inc; Wilkins Division.

G. Backflow Preventers:

1. Provide reduced pressure or double check type backflow preventers consisting of assembly including shutoff valves on inlet and outlet, and strainer on inlet. Assemblies shall include test cocks and pressure-differential relief valve located between two positive seating check valves. Comply with ASSE Standard 1013.
2. Manufacturers: Subject to compliance with requirements and water utility approval, provide backflow preventers from one of the following:
 - a. Febco.
 - b. Watts Industries, Inc.
 - c. Zurn Industries, Inc; Wilkins Division.

PART 3 - EXECUTION

3.1 INSTALLATION OF DOMESTIC WATER PIPING:

- A. Install piping level with no pitch. Locate groups of pipes parallel to each other, spaced to permit application of insulation and servicing of valves.

3.2 INSTALLATION OF EXTERIOR WATER PIPING:

- A. Water Service Piping: Extend water service piping of size and in location indicated to water service entrance at building. Provide sleeve in foundation wall for water service entry. Seal building penetration watertight. Provide shutoff valve, y-strainer, pressure reducing valve where inlet pressure exceeds 80 PSI, pressure gauge, and test tee with valve at water service entry inside building.

3.3 INSTALLATION OF VALVES:

- A. Sectional Valves: Install on each branch and riser, close to main, where branch or riser serves two or more plumbing fixtures or equipment connections, and elsewhere as indicated.
- B. Shutoff Valves: Install on inlet of each plumbing equipment item, and on inlet of each plumbing fixture, and elsewhere as indicated.
- C. Check Valves: Install on discharge side of each pump, and elsewhere as indicated.
- D. Balance Cocks: Install in each hot water recirculating loop, and elsewhere as indicated.
- E. Hose Bibbs: Install on exposed piping where indicated, with vacuum breaker.
- F. Wall Hydrants: Install on concealed piping where indicated, with vacuum breaker.

3.4 INSTALLATION OF BACKFLOW PREVENTION DEVICES:

- A. Install backflow prevention devices where indicated, and where required by authority having jurisdiction.
- B. Pipe relief outlet to nearest floor drain, or exterior of building.

3.5 INSTALLATION OF PRESSURE REGULATING VALVES:

- A. Install pressure regulating valves where indicated. Provide inlet and outlet shutoff valves, and globe valve bypass. Provide pressure gauge on valve outlet.

3.6 FIXTURE AND EQUIPMENT CONNECTIONS:

- A. Fixture Connections: Provide hot and cold water piping runouts to fixtures of sizes indicated, but in no case smaller than required by authority having jurisdiction.
- B. Plumbing Equipment Connections: Provide water piping systems to plumbing equipment as indicated, and comply with equipment manufacturer's installation instructions. Provide shutoff valve and union for each connection. Provide drain valve on drain connection.

3.7 FIELD QUALITY CONTROL:

- A. Piping Tests: Test potable water piping in accordance with testing requirements of Division 22 **Basic Materials and Methods Sections**, and as listed below.
 - 1. Test all new, altered, extended, replaced, or repaired water distribution piping for leaks and defects. If testing is performed in segments, submit a separate report for each test, complete with a diagram of the portion of the system tested.
 - 2. Leave all new, altered, extended, replaced, or repaired water distribution piping uncovered and unconcealed until it has been tested and approved.
 - 3. Cap system and subject the piping system to a static water pressure of 50 PSIG above the operating pressure, without exceeding the pressure rating of the piping system materials. Isolate the test source and allow to stand for 2 hours. Leaks or loss of test pressure constitute defects that must be repaired.
 - 4. Repair all leaks and defects with new materials and retest system until satisfactory results are obtained.
- B. Test Reports: Prepare reports for all piping tests. Include required corrective action in reports.

3.8 ADJUSTING AND CLEANING:

- A. Cleaning, Flushing, and Inspection: Clean, flush, and inspect domestic water systems in accordance with requirements of Division 22 **Basic Materials and Methods Sections**, and as listed below:
 - 1. Purge all water distribution piping systems and parts of existing systems that have been altered, extended, or repaired prior to use.
 - 2. Use the purging and disinfecting procedure prescribed by the authority having jurisdiction. If the authority having jurisdiction does not prescribe the procedure, use the procedure described in either AWWA C651, or AWWA C652, or as described below.
 - a. Flush the piping system with clean, potable water until dirty water does not appear at the points of outlets.
 - b. Fill the system or part thereof with a water/chlorine solution containing at least 50 parts per million of chlorine. Isolation (valve off) the system or part thereof and allow to stand for 24 hours.
 - c. Drain the system or part thereof of the previous solution and refill with a water/chlorine solution containing at least 200 parts per million of chlorine and isolate and allow to stand for 3 hours.
 - d. Following the allowed standing time, flush the system with clean, potable water until system water is free of chlorine.
- B. Water Samples: Submit water samples in sterile bottles to the authority having jurisdiction. Repeat cleaning procedure if the biological examination made by the authority shows evidence of contamination.

- C. Reports: Prepare reports for all purging and disinfecting activities.

END OF SECTION 221116

SECTION 221316**SANITARY DRAINAGE AND VENT SYSTEMS****PART 1 - GENERAL****1.1 RELATED DOCUMENTS:**

- A. Drawings and general provisions of contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.
- B. The requirements as set forth in Division 22 **Basic Materials and Methods Sections** shall apply to work of this section.

1.2 DESCRIPTION OF WORK:

- A. Extent of sanitary drainage and vent systems work is indicated on drawings, and by requirements of this section.
- B. Refer to other Division 22 sections for the following work:
 - 1. Pipe and Pipe Fittings for sanitary drainage and vent systems.
 - 2. Supports and Anchors for sanitary drainage and vent systems.
 - 3. Plumbing Identification of sanitary drainage and vent systems.
 - 4. Insulation of condensate drain piping.

1.3 QUALITY ASSURANCE:

- A. **Manufacturer's Qualifications:** Firms regularly engaged in manufacture of sanitary drainage and vent systems products of types, materials, and size required, whose products have been in satisfactory use in similar service for not less than 5 years.
- B. **Installer's Qualifications:** Firm with at least 3 years of successful installation experience on projects with sanitary drainage and vent systems work similar to that required for project.
- C. **Codes and Standards:**
 - 1. **Code Compliance:** Fabricate and install sanitary drainage and vent systems in accordance with applicable state and local building codes.

1.4 SUBMITTALS:

- A. **Product Data:** Submit manufacturer's technical product data and installation instructions for sanitary drainage and vent systems materials and products.

1.5 OPERATION AND MAINTENANCE MANUALS:

- A. Include product data in Operation and Maintenance Manuals.

1.6 RECORD DRAWINGS:

- A. At project closeout, submit record drawings of installed sanitary drainage and vent systems, in accordance with requirements of Division 1 and 22.

PART 2 - PRODUCTS

2.1 SANITARY DRAINAGE AND VENT PIPES AND PIPE FITTINGS:

- A. General: Provide pipe and pipe fittings complying with Division 22 **Basic Materials and Methods Sections**, in accordance with the following listing.
- B. Interior Sanitary Drainage and Vent Piping Above Grade:
 - 1. Cast-iron soil pipe, service weight, hubless soil pipe fittings and joints, pipe sizes 10" and smaller.
 - 2. Cast-iron hub-and-spigot soil pipe, service weight, hub-and-spigot fittings, compression gasket joints, pipe sizes 15" and smaller.
 - 3. Copper tubing with cast-bronze drainage pattern fittings and solder joints, pipe sizes 6" and smaller.
- C. Interior Sanitary Drainage and Vent Piping Below Grade:
 - 1. Cast-iron hub-and-spigot soil pipe, service weight, hub-and-spigot fittings, compression gasket joints, pipe sizes 15" and smaller.
 - 2. PVC plastic sewer pipe and fittings with solvent cemented joints, pipe sizes 6" and smaller, where allowed by code. (Limited to structures not exceeding three floors above grade).
- D. Exterior Sanitary Drainage and Vent Piping Below Grade:
 - 1. Cast-iron hub-and-spigot soil pipe, service weight, hub-and-spigot fittings, compression gasket joints, pipe sizes 15" and smaller.
 - 2. PVC plastic sewer pipe and fittings with solvent cemented joints, pipe sizes 6" and smaller.
- E. Air Conditioning Unit Condensate Piping:
 - 1. Copper tube, Type "M" hard-drawn temper, wrought-copper fittings, solder-joints.

2.2 SUPPORTS AND ANCHORS:

- A. General: Provide supports and anchors complying with Division 22 **Basic Materials and Methods Sections**, in accordance with the following listing.
- B. Horizontal piping hangers and supports: Adjustable steel clevis hangers, steel pipe clamps, and pipe saddle supports.
- C. Vertical piping supports: Two-bolt riser clamps.
- D. Building attachments: Concrete inserts, C-clamps, and steel brackets.

2.3 SANITARY DRAINAGE AND VENT PIPING PRODUCTS:

- A. Cleanout Plugs: Cast-bronze or brass, threads complying with ANSI B2.1, countersunk head.

- B. Floor Cleanouts: Cast-iron body and frame, cleanout plug, adjustable nickel-bronze top, exposed flush type, standard non-slip scored or abrasive finish.
- C. Wall Cleanouts: Cast-iron body adaptable to pipe with cast-bronze or brass plug, stainless steel cover, including screws.
- D. Yard Cleanouts: Heavy duty cast-iron body and cover, bronze plug, with "C.O." cast in cover.
- E. Floor Drains: Refer to plumbing fixture schedule on the drawings.
- F. Floor Sinks: Refer to plumbing fixture schedule on the drawings.
- G. Flashing Flanges: Cast-iron watertight stack or wall sleeve with membrane flashing ring. Provide underdeck clamp and sleeve length as required.
- H. Vent Flashing Sleeves: Cast-iron caulking type roof coupling for cast-iron stacks, cast-iron threaded type roof coupling for steel stacks, and cast-bronze stack flashing sleeve for copper tubing.
- I. Trap Primers: Provide bronze trap primer valve with automatic vacuum breaker, complying with ASSE 1018, with 1/2" connections matching mating piping system. Install trap primer on floor drains and floor sinks, as required by code and as indicated on the drawings.
- J. Manufacturers: Subject to compliance with requirements, provide sanitary drainage and vent piping products from one of the following:
 - 1. Josam Manufacturing Co.
 - 2. Wade/Tyler Drainage Products
 - 3. Zurn Industries, Inc.

PART 3 - EXECUTION

3.1 INSTALLATION OF SANITARY DRAINAGE AND VENT PIPING:

- A. Install underground building drains making connection to stub as indicated and in accordance with city and state plumbing codes.
- B. Install sanitary drainage piping pitched to drain at invert elevations indicated or at minimum slope of 1/4" per foot (2%), for pipe sizes 3" and smaller, 1/8" per foot (1%), for pipe sizes 4" and larger.

3.2 INSTALLATION OF AIR CONDITIONING CONDENSATE PIPING:

- A. Install air conditioning unit condensate piping pitched to drain at a minimum slope of 1/8" per foot, to a code approved drain.
- B. Provide a vented P-trap at each air conditioning unit, or comply with manufacturers trap detail and installation requirements.
- C. Provide condensate pump at each unit where proper slope cannot be maintained.

3.3 INSTALLATION OF CLEANOUTS:

- A. Provide cleanouts in sanitary drainage and vent piping as indicated, as required by applicable city and state plumbing codes, and as specified herein.
 - 1. Provide cleanouts at each change in direction of piping greater than 45 degrees.
 - 2. Provide cleanouts at minimum intervals of 50' for piping 4" and smaller, and 100' for larger piping.
 - 3. Provide cleanouts at the base of each vertical stack.
- B. Provide floor and wall cleanout covers for concealed piping. Select type to match adjacent building finish.

3.4 INSTALLATION OF FLOOR DRAINS:

- A. Install drain flashing collar or flange so that no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes, where penetrated. Position drains so that they are accessible and easy to maintain.

3.5 INSTALLATION OF TRAP PRIMERS:

- A. Install trap primers as indicated, and in accordance with manufacturer's installation instructions.
- B. Pitch piping towards drain trap, minimum of 1/8" per foot (1%). Adjust trap primer for proper flow.

3.6 EQUIPMENT/FIXTURE CONNECTIONS:

- A. Piping runouts to equipment/fixtures: Provide waste piping runouts to equipment or plumbing fixtures and drains, with approved trap, of size indicated, but in no case smaller than required by Plumbing Codes.
- B. Locate piping runouts as close as possible to bottom of floor slab supporting fixtures or drains.

3.7 FIELD QUALITY CONTROL:

- A. General: Tests shall be in accordance with requirements of local plumbing codes and local utilities.
- B. Piping Test: Test the sanitary drainage and vent systems by filling with water with all points in the system being subjected to pressure of at least 10' of water. Water level shall remain stationary for a period of one hour, without any joint leakage.

END OF SECTION 221316

SECTION 221413
STORM WATER SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.
- B. The requirements as set forth in Division 22 **Basic Materials and Methods Sections** shall apply to work of this section.

1.2 DESCRIPTION OF WORK:

- A. Extent of storm water systems work is indicated on drawings, and by requirements of this section.
- B. Refer to other Division 22 sections for the following work:
 - 1. Pipe and Pipe Fittings for storm water systems.
 - 2. Supports and anchors for storm water systems.
 - 3. Plumbing Identification of storm water systems.
 - 4. Plumbing Insulation of storm water systems and drain bodies.

1.3 QUALITY ASSURANCE:

- A. **Manufacturer's Qualifications:** Firms regularly engaged in manufacture of storm water systems products of types, materials, and size required, whose products have been in satisfactory use in similar service for not less than 5 years.
- B. **Installer's Qualifications:** Firm with at least 3 years of successful installation experience on projects with storm water systems work similar to that required for project.
- C. **Codes and Standards:**
 - 1. **Code Compliance:** Fabricate and install storm water systems in accordance with applicable state and local building codes.

1.4 SUBMITTALS:

- A. **Product Data:** Submit manufacturer's technical product data and installation instructions for storm water systems materials and products.

1.5 OPERATION AND MAINTENANCE MANUALS:

- A. Include product data in Operation and Maintenance Manuals.

1.6 RECORD DRAWINGS:

- A. At project closeout, submit record drawings of installed storm water systems, in accordance with requirements of Division 1 and 22.

PART 2 - PRODUCTS

2.1 STORM PIPES AND PIPE FITTINGS:

- A. General: Provide pipe and pipe fittings complying with Division 22 **Basic Materials and Methods Sections**, in accordance with the following listing.
- B. Interior Storm Water Piping Above Grade:
 - 1. Cast-iron soil pipe, service weight, hubless soil pipe fittings and joints, pipe sizes 10" and smaller.
- C. Interior Storm Water Piping Below Grade:
 - 1. Cast-iron hub-and-spigot soil pipe, service weight, hub-and-spigot fittings, compression gasket joints, pipe sizes 15" and smaller.
 - 2. PVC plastic sewer pipe and fittings with solvent cemented joints, pipe sizes 6" and smaller. (Limited to structures not exceeding three floors above grade).

2.2 SUPPORTS AND ANCHORS:

- A. General: Provide supports and anchors complying with Division 22 **Basic Materials and Methods Sections**, in accordance with the following listing.
- B. Horizontal piping hangers and supports: Adjustable steel clevis hangers, steel pipe clamps, and pipe saddle supports.
- C. Vertical piping supports: Multiple-bolt riser clamps.
- D. Building attachments: Concrete inserts, C-clamps, steel brackets, and concrete sleeves.

2.3 STORM WATER PIPING PRODUCTS:

- A. General: Provide factory-fabricated drainage piping products of size and type indicated, and as specified herein.
- B. Roof Drains: Refer to plumbing fixture schedule on the drawings.
- C. Overflow Drains: Refer to plumbing fixture schedule on the drawings.
- D. Cleanout Plugs: Cast-bronze or brass, threads complying with ANSI B2.1, countersunk head.
- E. Floor Cleanouts: Cast-iron body and frame, cleanout plug, adjustable nickel-bronze top, exposed flush type, standard non-slip scored or abrasive finish.
- F. Wall Cleanouts: Cast-iron body adaptable to pipe with cast-bronze or brass cleanout plug, stainless steel cover, including screws.
- G. Manufacturers: Subject to compliance with requirements, provide storm water piping products from one of the following:

1. Josam Manufacturing Co.
2. J.R. Smith Manufacturing Co.
3. Wade/Tyler Drainage Products.
4. Zurn Industries, Inc.
5. Watts Drainage Products

PART 3 - EXECUTION

3.1 INSTALLATION OF STORM WATER PIPING:

- A. Install underground storm water piping making connection to stub as indicated and in accordance with city and state plumbing codes.
- B. Install storm water piping pitched to drain at minimum slope of 1/8" per foot (1%).

3.2 INSTALLATION OF ROOF/OVERFLOW DRAINS:

- A. Install drains in accordance with manufacturer's written instructions. Position drains so that they are accessible and easy to maintain.
- B. Coordinate with roofing contractor as required to interface drains with roofing work. Install drains at low points of surface areas to be drained.
- C. Install drain flashing collar or flange so that no leakage occurs between drain and adjoining substrate. Maintain integrity of waterproof membranes.

3.3 INSTALLATION OF CLEANOUTS:

- A. Provide cleanouts in conductor piping and storm drain piping as indicated, as required by applicable city and state plumbing codes, and as specified herein.
- B. Provide cleanouts at each change in direction of piping greater than 45 degrees.
- C. Provide cleanouts at minimum intervals of 50' for piping 4" and smaller, and 100' for larger piping.
- D. Provide cleanouts at the base of each conductor.
- E. Provide floor and wall cleanout covers for concealed piping. Select type to match adjacent building finish.

3.4 FIELD QUALITY CONTROL:

- A. General: Tests shall be in accordance with requirements of local plumbing codes and local utilities
- B. Piping Test: Test the storm water systems by filling with water with all points in the system being subjected to pressure of at least 10' of water. Water level shall remain stationary for a period of one hour.

3.5 PROTECTION:

- A. Protect drains during remainder of construction period to avoid clogging with construction materials and debris, and to prevent damage from construction work.

END OF SECTION 221413

SECTION 221429**SUMP AND CIRCULATING PUMPS****PART 1 - GENERAL****1.1 RELATED DOCUMENTS:**

- A. Drawings and general provisions of contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.
- B. The requirements as set forth in Division 22 **Basic Materials and Methods Sections** shall apply to work of this section.

1.2 DESCRIPTION OF WORK:

- A. Extent of plumbing pumps work required by this section is indicated on drawings, and by requirements of this section.
- B. Types of plumbing pumps specified in this section include the following:
 - 1. Inline Circulators.
- C. Refer to other Division 22 sections for the following:
 - 1. Plumbing identification of pumps.
 - 2. Testing, adjusting, and balancing of pumps.
- D. Refer to Division 26 sections for the following work:
 - 1. Power supply wiring and conduit from power source to power connection on pumps. Include wiring and conduit to starters, disconnects, and required electrical devices, except where specified as furnished, or factory-installed, by manufacturer.

1.3 QUALITY ASSURANCE

- A. **Manufacturer's Qualifications:** Firms regularly engaged in manufacture of pumps with characteristics, sizes and capacities required, whose products have been in satisfactory use in similar service for not less than 5 years.
- B. **Codes and Standards:**
 - 1. Hydraulic Institute Compliance: Design, manufacture, and install plumbing pumps in accordance with HI "Hydraulic Institute Standards".
 - 2. UL Compliance: Design, manufacture, and install plumbing pumps in accordance with UL 778 "Motor Operated Water Pumps".
 - 3. UL and NEMA Compliance: Provide high efficiency electric motors and components that are listed and labeled by UL and comply with NEMA standards.
 - 4. National Electrical Code Compliance: Components shall comply with NFPA 70 "National Electrical Code".
 - 5. SSPMA Compliance: Test and rate sump and sewage pumps in accordance with the Sump and Sewage Pump Manufacturers Association Standards.

**SUMP AND CIRCULATING
PUMPS**

1.4 SUBMITTALS:

- A. **Product Data:** Submit manufacturer's pump specifications, installation and start-up instructions, and current accurate pump characteristic performance curves with selection points clearly indicated.
- B. **Shop Drawings:** Submit manufacturer's assembly-type shop drawings indicating dimensions, weight loading, required clearances, and methods of assembly of components.
- C. **Wiring Diagrams:** Submit manufacturer's electrical requirements for power supply wiring to plumbing pumps. Submit manufacturer's ladder-type wiring diagrams for interlock and control wiring. Clearly differentiate between portions of wiring that are factory-installed and portions to be field-installed.
- D. **Maintenance Data:** Submit maintenance data and parts lists for each type of pump, control, and accessory. Include "trouble-shooting" maintenance guide.

1.5 OPERATION AND MAINTENANCE MANUALS:

- A. Include maintenance data, product data, shop drawings, and wiring diagrams in Operation and Maintenance Manual.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Handle pumps and components carefully to prevent damage, breaking, denting and scoring. Do not install damaged pumps or components; replace with new.
- B. Store pumps and components in clean dry place. Protect from weather, dirt, fumes, water, construction debris, and physical damage.
- C. Comply with Manufacturer's rigging and installation instructions for unloading pumps, and moving them to final location.

PART 2 - PRODUCTS:

2.1 GENERAL:

- A. Provide factory assembled and tested pumps as indicated on the drawings.
- B. **Preparation for shipping:** After assembly and testing, clean flanges and exposed machined metal surfaces and treat with an anticorrosion compound. Protect flanges, pipe openings, and nozzles with wooden flange covers or with screwed in plugs.
- C. **Motors:** Conform to NEMA standards. Provide single, multiple, or variable speed with type of enclosure and electrical characteristics as indicated. Provide built-in thermal overload protection and grease-lubricated ball bearings. Select motors that are non-overloading within full range of the pump performance curve.
- D. Apply factory finish paint to assembled and tested units prior to shipping.

2.2 INLINE CIRCULATORS

- A. General: Provide horizontal inline, centrifugal circulators, separately coupled, single-stage, all bronze, radially split case design, with mechanical seals, and rated for 125 PSIG working pressure and 225°F continuous water temperature.
- B. Casings: Provide bronze casings, with threaded companion flanges for piping connections smaller than 2-½" inches, and threaded gauge tappings at inlet and outlet connections.
- C. Impellers: Provide statically and dynamically balanced, closed overhung, single suction impellers fabricated from tempered brass conforming to ASTM B 36, and keyed to shaft.
- D. Pump Shaft and Sleeve: Provide steel shaft with oil-lubricated copper sleeve.
- E. Seals: Provide mechanical seals consisting of carbon steel rotating ring, stainless-steel spring, ceramic seat, and Buna-N bellows and gasket.
- F. Pump Bearings: Provide oil-lubricated, bronze journal and thrust bearings.
- G. Shaft Couplings: Provide flexible shaft couplings capable of absorbing torsional vibration and shaft misalignment.
- H. Motors: Provide open drip proof motors with built-in thermal overload protection, resiliently mounted to the pump casing.
- I. Manufacturers: Subject to compliance with requirements, provide inline circulators from one of the following:
 - 1. Amtrol, Inc.
 - 2. Armstrong Pumps, Inc.
 - 3. Aurora Pump; Unit of General Signal.
 - 4. Bell and Gossett; ITT Fluid Handling Division.
 - 5. Peerless Pump.
 - 6. Taco, Inc.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions under which plumbing pumps are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.
- B. Examine rough-in for plumbing piping systems to verify actual locations of piping connections prior to installation.

3.2 INSTALLATION OF PLUMBING PUMPS:

- A. General: Install plumbing pumps where indicated, in accordance with manufacturer's published installation instructions, complying with recognized industry practices to ensure that plumbing pumps comply with requirements and serve intended purposes.
- B. Access: Provide access space around plumbing pumps for service as indicated, but in no case less than that recommended by manufacturer.

- C. Support: Support pumps and piping separately so that the weight of the piping system does not rest on the pump. Suspend inline pumps with all-thread hanger rod and vibration isolation hangers of sufficient size to support the weight of the pump.
- D. Electrical Wiring: Install electrical devices furnished by manufacturer but not specified to be factory-mounted. Furnish copy of manufacturer's wiring diagram submittal to Electrical Installer. Verify that electrical wiring installation is in accordance with manufacturer's submittal and installation requirements of Division 26 sections. Do not proceed with equipment start-up until wiring installation is acceptable to equipment installer.
- E. Piping Connections: Provide piping, valves, accessories, gages, supports, and flexible connections as indicated on drawings.

3.3 ADJUSTING AND CLEANING:

- A. Alignment: Check alignment, and where necessary, realign shafts of motors and pumps within manufacturer's recommended tolerances, and in presence of manufacturer's service representative. Submit alignment report to engineer.
- B. Start-Up: Lubricate pumps before start-up. Start-up in accordance with manufacturer's instructions.
- C. Cleaning: Clean factory-finished surfaces. Repair marred or scratched surfaces with manufacturer's touch-up paint.

END OF SECTION 221429

SECTION 223400**FUEL FIRED DOMESTIC WATER HEATERS****PART 1 - GENERAL****1.1 RELATED DOCUMENTS:**

- A. Drawings and general provisions of contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.
- B. The requirements as set forth in Division 22 **Basic Materials and Methods Sections** shall apply to work of this section.

1.2 DESCRIPTION OF WORK:

- A. Extent of water heater work required by this section is indicated on drawings, and by requirements of this section.
- B. Types of water heaters specified in this section include the following:
 - 1. Commercial Fuel Fired Water Heaters.
- C. Refer to other Division 22 sections for the following work:
 - 1. Pipe and pipe fittings for water heaters.
 - 2. Pipe specialties for water heaters.
 - 3. Meters and gauges for water heaters.
 - 4. Plumbing identification for water heaters.
 - 5. Breechings for gas fired water heaters.
- D. Refer to Division 26 sections for electrical wiring and conduit, disconnects, wires/cables, raceways, and other required electrical devices.

1.3 QUALITY ASSURANCE:

- A. **Manufacturer's Qualifications:** Firms regularly engaged in manufacturer of water heaters of types and capacities required, whose products have been in satisfactory use in similar service for not less than 5 years.
- B. **Codes and Standards:**
 - 1. **UL Compliance:** Construct water heaters in accordance with the following UL standards:
 - a. Provide water heater components which are UL Listed and labeled.
 - 2. **NEC Compliance:** Install water heaters in accordance with requirements of NFPA 70, "National Electrical Code".
 - 3. **NFPA Compliance:** Install gas-fired water heaters in accordance with requirements of NFPA 54, "National Fuel Gas Code".
 - 4. **AGA Compliance:** Provide gas fired water heaters that are listed and labeled by the American Gas Association.

5. ASME Code Compliance: Provide water heaters and safety relief valves that comply with ASME Boiler and Pressure Vessel Code and are stamped with the appropriate ASME code symbols.
6. ASHRAE Compliance: Provide water heaters with Performance Efficiencies meeting or exceeding those prescribed in ASHRAE 90A, "Energy Conservation in New Building Design".
7. NSF Compliance: Provide water heaters that have been listed and labeled by National Sanitation Foundation.

1.4 SUBMITTALS:

- A. Product Data: Submit manufacturer's technical product data including rated capacities and efficiencies of selected model clearly indicated; operating weights; furnished specialties and accessories; and installation and start-up instructions.
- B. Shop Drawings: Submit manufacturer's assembly type shop drawings indicating dimensions, required clearances, and methods of assembly of components.
- C. Wiring Diagrams: Submit manufacturer's electrical requirements for electrical power supply wiring to water heaters. Submit manufacturer's ladder-type wiring diagrams for interlock and control wiring required for final installation of water heaters and controls. Differentiate between portions of wiring that are factory installed and portions that are to be field installed.
- D. Maintenance Data: Submit maintenance data and parts lists for each type and size of water heater, control, and accessory; including "trouble shooting" maintenance guide.
- E. Certificates: Submit certificates of Shop Inspection and Data Report as required by provisions of ASME Boiler and Pressure Vessel Code.

1.5 OPERATION AND MAINTENANCE MANUALS:

- A. Include product data, shop drawings, wiring diagrams, and maintenance data in Operation and Maintenance Manuals.

1.6 DELIVERY, STORAGE AND HANDLING:

- A. Handle water heaters and components carefully to prevent damage, breaking, denting and scoring. Do not install damaged water heaters or components. Remove from site and replace with new.
- B. Store water heaters and components in clean dry place. Protect from weather, dirt, fumes, water, construction debris, and physical damage.
- C. Comply with manufacturer's rigging and installation instructions for unloading water heaters, and moving units to final location for installation.

1.7 WARRANTY

- A. Provide written warranty, signed by manufacturer, agreeing to replace within warranty period, water heaters that are inadequate and/or have defective materials and workmanship, including leakage, breakage, improper assembly, or failure to perform as required. This warranty shall be applicable provided manufacturer's instructions for protecting and maintaining the water heaters have been followed during the warranty period.
- B. Warranty Period: 5 years from Date of Substantial Completion.

PART 2 - PRODUCTS

2.1 COMMERCIAL FUEL FIRED WATER HEATERS

- A. General: Provide commercial fuel fired water heaters of sizes and capacities as indicated on drawings. Provide certification of design by AGA under Volume III tests for commercial water heaters for delivery of 120 °F water.
- B. Heater: Construct for working pressure of 150 PSI. Provide boiler type hand hole cleanout; magnesium anode rod; 3/4" tapping for relief valve; glass lining on internal surfaces exposed to water.
- C. Safety Controls: Equip with automatic gas shutoff device to shut off entire gas supply in event of excessive temperature in tank; and pilot safety shutoff.
- D. Draft Hood: Equip with AGA certified draft hood.
- E. Jacket: Insulate tank with vermin-proof glass fiber insulation. Provide outer steel jacket with baked enamel finish over bonderized undercoating.
- F. Accessories: Provide brass drain valve; 3/4" pressure and temperature relief valve; and radiant floor shield.
- G. Controls: Provide gas pressure regulator; pilot gas regulator; thermostat; and temperature limit control.
- H. Manufacturers: Subject to compliance with requirements, provide commercial gas fired water heaters of one of the following:
 - 1. AO Smith Corporation; Consumer Products Division.
 - 2. State Industries, Inc.

PART 3 - EXECUTION

3.1 EXAMINATION:

- A. Examine areas and conditions under which water heaters are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.2 INSTALLATION OF WATER HEATERS:

- A. General: Install water heaters in accordance with manufacturer's installation instructions. Install units plumb and level, firmly anchored in locations indicated, and maintain manufacturers recommended clearances.
- B. Piping: Connect hot and cold water piping to units with shutoff valves and unions. Connect recirculating water line to unit with shutoff valve, check valve, and union. Extend relief valve discharge to closest floor drain, or as indicated.

- C. Gauges: Provide thermometer on inlet and outlet piping of water heaters.
- D. Fuel Fired Water Heaters: Connect fuel supply to fuel line with drip leg, tee, fuel cock, and union; full size of unit inlet connection. Locate piping so as not to interfere with service of unit.
 - 1. Extend regulator vent to building exterior and terminate with insect screen covered fitting.

3.3 FIELD QUALITY CONTROL:

- A. Start-up of Fuel Fired Water Heaters: Start up, test and adjust fuel fired water heaters in accordance with manufacturer's start up instructions, and utility company's requirements. Check and calibrate controls, and adjust burner for maximum efficiency.

END OF SECTION 223400

SECTION 224213
PLUMBING FIXTURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.
- B. This section is a Division 22 **Basic Materials and Methods Section** and is part of each Division 22 section making reference to pipes and pipe fittings specified herein.

1.2 DESCRIPTION OF WORK:

- A. Plumbing fixtures work required by this section is indicated on drawings and schedules and by requirements of this section.
- B. Plumbing fixtures specified in this section include the following:
 - 1. Flush Valves.
 - 2. Vitreous China Fixtures.
 - 3. Water Closet Seats.

1.3 QUALITY ASSURANCE:

- A. Manufacturers Qualifications: Firms regularly engaged in manufacture of plumbing fixtures of types and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.
- B. Codes and Standards:
 - 1. ANSI Standard A117.1: "Specifications for Making Buildings and Facilities Accessible To and Usable By Physically Handicapped People."
 - 2. Public Law 90-480: "Architectural Barriers Act of 1968."

1.4 SUBMITTALS:

- C. Product Data: Submit manufacturer's technical product data, including installation instructions, and dimensioned drawings for each type of plumbing fixture. Include pressure drop for each fixture.
- D. Maintenance Data: Submit maintenance data and spare parts lists for each type of plumbing fixture.
- A. Color Charts: Submit manufacturer's standard color charts for cabinet finishes and fixture colors.

PART 2 - PRODUCTS

2.1 PLUMBING FIXTURES:

- A. Refer to Plumbing Fixture Schedule on drawings.
- B. Manufacturers: Subject to compliance with requirements, provide plumbing fixtures of each type from one of the following:
 - 1. Flush Valves:
 - a. Sloan Valve Co.
 - b. Zurn.
 - c. Fixture Manufacturer.
 - 2. Vitreous china type fixtures:
 - a. American Standard.
 - b. Kohler.
 - c. Crane.
 - 3. Water Closet Seats:
 - a. Bemis Manufacturing Co.
 - b. Beneke Corp.
 - c. Forbes-Wright Industries, Inc.; Church Products.
 - d. Olsonite Corp.; Olsonite Seats.
 - e. Church Seat Company.

PART 3 - EXECUTION

3.1 INSTALLATION:

- A. Install plumbing fixtures level and plumb in accordance with fixture manufacturer's written instructions, rough-in drawings, and applicable codes and regulations.
- B. Mount fixtures at heights indicated on the architectural drawings.
- C. Comply with the installation requirements of referenced standards for plumbing fixtures for the physically handicapped.
- D. Fasten plumbing fixtures securely to supports or building structure as scheduled on the drawings. Secure supplies behind or within wall construction to provide rigid installation.
- E. Set mop basins in a leveling bed of cement grout.
- F. Provide a stop valve in an accessible location on each water connection to each fixture.
- G. Provide escutcheons at each wall, floor, and ceiling penetration in exposed finished locations and within casework.

3.2 START-UP:

- A. Test fixtures to demonstrate proper operation upon completion of installation and after units are water pressurized. Replace malfunctioning units, then retest.
- B. Adjust water pressure at faucets and flush valves to provide proper flow.
- C. Replace washers of leaking or dripping faucets and stops.

3.3 CLEANING:

- A. Clean fixtures, trim, and strainers using manufacturer's recommended cleaning methods and materials.

END OF SECTION 224213

SECTION 230000
BASIC MECHANICAL REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to Work of this Section.
- B. This Section is a Division 23 **Basic Materials and Methods Section**, and is a part of each Division 23 section making reference to mechanical related Work specified herein.

1.2 DESCRIPTION OF WORK:

- A. Furnish all labor, equipment, supplies, and materials for complete mechanical, plumbing, and fire protection systems. All Work shall be in strict accordance with the specifications and drawings.

1.3 WORK SPECIFIED IN OTHER SECTIONS:

- A. Concrete pads for mechanical Work.
- B. Excavation and backfill for mechanical Work.
- C. Painting for mechanical work, except as specified in this section.

1.4 COORDINATION OF WORK:

- A. Coordinate all Work with other trades and existing conditions to prevent conflicts. When conflicts arise, remove and relocate items causing such conflicts at no additional cost to the Owner.
- B. Provide a job site representative whenever necessary to coordinate Work with others.
- C. Refer to other discipline's drawings, relevant equipment drawings, and shop drawings to determine available clearances and possible obstructions. Make necessary offsets or transitions as required to clear structural members and existing equipment.
- D. Division 23 Contractors shall be responsible for all resultant costs incurred for changes required to accommodate actual equipment furnished when the equipment has characteristics differing from that specified or shown on the drawings.
- E. Electrical Work: Furnish all electrical devices in association with mechanical equipment including but not limited to motors, relays, pressure and temperature control devices, and all motor starters, controls, or protective devices factory wired and installed as an integral part of the equipment. Division 26 shall furnish and install all disconnect switches, start-stop stations and motor starters which are not furnished as an integral part of the equipment and which are not specified or indicated to be furnished by Division 23. Division 26 shall also install all power wiring, miscellaneous controls, control wiring, and interlock wiring when specifically shown on the electrical drawings.

1.5 HVAC SYSTEM INSTALLATION, GENERAL:

- A. Sequence, coordinate, and integrate the various elements of mechanical systems, materials, and equipment. Comply with the following requirements.
1. Coordinate mechanical systems, equipment, and materials installation with other building components.
 2. Verify all dimensions by field measurements.
 3. Arrange for chases, slots, and openings in other building components during progress of, to allow for mechanical installations.
 4. Coordinate the installation of required supporting devices and sleeves to be set in poured-in-place concrete and other structural components, as they are constructed.
 5. Sequence, coordinate, and integrate installations of mechanical materials and equipment for efficient flow of the Work. Give particular attention to large equipment requiring positioning prior to closing in the building.
 6. Where mounting heights are not detailed or dimensioned, install systems, materials, and equipment to provide the maximum headroom possible.
 7. Coordinate connection of mechanical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies. Provide required connection for each service.
 8. Install systems, materials, and equipment to conform with drawings and specs, to greatest extent possible. Conform to arrangements indicated by the Contract Documents, recognizing that portions of the Work are shown only in diagrammatic form. Where coordination requirements conflict with individual system requirements, refer conflict to the Construction Manager for resolution prior to installation.
 9. Install systems, materials, and equipment level and plumb, parallel and perpendicular to other building systems and components, where installed exposed in finished spaces.
 10. Install mechanical equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations. Extend grease fittings to an accessible location.
 11. Install systems, materials, and equipment giving right-of-way priority to systems required to be installed at a specified slope.

1.6 QUALITY ASSURANCE:

- A. All Work shall be performed by craftsman normally engaged in the respective craft required for each installation.
- B. Qualify welding and brazing processes and operators for piping systems in accordance with ASME Boiler and Pressure Vessel Code, Section IX "Welding & Brazing Qualification. Qualify welding processes and welding operators for miscellaneous supports in accordance with AWS D1.1 "Structural Welding Code-Steel". Each welder shall have satisfactorily passed AWS qualification test for welding processes involved and their certification shall be current.

1.7 FEES, PERMITS, AND INSPECTIONS:

- A. Provide all fees and permits that are required in connection with this Work.
- B. Secure all inspections as required by the authorities having jurisdiction.
- C. Where applications are required for procuring of services for the building, prepare and file such application. Furnish all information required in connection with the application in the form required by the utility company and/or municipal department.

1.8 APPLICABLE CODES AND STANDARDS:

- A. All Work shall comply with all applicable laws, codes, recommendations, regulations, and interim amendments of the governmental bodies having jurisdiction.

- B. All Work shall be performed in compliance with all applicable and governing regulations, including OSHA regulations.
- C. A reference to technical society, organization, or body in the specification is in accordance with the following abbreviations, and all Work shall be performed, as a minimum, in accordance with the latest edition of their publications:
- | | |
|------------|---|
| 1. ADC | Air Diffusion Council |
| 2. AMCA | Air Moving and Conditioning Association, Inc. |
| 3. ANSI | American National Standards Institute |
| 4. ARI | American Refrigeration Institute |
| 5. ASTM | American Society for Testing and Materials |
| 6. ASHRAE | American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc. |
| 7. ASME | American Society of Mechanical Engineers |
| 8. AABC | Associated Air Balance Council |
| 9. BOCA | Building Officials & Code Administrators International, Inc. |
| 10. CISPI | Cast Iron Soil Pipe Institute |
| 11. ETL | Environmental Testing Labs |
| 12. FIA | Factory Insurance Association |
| 13. FM | Factory Mutual Laboratories |
| 14. IAPMO | International Association of Plumbing and Mechanical Officials |
| 15. IEEE | Institute of Electrical and Electronics Engineers, Inc. |
| 16. MSS | Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. |
| 17. NEMA | National Electrical Manufacturer's Association |
| 18. NEBB | National Environmental Balancing Bureau |
| 19. NFPA | National Fire Protection Association |
| 20. NRCA | National Roofing Contractors Association |
| 21. NSF | National Sanitation Foundation |
| 22. OSHA | Occupational Safety & Health Administration |
| 23. SMACNA | Sheet Metal and Air Conditioning Contractors National Association, Inc. |
| 24. SSPMA | Sump and Sewage Pump Manufacturer's Association |
| 25. UBC | International Conference of Building Officials |
| 26. UL | Underwriters' Laboratories, Inc. |
- D. All Work shall comply with rules and regulations of utilities and/or municipal departments affected by connections of services.
- E. Should these specifications and/or drawings conflict with the building codes, standards, laws, ordinances, utility company rules and regulations, etc., the more stringent requirements shall take precedence. Notify the Architect/Engineer immediately with all conflicts.

1.9 GLOSSARY OF TERMS

A. Terms:

- | | |
|--------------|--|
| Contractor - | The particular sub-contractor who is directly responsible for the work specified herein. |
| Shall - | Action that is required without option or qualification. |
| May - | Action that is desirable or is at the Contractors choice or option. |
| Should - | Recommendation for the Contractor to follow as an aid in performing the required work. |

- Provide - Contractor shall furnish and install specified item(s).
- Furnish - Contractor shall be responsible for obtaining specified items.
- Install - Contractor shall be responsible for all labor and construction equipment necessary to set in place, connect, calibrate and/or test the specified items furnished by him or others.
- Or Equal - Item should possess the same performance qualities and characteristics as the one specified, and fulfill the function without any decrease in quality, durability or longevity.

1.10 SUBSTITUTIONS:

- A. The materials, products, and equipment described in the specifications or on the drawings establish a standard of required function, dimension, appearance, and quality to be met by any proposed substitution.
- B. Reference to any article, device, product, material, fixture, form, or type of construction by name, make, or catalog number, shall be interpreted as having established a standard of quality and shall not be construed as limiting competition. Articles, fixtures, etc. of equal quality by manufacturers listed in this specification for the applicable use, shall be acceptable, subject to spatial, structural and electrical constraints of the project design.
- C. No substitution will be considered unless written request for approval has been received by the Architect/Engineer at least five working days prior to the date for receipt of Bids. Each request shall include the name of the material or equipment for which it is to be substituted and complete description of the proposed substitute including shop drawings, performance and test data, and other information necessary for an evaluation. Include a statement setting forth changes in other materials, equipment, or Work that incorporation of the proposed substitute would require. The burden of proof of the merit of the proposed substitute is on the proposer. The Engineer's approval or disapproval of a proposed substitution shall be final.
- D. Approval of a proposed substitution prior to receipt of Bids shall be set forth in an Addendum. Approvals made in all other manner shall not be considered binding.

1.11 SUBMITTALS:

- A. Submit shop drawings and product data as specified in Division 1. Engineer shall retain one copy of each submittal.
- B. Each submittal shall include a letter indicating all deviations from the drawings and specifications.
- C. Checking of shop drawings is a gratuitous assistance by the Engineer and shall not relieve the contractor of responsibility for deviations, errors, or omissions that may exist in the shop drawings. Shop drawings submitted and rejected more than two times due to incomplete data or unacceptable material shall be reviewed by the Engineer as an additional cost to Division 23 Contractors at \$75.00 per hour, two hours minimum.
- D. Shop drawing submittals shall include the following for each piece of equipment and material, as applicable:
 1. Product data listing manufacturer, model number, materials, accessories, and miscellaneous data as required to describe the equipment.
 2. Capacity, pressure drops, rpm, motor horsepower, and other miscellaneous data to quantify size of equipment.

3. Dimensional drawings showing layout, connection points and sizes, weights, etc.
 4. Wiring diagrams, including power and control wiring. Distinguish between factory and field wiring.
 5. Parts list.
 6. Installation and maintenance manuals
 7. Warranty statement.
- E. The following information shall be submitted in accordance with this section.
1. Detailed drawings of fabrication and installation for metal fabrications, supports, and anchorage for mechanical materials and equipment.
 2. Coordination schedule for access door locations, sizes, and types.
 3. Welder certifications.
- F. At Contractor's option, ductwork and hydronic piping shop drawings may be prepared electronically. Engineer shall prepare electronic background drawings for the Contractor at Contractor's request. A charge of \$150.00 per sheet requested shall be paid by Contractor prior to receiving electronic files. Contractor shall coordinate shop drawings with other trade's shop drawings, and indicate all required offsets or changes. On completion of the project, the Contractor shall furnish the edited electronic shop drawings to the Engineer.
- G. Refer to individual Division 23 sections for additional requirements.

1.12 WARRANTIES:

- A. Materials and equipment furnished shall operate and perform as designed with respect to efficiencies, capacities and quietness, for one year from substantial completion. Provide all services required to repair or replace, at no additional cost, defective parts of the installation resulting from the supply of faulty workmanship or material. These services shall be furnished within 24 hours of initial report of the defect. Lack of maintenance, accidents, or carelessness on the part of the Owner shall not be included in this warranty.
- B. Provide additional warranties and warranty extensions as identified in individual Division 23 Sections.

1.13 RECORD DRAWINGS:

- A. Record drawings shall be kept and prepared in accordance with Division 1 and as specified herein.
1. A complete "Record" set of blueline prints shall be kept at the project site and shall be corrected daily to show all changes in layout from the original drawings and specifications. This "Record" set shall be used for this purpose only. On completion of the project, two new sets of blueline prints shall be obtained and all changes noted on the field Record set shall be neatly transferred (in red pencil) to the two new sets of prints.
 2. At Contractor's option, record drawings may be prepared electronically. Engineer shall prepare electronic background drawings for the Contractor at Contractor's request. A charge of \$150.00 per sheet requested shall be paid by Contractor prior to receiving electronic files. Electronic record drawings shall be maintained at the project site and shall be updated daily to show all changes in layout from the original drawings. On completion of the project, the Contractor shall furnish the edited electronic record drawings to the Engineer.
- B. Indicate actual locations of installed equipment, and actual routing of ducts and piping.
- C. Indicate locations of all capped pipes by two dimensions and depth below grade.
- D. Indicate actual manufacturers and model numbers of installed equipment on equipment schedules.

1.14 OPERATION AND MAINTENANCE MANUALS:

- A. During the course of construction, collect and compile three (3) sets of operating instructions, wiring diagrams, catalog cuts, lubrication and preventive maintenance instructions, parts lists, etc. for all equipment furnished under this contract. All literature including warranties shall be included in the Operation and Maintenance Manuals.
- B. All literature and instructions shipped with the equipment shall be included in the Operation and Maintenance Manuals.
- C. At completion of Work, and prior to request for final inspection, submit Operation and Maintenance Manuals to Architect in accordance with Division 1 and as specified herein. Manuals shall be bound in heavy duty, three-ring, vinyl covered, hard-backed binder, with clear plastic pocket on spine and cover. Use pocket folders for folded sheet information. Spine and cover of each binder shall have the following typewritten lettering inserted:

**Operation and Maintenance Manual
for Mechanical Systems of
(Project Name)**

- D. Operation and Maintenance Manuals shall include the following:
 - 1. Provide a master index at beginning of Manual listing all items included. Use plastic tab indexes for each section of Manual.
 - 2. Provide a directory, listing the name, address, and phone number of Architect, Mechanical and Electrical Engineers, General Contractor, and all Subcontractors.
 - 3. Provide a directory, listing all equipment installed, and indicating the name, address, and phone number of each supplier.
 - 4. Provide a section for each system, which shall include the following:
 - a. General description of each system.
 - b. Schematic diagrams for each system. Each diagram shall indicate locations of starters, thermostats, thermometers, pressure gauges, valves, etc. Correct setting for each control instrument shall be indicated on these diagrams.
 - 5. Provide a section for each piece of equipment which shall include the following:
 - a. Manufacturer's catalog data indicating capacity, size, etc., by underlining the applicable data.
 - b. Manufacturer's installation and maintenance manuals.
 - c. Performance curves for fans, etc.
 - d. Lubrication schedule, indicating type and frequency of lubrication required.
 - e. Recommended list of spare parts to be stocked for preventive maintenance.
 - f. Equipment parts identification list for repair and replacement purposes.
 - g. Wiring diagram for the specific piece of equipment. Generalized wiring diagrams are not acceptable.
 - h. Copies of completed warranty certificates.
 - i. Temperature control system diagrams, identifying individual components and their location. Sequence of operation shall be included with diagram. Temperature control diagrams may be incorporated with system schematic diagrams.
 - 6. Provide a copy of the certified test and balance report.
 - 7. Provide a copy of each approved shop drawing.
 - 8. Provide a schedule of valves and dampers with their identification number, pertinent data, and location.

1.15 SYSTEM DEMONSTRATIONS:

- A. After systems have been tested, balanced, and placed in proper working order, but before final acceptance of the mechanical systems, demonstrate the systems to the Owner. All features and

functions of all systems shall be explained and the Owner shall be instructed in proper operation and maintenance of the equipment and systems.

- B. Instruct Owner in the maintenance procedures to drain and protect water systems from freezing during winter conditions.
- C. Coordinate the dates and times for performing the demonstrations with the Owner.
- D. Upon completion of demonstrations, submit a certificate certifying the demonstrations have been completed. Certificate shall list each system demonstrated, dates demonstrations were performed, and names of personnel in attendance. Certificate shall be signed by the Contractor and the Owner.

1.16 MAINTENANCE MATERIALS:

- A. All special tools provided by the manufacturer for installation or maintenance of the equipment shall be delivered to the Owner before final acceptance.

1.17 TEMPORARY HEATING AND COOLING:

- A. Provide complete and frequent periodic maintenance of heating and cooling equipment and associated peripheral equipment, in accordance with the manufacturer's requirements, should it be used for heating or cooling purposes prior to substantial completion. This includes filter changes, water treatment chemicals, lubrication, etc.
- B. Any damage to the equipment or damage to any part of the facility, resulting from temporary operation of the equipment shall be the responsibility of the Contractor.
- C. Use of the equipment for temporary heating and cooling shall not affect the starting date of the one-year warranty and service requirements specified elsewhere in the specifications. At substantial completion, all equipment shall be clean and in like new condition. Replace all filters with clean, unused filters as specified.

1.18 PRE-PURCHASED PRODUCTS:

- A. General: The Owner has negotiated purchase orders with suppliers of material and equipment to be incorporated into the Work. The contractor shall include costs for receiving, handling, storage (if required), hoisting, installation and start up and commissioning of these Owner furnished items.
- B. The Contractor's responsibilities are the same as if the Contractor purchased these products, including warranty administration.
- C. A "Schedule of Pre-Purchased Products" is included at the end of this Section.

1.19 PRE-ORDERED PRODUCTS:

- A. General: The Owner may negotiate purchase orders with suppliers of material and equipment to be incorporated into the Work to facilitate the project schedule. The contractor shall include the cost of equipment to the Owner, profit, costs of receiving, off-loading, handling, storage off-site if necessary, installation, and warranty of these items. The contractor shall be fully responsible for storage and protection of all pre-ordered products.
- B. The Contractor's responsibilities are the same as if the Contractor ordered these products, including warranty administration.
- C. A "Schedule of Pre-Ordered Products" is included at the end of this Section.

PART 2 - PRODUCTS

2.1 MATERIALS:

- A. Unless otherwise approved in writing, all materials furnished under this specification shall be new and shall be standard products of manufacturers regularly engaged in the production of such equipment, and shall be the manufacturer's latest design.
- B. Equipment of any one type shall be by one manufacturer unless specifically indicated otherwise.
- C. All belt or chain drives, fan blades, coupling, and other moving or rotating parts shall be covered on all sides with safety guards as required by OSHA. Each guard shall be designed for easy installation and removal. All necessary supports and accessories shall be provided for each guard. Safety guards shall be designed to allow adequate ventilation of belts, etc. to prevent overheating.

2.2 MECHANICAL EQUIPMENT NAME PLATES:

- A. General: For each piece of mechanical equipment, provide a permanent operational data name plate indicating manufacturer, product name, model number, serial number, capacity, operating and power characteristics, labels of testing agencies, and similar essential data.
- B. Location: Locate nameplates in an accessible location.

2.3 MISCELLANEOUS METALS:

- A. Steel plates, shapes, bars, and bar grating: ASTM A 36.
- B. Cold-Formed Steel Tubing: ASTM A 500.
- C. Hot-Rolled Steel Tubing: ASTM A 501.
- D. Steel Pipe: ASTM A 53, Schedule 40, welded.
- E. Fasteners: Zinc-coated or cadmium plated, type, grade, and class as required.

2.4 MISCELLANEOUS LUMBER:

- A. Framing Materials: Standard Grade, light-framing-size lumber of any species. Number 3 Common or Standard Grade boards complying with Western Wood Products Association (WWPA) or West Coast Lumber Inspection Bureau (WCLIB) rules. Lumber shall be preservative pressure treated in accordance with American Wood Preservers Bureau (AWPB) LP-2, and kiln dried to a moisture content of not more than 19 percent.

2.5 CONCRETE:

- A. Portland cement shall conform to ASTM C-150, Type I or II as specified in Division 3.
- B. Non-shrink, Nonmetallic Grout: Premixed, factory-packaged, non-staining, non-corrosive, nongaseous grout, recommended for interior and exterior applications, and as specified in Division 3.

2.6 ACCESS DOORS:

- A. Manufacturers: Subject to compliance with requirements, provide access doors by one of the following:

1. J.L. Industries.
 2. Karp Associates, Inc.
 3. Milcor Div. Inryco, Inc.
- B. Steel Access Doors and Frames: Factory-fabricated and assembled units complete with attachment devices and fasteners ready for installation. Joints and seams shall be continuously welded steel, with welds ground smooth and flush with adjacent surfaces.
- C. Frames: 16-gage steel, with suitable means of anchoring frame to wall construction. Provide a 1" wide exposed perimeter flange for units installed in unit masonry, pre-cast concrete, cast-in-place concrete, ceramic tile, or wood paneling. Provide units with perforated flanges and wallboard bead for installation in gypsum wallboard or plaster.
- D. Doors: Flush panel, 14-gage sheet steel, with concealed spring hinges or concealed continuous piano hinge set to open 175 degrees. Provide screwdriver activated locking device. Finish shall be factory applied prime cost.
- E. Fire-Rated Units: Self-closing mechanism and UL rated for the installation encountered. Provide UL label on each fire-rated access door.

2.7 FIRE STOP MATERIALS

- A. Manufacturers: Subject to compliance with requirements, provide fire stop materials by one of the following:
1. International Protective Coatings Corp.
 2. Specified Technologies, Inc.
 3. 3M Company, Inc.
- B. Fire Resistant Sealants: One-part elastomeric sealant or two-part foamed-in-place silicone sealant, formulated for use in through-penetration fire-stopping around cables, conduit, pipes, and duct penetrations through fire-rated walls and floors. Sealants and accessories shall have fire resistance ratings as required for the installation. Fire ratings for the sealants shall be as established by testing identical assemblies in accordance with ASTM E 814, by UL, or other testing and inspection agency acceptable to authorities having jurisdiction.
- C. Fire Safing: Mineral wool or ceramic fiber material manufactured for the specific purpose of fire safing.

2.8 KITCHEN HOODS

- A. Provide kitchen hoods as indicated on the drawings and install per manufacturer instructions. Obtain all required permits and inspections as required by the local jurisdiction.

PART 3 - EXECUTION

3.1 WORKMANSHIP:

- A. All Work shall be performed by experienced mechanics in accordance with first class practice, and the Work shall be neat in appearance and complete to perform the intended function.

3.2 INSPECTION:

- A. Examine areas and conditions under which the mechanical systems and equipment are to be installed. Do not proceed with Work until unsatisfactory conditions have been corrected.

3.3 ROUGH-IN:

- A. Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected.
- B. Refer to equipment specifications in Divisions 2 through 16 for rough-in requirements.

3.4 SAFETY:

- A. Provide warning lights, signs, and guards for safety as required.
- B. Safety of personnel on the project site shall be the responsibility of all divisions. Comply with all local, state, and federal regulations for safety.

3.5 HOUSEKEEPING:

- A. The premises shall be kept broom clean at all times.
- B. Stocks of material and equipment stored on the premises shall be stored in a neat and orderly manner in their shipping containers. Material and equipment shall be protected as recommended by the manufacturer.
- C. Remove all waste material present as a result of mechanical Work from the premises.
- D. Exposed surfaces of ductwork, piping, and equipment shall be cleaned of all dirt, plaster, labels, fabrication marks, concrete, etc. before final acceptance of the Work.
- E. Finish and cleaning: At the completion of the Work, the following shall be completed:
 - 1. The entire system of ductwork, piping, and equipment shall be cleaned internally. For piping, open all dirt pockets and strainers, and clean strainer screens of all accumulated debris. For ductwork, open all access doors and remove all loose material. Replace all filters with new filters at time of final acceptance.
 - 2. All tanks, fixtures, and pumps shall be drained and proven free of sludge and accumulated matter.
 - 3. All temporary labels, stickers, etc., shall be removed from all fixtures and equipment. (Permanent name plates, equipment model numbers, ratings, etc. shall not be removed).
 - 4. Clean all material and equipment installed. Dirt, dust, plaster, stains, and foreign matter shall be removed from all surfaces. Damaged finishes shall be touched-up and restored to original condition.

3.6 SCAFFOLDING AND HOISTING:

- A. Furnish all scaffolding and hoisting required for the Work of Division 23.

3.7 CUTTING AND PATCHING:

- A. Cutting and patching shall be performed in accordance with Division 1 and as specified herein.
- B. No structural members shall be cut, drilled, or penetrated without prior approval from the Architect.
- C. Coordinate the placing of the openings in new structures as required for the installation of mechanical Work.

- D. Furnish accurate locations and sizes of required openings for the mechanical systems to the appropriate personnel. This shall not relieve the Division 23 Contractor of the responsibility of checking to assure that proper size openings are provided. When additional patching is required due to failure to inspect this Work, the Division 23 Contractor shall be responsible for the patching required to properly close the openings.
- E. When cutting and patching of the structure is made necessary due to failure to install piping, sleeves, or equipment on schedule, or due to the failure to furnish, on schedule, the information required for the leaving of openings, then the Division 23 Contractor shall be responsible for the cutting and patching required.
- F. All roofing Work in new structures shall be performed under Division 7. Coordinate as required.

3.8 PROTECTION OF WORK:

- A. All pipe and duct openings shall be kept closed by means of plugs or caps to prevent the entrance of foreign matter.
- B. Special care shall be taken for the protection of equipment. All equipment and material shall be completely protected from weather, moisture, dust, paint, plaster, etc. until the project is completed. Damage from rust, paint, scratches, etc. shall be repaired as required to restore equipment to original condition.
- C. Protection of equipment during plastering and painting shall be the responsibility of others, but this shall not relieve Division 23 from the responsibility of checking to assure that adequate protection is provided.
- D. Where the installation or connection of equipment requires Work in areas previously finished, Division 23 shall be responsible that such areas are protected and are not marred, soiled, or otherwise damaged. Repairing and refinishing damaged areas shall be the responsibility of Division 23 and shall be approved by the Architect.
- E. Provide and maintain temporary partitions or dust barriers adequate to prevent the spread of dust and dirt to adjacent finished areas.
- F. All trenches and pits shall be maintained on a continuous basis, free of water for protection of Work.
- G. Protect floor drains during construction and cleaning to avoid clogging with dirt and debris.

3.9 ERECTION OF SUPPORTS AND ANCHORAGE:

- A. Metal: Cut, fit, and place miscellaneous metal fabrications accurately in location, alignment, and elevation as required to support and anchor mechanical materials and equipment.
 - 1. Field Welding: Comply with AWS "Structural Welding Code."
 - 2. Select fastener sizes that will not penetrate members where opposite side will be exposed to view, will receive finish materials, or may damage other surfaces, such as roofing. Make tight connections between members.
- B. Wood: Cut, fit, and place wood supports, nailers, and blocking accurately in location, alignment, and elevation where indicated on the drawings to support and anchor mechanical materials and equipment.
 - 1. Select fastener sizes that will not penetrate members where opposite side will be exposed to view, will receive finish materials, or may damage other surfaces, such as roofing.
 - 2. Make tight connections between members.

3. Install fasteners without splitting wood members.
- C. Attach anchors and fasteners to building structure as required to support applied loads. Location and type of fasteners used shall be approved by the Architect.

3.10 APPLICATION OF SEALANTS:

- A. Install sealant as required by manufacturer's printed instructions.
- B. Installation of Fire-Stopping Sealant: Install sealant, including forming, packing, and other accessory materials, to fill openings around mechanical services penetrating floors and walls, to provide fire-stops with fire-resistance ratings indicated for floor or wall assembly in which penetration occurs. Comply with installation requirements established by testing and inspecting agency.

3.11 INSTALLATION OF ACCESS DOORS:

- A. Furnish access doors/fire rated access doors as required for access to concealed equipment, valves, dampers, controls, etc.
- B. Equipment above lay-in ceilings shall not require an access door in the ceiling.

3.12 PAINTING:

- A. Equipment with damaged finishes shall be repainted to match the original factory finish.
- B. All exposed ferrous metal including exposed threads on pipe, and welds furnished by Division 23, such as hangers, struts, structural steel, etc., shall be primed as specified in Division 9.

END OF SECTION 230000.

SECTION 230514**MECHANICAL RELATED WORK****PART 1 - GENERAL****1.1 RELATED DOCUMENTS:**

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to Work of this Section.
- B. This Section is a Division 23 **Basic Materials and Methods Section** and is part of each Division 23 Section making reference to mechanical related Work specified herein.

1.2 DESCRIPTION OF WORK:

- A. Extent of mechanical related Work required by this Section is indicated on drawings and/or specified in other Division 23 Sections.
- B. Mechanical related Work specified in Division 2 Sections, but is Work of Division 23 includes the following:
 - 1. Excavating and backfill for Mechanical Work:
 - a. Interior piping below slabs.
 - b. Exterior underground mechanical utilities and services.
 - 2. Concrete for Mechanical Work:
 - a. Rough grouting in and around mechanical Work.
 - b. Patching concrete cut to accommodate mechanical Work.
 - c. Concrete equipment pads.

1.3 PROJECT CONDITIONS:

- A. Existing Utilities: Locate and protect existing utilities and other underground Work in manner which will ensure that no damage or service interruption will result from excavating and backfill.
- B. Protect property from damage that might result from excavating and backfill.
- C. Protect persons from injury at excavations by barricades, warnings and illumination.
- D. Coordinate excavations with weather conditions to minimize possibility of washouts, settlements and other damages and hazards.
- E. Provide temporary covering or enclosure and temporary heat as necessary to protect bottoms of excavations from freezing and frost action. Do not install mechanical Work on frozen excavation bases or subbases.

PART 2 - PRODUCTS**2.1 EXCAVATING AND BACKFILLING FOR MECHANICAL WORK:**

- A. Backfill Materials: Refer to Division 2 for excavating and backfill requirements.

2.2 MATERIALS OF CONCRETE WORK:

- A. Refer to Division 3 for concrete requirements.

PART 3 - EXECUTION

3.1 ACCESS FOR MECHANICAL WORK:

- A. Coordinate with and instruct the General Contractor to install the proper sized access doors in the proper location to provide access to all mechanical items requiring service or maintenance. This shall include but not be limited to valves, dampers, traps, operators, control sensors, and devices, and filters.

3.2 EXCAVATION AND BACKFILLING FOR MECHANICAL WORK:

- A. Refer to Division 2 Sections for requirements related to the Work specified herein.
- B. Do not excavate for mechanical Work until Work is ready to proceed without delay, so that total time lapse from excavation to completion of backfill will be minimum.
- C. Provide all excavation and backfill as necessary to install the piping and systems as shown on the drawings.
- D. Care shall be taken in excavating, that walls and footings and adjacent load bearing soils are not disturbed in any way. Where pipes must cross under a wall footing, the excavation shall be kept at a minimum to accommodate the pipe.
- E. Slope sides of excavation as required for soil and local codes and ordinances. Provide shoring and bracing as required. Maintain shoring and bracing in excavation regardless of time period excavation is open. Remove shoring and bracing before backfilling.
- F. Excavation shall be kept free from water by pumping if necessary. Sewers shall not be used as drain for such water.
- G. No length of trench shall be left open for more than is absolutely necessary for installation and testing.
- H. Pipe shall be supported directly on undisturbed soil (virgin or compacted), do not excavate beyond indicated depth. If existing soil is unsuitable (soft spot or rock), excavate to solid subgrade, or 6" for rock, below bottom of work and provide subbase material as required. Hand excavate bottom cut to insure accurate elevations. Bottoms of all trenches shall be so shaped that when pipe is in place the lower fourth of the circumference for the full length of the pipe shall be supported on undisturbed soil or compacted fill, as applicable. Bell holes shall be excavated so the bell supports no part of the weight of the pipe.
- I. Protect excavation bottoms against freezing when temperature is less than 35°F.
- J. Immediately after testing, trench shall be carefully backfilled with earth free from clods, brick, etc. to a depth one-half the pipe diameter and then firmly tamped in such a manner as not to disturb alignment or joints of the pipe. Thereafter the backfill shall be tamped every vertical foot.
- K. Pavement or concrete damaged during excavation shall be restored to original condition.
- L. Locate existing underground utilities in excavation areas. Maintain and protect existing services that transit the area of an excavation trench.

3.3 PERFORMANCE AND MAINTENANCE OF EXCAVATION WORK:

MECHANICAL RELATED WORK

- A. Subsidence: Where subsidence is measurable or observable at mechanical Work excavations during general project warranty period, remove surface (pavement, lawn or other finish), add backfill material, compact, and replace surface treatment. Restore appearance, quality, and condition of surface or finish to match adjacent Work, and eliminate evidence of restoration to greatest extent possible.

3.4 INSTALLATION OF CONCRETE WORK:

- A. Installation shall be in accordance with the requirements of Division 3.

END OF SECTION 230514.

SECTION 230529
SUPPORTS AND ANCHORS

PART 1- GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to Work of this Section.
- B. This Section is a Division 23 **Basic Materials and Methods Section** and is part of each Division 23 Section making reference to pipes and pipe fittings specified herein.

1.2 DESCRIPTION OF WORK:

- A. The extent of Work required by this section includes supports and anchors required for piping and equipment.
- B. Types of supports and anchors specified in this section include the following:
 - 1. Horizontal piping hangers and supports.
 - 2. Vertical piping clamps.
 - 3. Hanger rod attachments.
 - 4. Structural attachments.
 - 5. Alignment guides.
 - 6. Anchors.
 - 7. Saddles and shields.
 - 8. Trapeze hangers.
 - 9. Equipment supports.
- C. Refer to Division 3 for concrete housekeeping pads.
- D. Refer to Division 7 for installation of roof equipment supports.
- E. Refer to other Division 21 Sections for hangers and supports of fire protection piping systems.

1.3 QUALITY ASSURANCE:

- A. Manufacturer's qualifications: Firms regularly engaged in manufacture of supports and anchors of types and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.
- B. Codes and Standards:
 - 1. Code Compliance: Comply with applicable plumbing codes pertaining to materials and installation of supports and anchors.
 - 2. UL and FM Compliance: Provide UL listed and FM approved products where required by other Division 23 Sections.
 - 3. Manufacturer's Standardization Society Compliance:
 - a. Hangers and support components shall be factory fabricated of materials, design, and manufacturer complying with MSS-SP-58.
 - b. Comply with MSS-SP-69 for selection and application of pipe hangers and supports.

1.4 SUBMITTALS:

- A. Product Data: Submit manufacturer's product data and installation instructions for each type of support and anchor.

PART 2 - PRODUCTS

2.1 GENERAL:

- A. Manufacturers:
 - 1. Pipe hangers and supports: Subject to compliance with requirements, provide pipe hangers and supports from one of the following manufacturers:
 - a. B-Line Systems, Inc.
 - b. Grinnell.
 - 2. Trapeze Hangers: Subject to compliance with requirements, provide trapeze hangers from one of the following manufacturers:
 - a. B-Line Systems, Inc.
 - b. Power-strut.
 - c. Unistrut.
 - d. Field fabricated as specified.
 - 3. Equipment supports:
 - a. Custom Curb, Inc.
 - b. The Pate Company.
 - c. Thy Curb.
- B. Additional pipe hangers and supports selected in accordance with MSS-SP-69 may be used with prior written approval of Engineer.
- C. PVC and Polypropylene pipe shall be supported with the same type hangers listed for other types of pipe, and as recommended by the pipe manufacturer.

2.2 HANGER RODS:

- A. Carbon steel rod, threaded ends, or continuous thread.
- B. Provide locknut at each connection.

2.3 HORIZONTAL PIPING HANGERS AND SUPPORTS:

- A. General: Select size of hangers and supports to exactly fit pipe size for bare piping, and to exactly fit around piping insulation with saddle or shield for insulated piping. Use only one type of hanger by one manufacturer for each piping service.
- B. Adjustable steel clevis hangers:
 - 1. MSS-SP-69 Type 1.
 - 2. Service:
 - a. Insulated steel, cast iron, or copper pipe.
 - b. Uninsulated steel or cast iron pipe.
- C. Split pipe ring hangers:
 - 1. MSS-SP-69 Type 11 with swivel turnbuckle, MSS-SP-69 type 15.
 - 2. Provide dielectric plastic insert between copper pipe and hanger.
 - 3. Service:
 - a. Uninsulated copper pipe.

- D. Adjustable roller hangers:
 - 1. MSS-SP-69 Type 43.
 - 2. Service:
 - a. Insulated or uninsulated steel, cast iron, or copper pipe with axial thermal expansion in excess of 1/2".
- E. Pipe saddle supports:
 - 1. MSS-SP-69 Type 36.
 - 2. Service:
 - a. Insulated or uninsulated steel, cast iron, or copper pipe.
- F. Adjustable pipe saddle supports:
 - 1. MSS-SP-69 Type 38.
 - 2. Service:
 - a. Insulated or uninsulated steel, cast iron, or copper pipe.
- G. Adjustable pipe roller supports:
 - 1. MSS-SP-69 Type 46.
 - 2. Service:
 - a. Insulated or uninsulated steel, cast iron, or copper pipe with axial thermal expansion in excess of 1/2".
- H. Spring cushion roll:
 - 1. MSS-SP-69 Type 48 or 49.
 - 2. Service:
 - a. Pipe runs with thermal expansion in vertical dimension.

2.4 VERTICAL PIPING CLAMPS:

- A. General: Select size of vertical piping clamps to exactly fit pipe size of bare piping.
- B. Extension riser clamps:
 - 1. MSS-SP-69 Type 8.
 - 2. Clamp shall be secured directly to pipe, under any insulation.
 - 3. Provide plastic coated extension riser clamps for copper pipes.
 - 4. Service:
 - a. Insulated or uninsulated steel, cast iron, or copper pipe.

2.5 HANGER ROD ATTACHMENTS:

- A. General: Select size of hanger rod attachments to suit hanger rods.
- B. Steel Turnbuckles:
 - 1. MSS-SP-69 Type 13.
 - 2. Provide turnbuckles for adjustment at every hanger.
- C. Malleable Iron Sockets:
 - 1. MSS-SP-69 Type 16.

2.6 STRUCTURAL ATTACHMENTS:

- A. Select size of structural attachments to suit hanger rods.
- B. Malleable iron concrete inserts:
 - 1. MSS-SP-69 Type 18.
 - 2. Service:
 - a. Attachment to reinforced concrete.
- C. Expansion shields and anchors:
 - 1. Self drilling expansion shields and machine bolt expansion anchors. Applied load shall not exceed 25 percent of proof test load.
 - 2. Service:
 - a. Attachment to reinforced concrete of 4" minimum thickness.
- D. C-clamps:
 - 1. MSS-SP-69 Type 23.
 - 2. Service:
 - a. Attachment to bottom flange of structural steel beam.
- E. Top beam C-clamps:
 - 1. MSS-SP-69 Type 19.
 - 2. Service:
 - a. Attachment to top flange of structural steel beam.
- F. Malleable iron beam clamp with extension piece:
 - 1. MSS-SP-69 Type 30.
 - 2. Service:
 - a. Attachment to center of structural steel beam.
- G. Side beam brackets:
 - 1. MSS-SP-69 Type 34.
 - 2. Service:
 - a. Attachment to wood structural members.
- H. Welded steel brackets: Provide one of the following for indicated loading:
 - 1. Light duty: MSS-SP-69 Type 31 (750 lbs.)
 - 2. Medium duty: MSS-SP-69 Type 32 (1500 lbs.)
 - 3. Heavy duty: MSS-SP-69 Type 33 (3000 lbs.)

2.7 ALIGNMENT GUIDES:

- A. Pipe slide and slide plate:
 - 1. MSS-SP-69 Type 35.
 - 2. Service:
 - a. Pipes requiring guides for restraint of thermal expansion.

2.8 ANCHORS:

- A. Anchors shall be field fabricated by welding steel shapes, plates, and bars to piping and to building structure.

2.9 SADDLES AND SHIELDS:

- A. General: Provide factory fabricated saddles or shields under piping hangers and supports for all insulated piping. Size saddles and shields for exact fit to mate with pipe insulation.
- B. Steel pipe covering protection saddles:
 - 1. MSS-SP-69 Type 39.
- C. Protection shields:
 - 1. MSS-SP-69 Type 40.

2.10 TRAPEZE HANGERS:

- A. Trapeze hangers shall be manufacturer's standard products for the application intended.

2.11 EQUIPMENT SUPPORTS:

- A. Roof mounted equipment support rails:
 - 1. General: Select style as recommended by support rail manufacturer to conform with roof insulation and construction.
 - 2. Construction: Minimum 18 gauge galvanized steel with integral base plate, continuous welded corner seams, factory installed pressure treated wood nailer, and minimum 18 gauge galvanized steel counter flashing.

2.12 MISCELLANEOUS MATERIALS:

- A. Steel plates, shapes, and bars: Comply with ASTM A36.
- B. Cement grout: Portland cement, ASTM C150 Type I or Type III, clean uniformly graded, natural sand, ASTM C404, Size No. 2. Mix ratio shall be 1.0 part cement to 3.0 parts sand, by volume, with minimum amount of water required for placement and hydration.

PART 3 - EXECUTION

3.1 INSPECTION:

- A. Examine areas and conditions under which supports and anchors are to be installed. Do not proceed with Work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.2 PREPARATION:

- A. Proceed with installation of hangers and supports only after required building structural Work has been completed in areas where the Work is to be installed.
- B. Prior to installation of anchors, Installer shall meet at project site with installers of other work as required to coordinate the installation of concrete inserts.

3.3 INSTALLATION OF HANGERS AND SUPPORTS:

- A. General: Provide hangers, supports, clamps and attachments to support piping properly from building structure. Arrange for grouping of parallel runs of horizontal piping supported together on

heavy-duty trapeze hangers where possible. Where piping of various sizes is supported together by trapeze hangers, space hangers for smallest pipe size or install intermediate supports for smaller diameter pipe as specified for individual pipe hangers. All components of each hanger or support shall be sized as recommended by the manufacturer, for the weight encountered.

B. Maximum Spacing:

1. Provide hangers for horizontal piping in accordance with MSS-SP-69 or with the following maximum spacing and minimum rod sizes:

Nominal Pipe Size (Inches)	Steel Pipe Span (Ft)	Copper Pipe Span (Ft)	PVC, ABS, Polypropylene Pipe Span (Ft)*	CPVC Pipe Span (Ft)*	Minimum Rod Diameter (In)
Up to 3/4	7	5	3	3	3/8
1 to 1-1/4	7	6	4	4	3/8
1-1/2 to 2	9	8	4	5	3/8
2-1/2	11	9	6	6	1/2
3	12	10	6	7	1/2
4	14	12	6	7	5/8
5	16	13	6	8	5/8
6	17	14	6	8	3/4
8	19	16	7		7/8
10	22	18	8		7/8
12	23	19	9		7/8

*Based on service temperature less than 100 degrees F.

2. Cast iron and ductile iron piping hanger maximum spacing shall be 12 ft, with at least one hanger for each pipe section. Hangers shall be located adjacent to joints, changes in direction, and branch connections.
 3. Support requirements for plastic pipe varies with pipe schedule, temperature, and insulation. Use manufacturer's recommended spans where more stringent.
 4. Glass piping hanger maximum spacing shall be 8 ft. If three or more couplings are used within a normal 8 ft. span, use an additional hanger.
- C. Vertical Support:** Support vertical pipes at each floor.
- D. Accessories:** Provide hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories. Except as otherwise indicated for exposed continuous pipe runs, install hangers and supports of same type and style as installed for adjacent similar piping.
- E. One pipe shall not be suspended from another pipe.**
- F. Fire protection piping:** Support fire protection system piping independently from other piping systems in accordance with NFPA 13.
- G. Electrolysis prevention:** Prevent electrolysis in support of copper tubing by use of hangers and supports which are copper plated, or by manufactured plastic or rubber sleeves. The fire hazard classification of plastic or rubber sleeves used in return air plenums shall not exceed flame spread 25, fuel contribution 50, and smoke developed rating of 50.
- H. Provision for movement:** Install hangers and supports to allow controlled movement of piping systems to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends and similar units.

- I. Provision for adjustment: All pipe hangers and supports shall secure pipe in place, prevent pipe vibration, and shall be capable of adjustment of pipe and elevation after installation. All adjustable members shall be provided with suitable locking features.
- J. Load distribution: Provide hangers and supports so that piping live and dead loading and stresses from movement will not be transmitted to connected equipment.
- K. Pipe slopes: Provide hangers and supports to provide indicated pipe slopes, and so that maximum pipe deflections allowed by ANSI B31.9 are not exceeded.
- L. Insulated piping: Comply with the following installation requirements:
 - 1. Clamps: Attach claps, including spacers, to piping with clamps projecting through insulation. Do not exceed pipe stresses allowed by ANSI B31.9.
 - 2. Protection shields: Install protection shields at each hanger supporting insulated piping.
 - 3. Steel pipe covering protection saddles: Install protection saddles or rigid insulation inserts to prevent deformation of insulation and jacket as follows:
 - a. For pipe size less than 8", install steel pipe covering protection saddle as specified below, or eliminate saddle and provide the following:
 - 1) Hot pipe: Calcium silicate insulation inserts, 180 degree pipe coverage. Maintain insulation vapor barrier.
 - 2) Cold pipe: Urethane insulation inserts, 180 degree pipe coverage. Maintain insulation vapor barrier.
 - b. For pipe size 8" and larger, install steel pipe covering protection saddles. Fill interior voids with segments of insulation matching adjoining insulation. Maintain insulation vapor barrier.

3.4 INSTALLATION OF STRUCTURAL ATTACHMENTS:

- A. Install structural attachments at required locations within concrete or on structural steel for proper piping support.
- B. Space attachments within maximum piping span length indicated in MSS-SP-69.
- C. Install additional building attachments where support is required for additional concentrated loads, including valves, flanges, guides, strainers, expansion joints, and at changes in direction of piping.
- D. Install concrete inserts before concrete is placed. Fasten inserts securely to forms. Where concrete with compressive strength less than 2500 PSI is indicated, install reinforcing bars through openings at top of inserts.

3.5 INSTALLATION OF ANCHORS:

- A. Install anchors at proper locations to prevent stresses from exceeding those permitted by ANSI B31.9, and to prevent transfer of loading and stresses to connected equipment.
- B. Fabricate anchors by welding steel shapes, plates, and bars to piping and to structure. Comply with ANSI B31.9 and with AWS Standards D1.1.

3.6 INSTALLATION OF ALIGNMENT GUIDES:

- A. Install pipe alignment guides on piping that adjoins expansion joints and elsewhere as indicated.
- B. Anchor alignment guides to building structure as required to prevent damage to the guide or the building.

3.7 INSTALLATION OF EQUIPMENT SUPPORTS:

- A. Provide structural steel stands to support equipment not floor mounted or suspended from structure. Construct of structural steel members. Provide factory fabricated tank saddles for tanks mounted on steel stands.
- B. Coordinate with Division 3 for concrete housekeeping pads. Furnish scaled layouts of all required pads. Furnish templates, anchor bolts, and accessories necessary for pad construction.
- C. Furnish equipment supports to Division 7 Contractor for installation.

3.8 METAL FABRICATION:

- A. Cut, drill, and fit miscellaneous metal fabrications for pipe anchors and equipment supports. Install and align fabricated anchors in indicated locations.
- B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.
- C. Field Welding: Comply with AWS D1.1 for procedures of manual shielded metal-arc welding, appearance and quality of welds made, methods used in correcting welding Work, 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.
 - 4. Finish welds at exposed connections so that no roughness shows after finishing, and so that contours welded surfaces to match adjacent contours.

3.9 ADJUSTING, PAINTING AND CLEANING:

- A. Hanger adjustment: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
- B. Support adjustment: Provide grout under supports to bring piping and equipment to proper level and elevations.
- C. Painting: Immediately after erection of anchors and supports, clean field welds 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 touch-up of field painted surfaces. For galvanized surfaces, clean welds, bolted connections, and abraded areas and apply galvanizing repair paint to comply with ASTM A780.
- D. Cleaning: Clean factory finished surfaces. Repair marred or scratched surfaces with manufacturer's touch-up paint.

END OF SECTION 230529.

SECTION 230548
VIBRATION ISOLATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to Work of this Section.

1.2 DESCRIPTION OF WORK:

- A. Extent of vibration isolation Work required by this Section is indicated on drawings and schedules, and/or specified in other Division 23 Sections.
- B. Types of vibration isolation products specified in this Section include the following:
 - 1. Pad-type isolators.
 - 2. Isolation hangers.
 - 3. Isolation springs.
 - 4. Flexible duct connectors.
- C. Vibration isolation products furnished as part of factory-fabricated equipment are specified as part of the equipment assembly in other Division 23 Sections.
- D. Refer to other Sections for equipment foundations, hangers, sealant, gaskets and other Work related to vibration isolation Work.

1.3 QUALITY ASSURANCE:

- A. Product Qualification: Provide each type of vibration isolation unit produced by specialized manufacturer, with not less than 5 years successful experience in production of units similar to those required for project. Except as otherwise indicated obtain support isolation units from single manufacturer.

1.4 SUBMITTALS:

- A. Product Data: Submit manufacturer's specifications, detailed drawings, performance data and installation instructions for each type of unit required.
 - 1. Include data for each type and size of unit, showing isolation efficiency, stiffness, natural frequency and transmissibility at lowest operating speed of equipment.
 - 2. For spring units, show wire size, spring diameter, free height, solid-compression height, operating height, fatigue characteristics and ratio of horizontal to vertical stiffness.
- B. Shop Drawings: Submit shop drawings showing structural design and details of inertia bases, steel beam bases and other custom-fabricated Work not covered by manufacturer's submitted data.
- C. Submit shop drawings indicating scope of vibration isolation Work and locations of units and flexible connections. Indicate support isolation points for piping and ductwork including risers, air housings and inertia bases.

- D. Submit schedule of units, showing size or manufacturer's part number, weight supported, and resulting deflection of each unit.

PART 2 - PRODUCTS

2.1 PAD-TYPE ISOLATORS:

- A. Neoprene Pads: Oil-resistant neoprene sheets, of manufacturer's standard hardness and cross-ribbed pattern, designed for neoprene-in-shear-type vibration isolation, and in thickness required.
- B. Cork/Neoprene Pads: Close-grained composition cork sheet, laminated between 2 sheets of ribbed, oil-resistant neoprene, in thickness required.
- C. Manufacturer: Subject to compliance with requirements, provide pad-type isolators from one of the following:
 - 1. Amber/Booth Company, Inc.
 - 2. Korfund Dynamics Corp.
 - 3. Mason Industries, Inc.
 - 4. Vibration Eliminator Co., Inc.

2.2 ISOLATION HANGERS:

- A. General: Design brackets for 5 times rated loading of units. Fabricate units to accept misalignment of suspension members, and to accept rod type support members. Provide removable spacer in each unit to limit deflection during installation to rated-load deflection.
- B. Spring Hangers: Steel bracket with coil spring, spring retainers, neoprene impregnated fabric washer, and steel washer.
- C. Elastomeric Hangers: Steel bracket with rubber-in-shear element.
- D. Combination Spring-Elastomeric Hangers: Steel bracket with coil spring, spring retainers, neoprene impregnated fabric washer, and steel washer at bottom support connection point, with rubber-in-shear element at top support connection point.
- E. Manufacturer: Subject to compliance with requirements, provide isolation hangers from one of the following:
 - 1. Amber/Booth Company, Inc.
 - 2. Korfund Dynamics Corp.
 - 3. Mason Industries, Inc.
 - 4. Vibration Eliminator Co., Inc.

2.3 ISOLATION SPRINGS:

- A. Wound steel compression springs, of high-strength, heat-treated spring alloy steel, with outside diameter not less than 0.8 times operating height, lateral stiffness not less than vertical stiffness, and designed to reach solid height before exceeding rated fatigue point of steel.
- B. Provide base plate capable of accepting (2) ½" anchor bolts on opposite ends of base plate.
- C. Manufacturer: Subject to compliance with requirements, provide isolation springs from one of the following:

1. Amber/Booth Company, Inc.
2. Mason Industries, Inc.
3. Vibration Eliminator Co., Inc.

2.4 FLEXIBLE DUCT CONNECTORS:

- A. U.L. labeled laminated flexible sheet of flameproof 30 ounces per square yard fiberglass fabric neoprene reinforced with steel wire mesh where required for strength to withstand duct pressure indicated. Form connectors with full-faced 24 gauge minimum flanges and accordion bellows to perform as flexible isolation unit, and of manufacturer's standard length for each size unless otherwise indicated. Each unit shall have galvanized steel retaining rings for airtight connection with ductwork.
- B. Manufacturer: Subject to compliance with requirements, provide flexible duct connectors from one of the following:
 1. Duro Dyne.
 2. The Flexhaust Company, Inc.
 3. Mason Industries, Inc./Mercer Rubber Co.
 4. Proco Products, Inc.
 5. Ventfabrics.

PART 3 - EXECUTION

3.1 PERFORMANCE OF ISOLATORS:

- A. General: Comply with minimum static deflections recommended by the American Society of Heating, Refrigerating and Air Conditioning Engineers, HVAC Applications Handbook, latest edition, Table 42, "Selection Guide for Vibration Isolation" for selection and application of vibration isolation materials and units.
- B. Manufacturer's Recommendations: Except as otherwise indicated, comply with manufacturer's recommendations for selection and application of vibration isolation materials and units.

3.2 APPLICATIONS:

- A. General: Except as otherwise indicated, apply the following types of vibration isolators at indicated locations or for indicated items of equipment.
- B. Pad-type Isolators: Provide where indicated on the drawings, and at the following locations:
 1. Air handling units: Full perimeter.
 2. Chillers: Full base.
 3. Fluid coolers: Full base.
- C. Isolation Springs: Provide where indicated on the drawings, and at the following locations:
 1. Base mounted pumps with inertia frames: Isolation springs shall be anchored to concrete housekeeping pads with (2) ½" anchors at the base of each isolation spring.
 2. Air handling units not internally isolated.
- D. Flexible Duct Connectors: Provide where indicated on the drawings, and at all duct connections with vibration-isolation-mounted air handling equipment.

3.3 EXAMINATION OF RELATED WORK:

- A. Installer of vibration isolation Work shall observe installation of other Work related to vibration isolation Work, including Work connected to vibration isolation Work.
- B. Do not start-up equipment until inadequacies have been corrected in manner acceptable to vibration isolation Installer.

3.4 INSTALLATION:

- A. General: Except as otherwise indicated, comply with manufacturer's instructions for installation and load application to vibration isolation materials and units. Adjust to ensure that units do not exceed rated operating deflections or bottom out under loading, and are not short-circuited by other contacts or bearing points. Remove space blocks and similar devices (if any) intended for temporary protection against overloading during installation.
- B. Anchor and attach units to substrate and equipment as required for secure operation and to prevent displacement by normal forces.
- C. Adjust leveling devices as required to distribute loading uniformly onto isolators. Shim units as required where leveling devices cannot be used to distribute loading properly.
- D. Locate isolation hangers as near overhead support structure as possible.
- E. Flexible Duct Connectors: Bond flanges of flexible duct connectors to ducts and housings to provide airtight connections. Seal seams and penetrations to prevent air leakage.

3.5 COORDINATION:

- A. Furnish templates to fabricators of equipment bases, foundations and other support systems, as needed for coordination of vibration isolation units with other Work.

END OF SECTION 230548.

SECTION 230549
SEISMIC RESTRAINTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to Work of this Section.
- B. This Section is a Division 23 **Basic Materials and Methods Section**, and is part of each Division 23 Section making reference to pipes and pipe fittings specified herein.

1.2 DESCRIPTION OF WORK:

- A. All mechanical equipment, piping, and ductwork shall be supported and restrained in accordance with seismic codes, component manufacturer's standards, and applicable construction standards.
- B. Seismic restraint provided for this project shall keep all mechanical building system components in place during a seismic event.
- C. The work includes, but is not limited to the following:
 - 1. Seismic restraints for vibration isolated equipment.
 - 2. Seismic restraints for non-vibration isolated equipment.
 - 3. Seismic restraints for piping and ductwork.
 - 4. Certification of seismic restraint designs and installation supervision.
- D. Types of seismic restraints specified in this Section include the following:
 - 1. Seismic Cable Restraints.
 - 2. Seismic Solid Braces.
 - 3. Seismic Rod Clamps.
 - 4. Clevis Cross Bolt Braces.
 - 5. All-Directional Seismic Snubbers.
 - 6. Horizontal Thrust Restraints.

1.3 DEFINITIONS:

- A. **Positive Attachment:** Positive attachment is defined as a cast-in anchor, a drill-in wedge anchor, a double sided beam clamp loaded perpendicular to the beam, or a welded or bolted connection to structure. Single sided "C" type beam clamps for support rods of overhead piping, ductwork, fire protection, or any other equipment are not considered to be positive attachments.
- B. **Transverse Bracing:** Restraints applied to limit motion perpendicular to the centerline of a pipe or duct.
- C. **Longitudinal Bracing:** Restraints applied to limit motion parallel to the centerline of a pipe or duct.

1.4 QUALITY ASSURANCE:

- A. **Product Qualification:** Provide each type of seismic restraint produced by specialized manufacturer, with not less than 5 years successful experience in production of units similar to those required for project.

- B. Seismic Restraint Manufacturer's Responsibility: Manufacturer of seismic control equipment shall determine seismic restraint sizes and locations, and shall provide calculations and materials for restraint of mechanical equipment.
- C. Codes and Standards:
 - 1. Provide seismic restraints in accordance with the local Building Code, for seismic Zone.

1.5 SUBMITTALS:

- A. Product Data: Submit manufacturer's specifications, detailed drawings, performance data and installation instructions for each type of seismic restraint required.
- B. Shop Drawings: Submit shop drawings showing structural design and details of equipment bases including dimensions, structural member sizes, and support point locations. Where walls, floors, slabs, or supplementary steel work are used for seismic restraint locations, provide details of attachment methods for ducts and pipes. Restraint manufacturer's submittal shall include spacing, static loads, and seismic loads at all attachment and support points. Provide specific details of seismic restraints and anchors.
- C. Seismic Certification and Analysis: Submit Seismic restraint calculations for all connections of equipment to the structure. Calculations shall be stamped by a registered professional engineer with at least five years of seismic design experience, licensed in the state of the job location.

PART 2 - PRODUCTS

2.1 GENERAL:

- A. Where possible, provide California OSHPD pre-approved seismic devices.

2.2 SEISMIC RESTRAINTS:

- A. Seismic Cable Restraints: Provide galvanized steel aircraft cables sized to resist seismic loads with a minimum safety factor of two and arranged to provide all-directional restraint. Cables shall be pre-stretched to achieve a certified minimum modulus of elasticity. Cable end connections shall be steel assemblies that swivel to final installation angle and utilize two clamping bolts to provide proper cable engagement. Cables shall not be allowed to bend across sharp edges. Cable assemblies shall have Anchorage Pre-approval "R" number from California OSHPD.
- B. Seismic Solid Braces: Provide steel angles or channels sized to resist seismic loads with a minimum safety factor of two and arranged to provide all directional restraint. End connectors shall be steel assemblies that swivel to the final installation angle and utilize two through bolts to provide proper attachment. Solid brace assemblies shall have Anchorage Pre-approval "R" number from California OSHPD.
- C. Seismic Rod Clamps: Provide steel angles, sized to prevent buckling, clamped to pipe or equipment support rods utilizing a minimum of three ductile iron clamps at each restraint location. Rod clamp assemblies shall have an Anchorage Pre-approval "R" number from California OSHPD.
- D. Clevis Cross Bolt Braces: Provide preformed channels deep enough to be held in place by bolts passing over the cross bolt. Clevis cross bolt braces shall have Anchorage Pre-approval "R" number from California OSHPD. Provide clevis cross bolt braces at all clevis restraint locations.
- E. All-Directional Seismic Snubbers:

1. Restraining Angle Type: Provide interlocking steel members restrained by a one-piece molded neoprene bushing of bridge bearing neoprene. Bushings shall be replaceable and shall have a minimum thickness of ¼ inch. Rated loadings shall not exceed 1000 PSI. Snubber design shall have a minimum air gap of 1/8 inch in all directions before contact is made between the rigid and resilient surfaces. Snubber end caps shall be removable to allow inspection of internal clearances. Snubbers shall have Anchorage Pre-approval "R" number from California OSHPD.
 2. Bracket Type: Provide interlocking steel members restrained by shock absorbent rubber materials compounded to bridge bearing specifications. Elastomeric materials shall be replaceable, and shall have a minimum thickness of ¾ inch. Rated loadings shall not exceed 1000 PSI. Snubbers shall be manufactured with minimum air gap of 1/8", and maximum air gap of ¼" between hard and resilient material. Snubbers shall have Anchorage Pre-approval "R" number from California OSHPD.
- F. Horizontal Thrust Restraints: Provide spring element in series with a neoprene molded cup. Spring element shall be field adjustable to allow for maximum of ¼" movement at start and stop. The assembly shall be furnished with one rod and two angle brackets for attachment.
- G. Manufacturer: Subject to compliance with requirements, provide seismic restraints from one of the following:
1. Amber/Booth Company, Inc.
 2. Mason Industries, Inc.
 3. Vibration Eliminator Co., Inc.

PART 3 - EXECUTION

3.1 GENERAL:

- A. All seismic restrain systems shall be installed in strict accordance with the manufacturer's written instructions and all certified submittal data.
- B. Installation of seismic restraints shall not cause any change of position of equipment, piping, or ductwork that would result in stresses or misalignment.

3.2 SEISMIC RESTRAINT OF EQUIPMENT:

- A. The following equipment shall be seismically restrained:
 1. Air Handlers.
 2. Pumps.
 3. Roof mounted mechanical equipment.

3.3 SEISMIC RESTRAINT OF PIPING:

- A. The following piping shall be seismically restrained:
 1. All piping 2-1/2" diameter and larger.
 2. Piping 1-1/4" and larger when located in boiler rooms, mechanical equipment rooms, and refrigeration rooms.
- B. Transverse piping restraints shall be at 40 feet maximum spacing for all pipe sizes, except where lesser spacing is required to limit anchorage loads.
- C. Longitudinal restraints shall be at 80 feet maximum spacing for all pipe sizes, except where lesser spacing is required to limit anchorage loads.

- D. Gas piping and fuel oil piping transverse restraints shall be at 20 feet maximum spacing. Gas piping longitudinal restraints shall be at 40 feet maximum spacing.
- E. Where thermal expansion is a consideration, guides and anchors may be used as transverse and longitudinal restraints provided they have a capacity equal to or greater than the restraint loads in addition to the loads induced by expansion or contraction.
- F. Transverse restraint for one pipe section may also act as a longitudinal restraint for a pipe section of the same size connected perpendicular to it if the restraint is installed within 24 inches of the elbow or tee.
- G. Hold down clamps shall be used to attach pipes to all trapeze members before applying restraints in a manner similar to clevis supports.
- H. Branch lines shall not be used to restrain main lines.

3.4 SEISMIC RESTRAINT OF DUCTWORK:

- A. The following ductwork shall be seismically restrained:
 - 1. Rectangular ducts with cross sectional area of 6 square feet or larger.
 - 2. Round ducts with diameters of 28" or larger.
- B. Transverse restraints shall occur at 30 feet intervals, or at both ends of the duct run if less than the specified interval. Transverse restraints shall be installed at each duct turn and at each end of a duct run.
- C. Longitudinal restraints shall occur at 60 feet intervals with at least one restraint per duct run.
- D. Transverse restraints for one duct section may act as longitudinal restraint for a duct section connected perpendicular to it if the restraints are installed within 4 feet of the intersection of the ducts and if the restraints are sized for the larger duct.
- E. Ductwork shall be reinforced at the restraint locations. Reinforcement shall consist of an additional angle on top of the ductwork that is attached to the support hanger rods. Ductwork shall be attached to both upper angle and lower trapeze.
- F. Walls, including gypsum board non-bearing partitions, which have ducts running through them may replace a typical transverse brace. Provide channel framing around ducts and solid blocking between the duct and frame.

3.5 SEISMIC RESTRAINT EXCLUSIONS:

- A. Exclude seismic restraints on the following piping:
 - 1. Gas piping less than 1" inside diameter.
 - 2. All piping suspended by individual hangers 12 inches or less in length as measured from the top of the pipe to the bottom of the support where the hanger is attached. However, if the 12 inch limit is exceeded by any hanger in the run, seismic bracing is required for the run.
- B. Exclude seismic restraints on the following ductwork:
 - 1. Rectangular and oval ducts that are less than 6 square feet in cross sectional area.
 - 2. Round ducts that are less than 28 inches in diameter.
 - 3. All duct suspended by hangers 12 inches or less in length as measured from the top of the duct to the point of attachment to the structure. Hangers must be attached within 2 inches of the top of the duct with a minimum of two #10 sheet metal screws. If the 12" limit is exceeded by any hanger in the run, seismic bracing is required for the run.

END OF SECTION 230549.

SECTION 230553
MECHANICAL IDENTIFICATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to Work of this Section.
- B. This Section is a Division 23 **Basic Materials and Methods Section** and is part of each Division 23 Section making reference to pipes and pipe fittings specified herein.

1.2 DESCRIPTION OF WORK:

- A. Extent of Work required by this Section includes labels and identification tags for mechanical equipment and systems.
- B. Types of identification devices specified in this Section include the following:
 - 1. Pipe Markers.
 - 2. Pressure Sensitive Tape.
 - 3. Underground Type Plastic Line Markers.
 - 4. Engraved Plastic Laminate Signs.
 - 5. Ceiling Markers.

1.3 QUALITY ASSURANCE:

- A. Codes and Standards:
 - 1. ANSI Standards: Comply with ANSI A13.1 for lettering size, length of color field, colors, and viewing angles of identification devices.

1.4 SUBMITTALS:

- A. Submit product brochures describing the various types of identification devices required.
- B. Submit schedule of colors and wording for the signs and markers for the various systems and equipment. Terminology shall exactly match Contract Documents and shall be approved by Engineer prior to fabrication.
- C. Submit list of equipment to be provided with ceiling markers.

PART 2 - PRODUCTS

2.1 MANUFACTURERS:

- A. Subject to compliance with requirements, provide mechanical identification products of one of the following:

1. Allen Systems, Inc.
2. W.H. Brady Co.
3. Seton Identification Products.
4. Brimar Industries, Inc.

2.2 PIPE MARKERS:

A. General:

1. Lettering: Manufacturer's standard pre-printed nomenclature that best describes each piping system, as approved by Engineer.
2. Weather Resistance: Where pipe markers shall be exposed to the weather, provide products suitable for use in weather.
3. Flow Direction: Provide pipe markers with arrow indicating direction of flow, either integrally with service lettering, as a separate unit of plastic, or printed on pressure sensitive tape.

B. Snap-On Type: Provide manufacturer's standard pre-printed, semi-rigid snap-on, color-coded pipe markers, complying with ANSI A13.1.

C. Pressure-Sensitive Type: Provide manufacturer's standard pre-printed, permanent adhesive, color-coded, pressure-sensitive vinyl pipe markers, complying with ANSI A13. Each end of the marker shall be secured to the pipe with one complete wrapping of pressure-sensitive tape.

2.3 PRESSURE-SENSITIVE TAPE:

A. Provide manufacturer's standard color-coded pressure-sensitive (self-adhesive) vinyl tape, not less than 3 mils thick, minimum of 1-1/2" wide.

B. Color shall match color of pipe markers.

2.4 UNDERGROUND-TYPE PLASTIC LINE MARKERS:

A. General: Provide manufacturer's standard permanent, bright-colored, continuous-printed plastic tape, intended for direct-burial service.

B. Construction: Multi-ply tape consisting of solid aluminum foil core between 2-layers of polyethylene tape, not less than 6" wide x 4 mils thick.

C. Terminology: Provide tape with printing which most accurately indicates the type of service of buried pipe, as approved by the Engineer.

2.5 ENGRAVED PLASTIC-LAMINATE SIGNS:

A. General: Provide engraving stock melamine plastic laminate, complying with Fed. Spec. L-P-387, black lettering in white field, engraver's standard letter style, 1/2" high lettering on 1-1/2" high sign (single line) and 2" high sign (two lines). Secondary lettering, when required, shall be 2/3 to 3/4 of principal lettering size. Signs shall be punched for mechanical fastening, except where adhesive mounting is required.

B. Terminology: Terminology shall exactly match Contract Documents and shall be approved by Engineer prior to fabrication.

C. Thickness: 1/16" for units up to 20 square inches or 8" length; 1/8" for larger units.

D. Fasteners: Self-tapping stainless steel screws.

E. Adhesives: Plastic laminate label manufacturer's standard pressure sensitive adhesive backing.

2.6 CEILING MARKERS:

- A. Paper dot, self-adhesive, 3/4 inch diameter, yellow in color.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS:

- A. Coordination: Where identification is to be applied to surfaces which require insulation, painting or other covering or finish, install identification after completion of covering and painting.
- B. Visibility: All mechanical identification signs and markers shall be easily visible and legible. Division 23 shall relocate signs or markers that become visually blocked by Work of others.

3.2 PIPING SYSTEM IDENTIFICATION:

- A. Provide pipe markers and flow arrows of one of the types specified for all systems. Provide only one type of marker for all systems.
- B. Provide piping identification wherever piping is exposed to view in mechanical rooms, accessible maintenance spaces (shafts, tunnels, plenums) and exterior non-concealed locations. Locate pipe markers and color bands as follows:
 - 1. Near each valve and control device.
 - 2. Near each branch, excluding short take-offs for fixtures and terminal units. Mark each pipe at branch, where there could be question of flow pattern.
 - 3. Near locations where pipes pass through walls, floors, ceilings, or enter non-accessible enclosures.
 - 4. At access doors, manholes and similar access points that permit view of concealed piping.
 - 5. Near major equipment items and other points of origination and termination.
 - 6. At 25 foot intervals on long runs.
 - 7. On piping above removable acoustical ceilings.

3.3 UNDERGROUND PIPING IDENTIFICATION:

- A. During back-fill of each exterior underground piping system, provide continuous underground- type plastic line markers, located directly over buried line at 6" to 8" below finished grade. Where multiple small lines are buried in common trench and do not exceed overall width of 16", provide single line marker.

3.4 MECHANICAL EQUIPMENT IDENTIFICATION:

- A. Provide engraved plastic laminate label on each major item of mechanical equipment, each operational device, and on all other devices required by the Engineer.
- B. Provide signs to inform operator of operational requirements, to indicate safety and emergency precautions, and to warn of hazards and improper operations.
- C. Terminology:
 - 1. Air handling units: AHU-1, AHU-2, etc.
 - 2. Boilers: B-1, B-2, etc.
 - 3. Cooling towers: CT-1, CT-2, etc.
 - 4. Computer room cooling units: CRU-1, CRU-2, etc.

5. Condensing units: CU-1, CU-2, etc.
6. Energy recovery units: ERU-1, ERU-2, etc.
7. Exhaust fans: EF-1, EF-2, etc.
8. Fan coil units: FCU-1, FCU-2, etc.
9. Fan terminal units: FTU-1, FTU-2, etc.
10. Fluid coolers: FC-1, FC-2, etc.
11. Heat pumps: HP-1, HP-2, etc.
12. Liquid chilling units: CH-1, CH-2, etc.
13. Makeup air units: MAU-1, MAU-2, etc.
14. Rooftop units: RTU-1, RTU-2, etc.
15. Unit heaters: UH-1, UH-2, etc.
16. Water heaters: WH-1, WH-2, etc.
17. VAV terminal units: VTU-1, VTU-2, etc.

3.5 EQUIPMENT ABOVE CEILING:

- A. Provide ceiling markers on the one lay-in ceiling tile that should be removed for access to equipment above the ceiling. Locate marker in far right corner of ceiling tile.

END OF SECTION 230553.

SECTION 230593**TESTING, ADJUSTING AND BALANCING****PART 1 -GENERAL****1.1 RELATED DOCUMENTS:**

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to Work of this Section.
- B. The requirements as set forth in Division 23 **Basic Materials and Methods Sections** shall apply to Work of this Section.

1.2 DESCRIPTION OF WORK:

- A. Provide systems testing, adjusting, and balancing as required to check and adjust all the building environmental systems to produce the design objectives. It shall include:
 - 1. Balance of air distribution for all systems.
 - 2. Adjustment of total system to provide design quantities.
 - 3. Electrical measurement.
 - 4. Verification of performance of all equipment and automatic controls.
 - 5. Sound and vibration measurement.

1.3 QUALITY ASSURANCE:

- A. Required for all Corporate Development:
YUM! Brands, Inc. "Zero Defect" Test and Balance Program.
National Consultants: Test and Balance Corporation
 Melink Corporation
 Awarded Global

Refer to the Scope of Works Documents, section 00020, for instructions and contact information. Refer to "Support Tools" on the Yum website for an outline all applicable information pertaining to the "Zero Defect" Test and Balance Program.

- B. Codes and Standards:
 - 1. NEBB: "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems."
 - 2. ASHRAE 111-1988: Practices for Measurement, Testing, Adjusting, and Balancing of Building Heating, Ventilation, Air-Conditioning, and Refrigeration Systems.

1.4 QUALIFICATIONS:

- A. Procure the services of an independent air balance and testing agency, approved by the Owner, which specializes in the testing and balancing of mechanical systems as specified. Agency shall be National Environmental Balancing Bureau (NEBB) certified to adjust and balance mechanical systems.

1.5 SHOP DRAWINGS:

- A. Submit the following information in accordance with Division 23 Basic Materials and Methods Sections:

1. Within 30 days of award of contract, submit certification that the independent balancing firm meets certain criteria and provide a coordinated schedule, indicating intended site visits to review the mechanical work in progress and when the testing and balancing work will be performed.
2. Calibration Reports: Submit proof that all required instrumentation has been calibrated to tolerances required by NEBB, within a period of six months prior to starting the project.
3. Within 10 days of each site visit to inspect the mechanical work in progress, submit a report noting the systems inspected and any found deficiencies.
4. Within 30 days of the completion of the testing and balancing work, submit the test and balancing report. Submit testing, adjusting, and balancing reports bearing the seal and signature of the Test and Balance Engineer. The reports shall be certified proof that the systems have been tested, adjusted, and balanced in accordance with the referenced standards; are an accurate representation of how the systems have been installed and how the systems are operating. Reports shall be bound in a vinyl binder and the binder labeled "Balance and Test Report for Mechanical Systems of (PROJECT NAME)".

1.6 TEST AND BALANCE REPORT:

A. Include the following data in the agency's standard format:

1. General Information and Summary: Inside cover sheet to identify testing, adjusting, and balancing agency, Contractor, Owner, Architect, Engineer, and Project. Include addresses, and contact names and telephone numbers. Also include a certification sheet containing the seal and name address, telephone number, and signature of the Certified Test and Balance Engineer. Include in this division a listing of the instrumentation used for the procedures along with the proof of calibration. The remainder of the report shall contain the appropriate forms containing as a minimum, the information indicated.
2. Date of Data Collection
3. Fans:
 - a. Manufacturer, size and motor horsepower.
 - b. Amperage (nameplate, corrected full load and final).
 - c. Motor current characteristics, starter size, and heater size.
 - d. RPM (design and final operating).
 - e. Brake horsepower.
 - f. Fan CFM (design and final operating) - measured by traversing the duct.
 - g. Fan suction and discharge static pressure (design and final operating).
 - h. Fan reference number or name and location.
4. System External to Fans:
 - a. Grille or diffuser reference number and manufacturer.
 - b. Location (room number or name).
 - c. Design velocity and CFM.
 - d. Flow factor.
 - e. Final condition of balance.
5. Direct Expansion Cooling Coils:
 - a. Coil type, manufacturer, number of rows/fins per inch, and face area.
 - b. Coil reference number or name and location.
 - c. Entering and leaving air temperature (°F d.b./w.b.) (design and final).
 - d. Refrigerant suction pressure and temperature.
 - e. Coil air velocity (FPM).
6. Electric Heating Coils:
 - a. Manufacturer, model, reference number or name and location.
 - b. Full load amperage.
 - c. Electrical characteristics.

1.7 OPERATION AND MAINTENANCE MANUALS:

- A. Include the approved final test and balance report in Operation and Maintenance Manual.

1.8 PRE-BALANCING CONFERENCE:

- A. Prior to beginning of the testing, adjusting, and balancing procedures, schedule and conduct a conference with the Architect/Engineer and representatives of installers of the mechanical systems. The objective of the conference is final coordination and verification of the system operation and readiness for testing, adjusting, and balancing.

1.9 PROJECT CONDITIONS:

- A. Systems Operation: Systems shall be fully operational prior to beginning test and balance procedures.
- B. Contractor shall coordinate testing with the Testing and Balance Company. All systems shall be fully operational prior to commencement of testing. Correct all deficiencies noted in the Test and Balance Report within three days or prior to store opening.

1.10 SEQUENCING AND SCHEDULING:

- A. Test, adjust, and balance the air systems before testing of refrigerant systems.
- B. Provide opposite season check-out of all system components which may be required, and modify air distribution delivery and/or controls to any room, area, or zone, which may require adjustment during the first year of system operation.

PART 2 - PRODUCTS (Not Applicable.)

PART 3 - EXECUTION

3.1 TESTING AND BALANCING - GENERAL

- A. Balancing and testing shall not be started until the individual system has been completed, commissioned and is in full working order. Individual systems and equipment shall be placed in full operation and the operation of systems shall be continuous during the testing and balancing period. The cost of operating the systems shall be borne by Division 23.
- B. Assume responsibility for correcting all items determined to be the result of improper or incomplete installation.
- C. Contractor shall be responsible for providing test reports to the local jurisdiction as required for Certificate of Occupancy.
- D.
- E. All personnel involved in the execution of the balancing work shall be experienced and trained in the total balancing of mechanical systems, as well as being regular full time employees of the Balancing Agency. All work by the Agency shall be done under direct supervision of a certified test and balance engineer.
- F. All instruments shall be accurately calibrated and maintained in good working order, in accordance with NEBB requirements. Calibration histories for instruments shall be available for examination.
- G. Accuracy of measurements shall be in accordance with NEBB Standards.

- H. The mechanical systems including all equipment, apparatus and distribution systems shall be tested, balanced, and adjusted in accordance with the latest NEBB Standards.
- I. Provide a minimum of five (5) site visits while the mechanical Work is in progress to inspect the work for type and location of dampers, valves, etc. required to properly perform the testing and balancing. Recommendations, deficiencies, etc. shall be reported in the site visit report.
- J. Testing and balance agency, as a part of its contract, shall act as an authorized inspection agency, responsible through the Mechanical Contractor to the Engineer and the Owner, and shall report discrepancies of items not installed in accordance with contract systems drawings and/or specifications pertaining to the air distribution, cooling, heating and exhaust systems.
- K. Evaluate and compare measured data with manufacturer's published data on equipment and report any deviations and provide explanation for those deviations.
- L. Division 23 shall coordinate Work done by the testing and balancing agency in the following manner.
 - 1. Test and balancing agency shall review the drawings before Work is started and shall advise the engineer and contractor of any additional dampers required or other problems.
 - 2. Provide two sets of final prints of air conditioning plans to test and balancing agency prior to construction, for plan check purposes.
 - 3. Direct installing contractor to make all necessary changes or additions to air systems on items reported by test and balancing agency, whether indicated on drawings or not.
 - 4. Inform test and balancing agency of any major changes made to the system during construction and provide complete set of as built drawings.
 - 5. Correct excess air leakage with additional sealant in accordance with other Division 23 Sections.
 - 6. Test and balancing engineer shall provide periodical site visits as necessary, to inspect the work in progress, to note deficiencies, and make recommendations. A preliminary schedule shall be submitted for Architect / Engineer's approval.
 - 7. Furnish one set of filters to Test and Balancing Contractor for installation in air handling equipment prior to testing and balancing. Retain receipt from Testing and Balancing contractor that filters have been received and installed.
 - 8. Provide necessary equipment including additional sheaves for equipment to achieve design flows. Changing of sheaves is to be approved by the Engineer prior to Work being performed.
- M. Changes that are required for the final balancing results shall be provided by the appropriate trade. Such changes may include, but are not necessarily limited to the changing of pulleys, belts, dampers, or adding dampers or access panels.
- N. At the completion of the work, clean the area of all debris such that the Project is left in a neat and clean manner as deemed acceptable by the Owner.

3.2 TESTING AND BALANCING - AIR SYSTEMS

- A. Testing and balancing procedures shall be performed with clean filter media. Obtain a new set of air handling filters from Mechanical Contractor. Install these filters prior to beginning testing and balancing. Obtain receipt from Owner/Engineer that new filters have been installed before testing and balancing has begun.
- B. Before testing and balancing procedures are started, automatic dampers shall be checked for settings and operation.
- C. All equipment, ducts, coils, etc. shall be in clean condition before testing and balancing procedures are started.

- D. Air volumes for all main supply and major branch ducts shall be measured by using flow measuring stations provided or by use of the duct traverse pitot tube method, taking a minimum of 16 readings. Seal duct access holes with metal snap-in plugs. The use of duct tape to seal access holes is not permitted.
- E. Balancing dampers shall be adjusted for required main supply, return, and branch duct air quantities.
- F. Grilles and diffusers shall be adjusted to within 5% of individual requirements specified. Readjust grilles and diffusers as required to minimize drafts in all areas.
- G. Total air delivery from a fan system shall be obtained by adjustment of the fan speed. The drive motor of each fan shall not be loaded greater than the corrected full load amperage rating of the motor involved.

3.3 PERFORMING TESTING, ADJUSTING, AND BALANCING:

- A. Perform testing and balancing procedures on each system identified, in accordance with the detailed procedures outlined in the referenced standards.
- B. Cut insulation, ductwork, and piping for installation of test probes to the minimum extent necessary to allow adequate performance of procedures.
- C. Patch insulation, ductwork, and housings, using materials identical to those removed. Use of tape shall not be acceptable. At agency's option, use plastic or rubber plugs with retainers to patch drilled holes.
- D. Seal ducts and piping, and test for and repair leaks.
- E. Seal insulation to re-establish integrity of the vapor barrier.
- F. Mark equipment settings, including damper control positions, valve indicators, fan speed control levers, and similar controls and devices, to show final settings. Mark with paint or other suitable, permanent identification materials.
- G. Retest, adjust, and balance systems subsequent to significant system modifications, and resubmit test results.

3.4 TESTING FOR SOUND AND VIBRATION:

- A. Test and adjust mechanical systems for sound and vibration in accordance with the detailed instructions of the referenced standards.

END OF SECTION 230593

SECTION 230713**MECHANICAL INSULATION****PART 1 - GENERAL****1.1 RELATED DOCUMENTS:**

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to Work of this Section.
- B. The requirements as set forth in Division 23 **Basic Materials and Methods Sections** shall apply to Work of this Section.

1.2 DESCRIPTION OF WORK:

- A. Extent of work by this section includes insulation for the various mechanical and plumbing systems and equipment.
- B. Types of mechanical insulation specified in this section include the following:
 - 1. Piping System Insulation:
 - a. Fiberglass Insulation.
 - b. Flexible Unicellular Insulation.
 - c. Self-adhesive waterproofing membrane.
 - 2. Ductwork System Insulation:
 - a. Rigid Fiberglass Insulation.
 - b. Flexible Fiberglass Insulation.
 - c. Composite grease duct fire protection insulation.
 - 3. Insulation accessories.

1.3 QUALITY ASSURANCE:

- A. Installers Qualifications: Firm with at least 5 years successful installation experience on projects with mechanical insulation similar to that required for this project.
- B. Flame/Smoke Ratings: All materials used for mechanical insulation including insulation, jackets, coverings, sealers, mastics and adhesives, etc. shall have a flame-spread index of not more than 25 and a smoke-developed index not exceeding 50, as tested by ASTM E 84 (NFPA 255) method.

1.4 SUBMITTALS:

- A. Product Data: Submit manufacturer's specifications and installation instructions for each type of mechanical insulation.
- B. Submit schedule showing manufacturer's product number, thickness, and furnished accessories for each mechanical system requiring insulation.

1.5 DELIVERY, STORAGE, AND HANDLING:

- A. Deliver insulation, coverings, cements, adhesives, and coatings to site in containers with manufacturer's stamp or label affixed showing fire hazard ratings of products.
- B. Protect insulation against dirt, water, chemical and mechanical damage. Do not install damaged insulation. Remove damaged insulation from project site.

PART 2 - PRODUCTS

2.1 PIPING SYSTEM INSULATION:

A. Fiberglass Pipe Insulation:

1. Rigid, one-piece fiber glass pipe insulation, complying with requirements of ASTM C 547; with a factory applied white kraft bonded to aluminum foil, reinforced with fiberglass yarn vapor jacket with self-sealing adhesive lap longitudinal joints and butt strips for transverse joints. Jacketing shall conform to ASTM C 1136, Type I, and shall have a maximum vapor transmission rating of 0.02 perm when tested according to ASTM E 96, Procedure A. Thermal conductivity (K value) shall not exceed 0.25 BTU•in./hr.•ft²•°F at 75°F mean temperature, and insulation and jacket shall be rated for operating temperatures up to 850°F. Provide insulation thickness as indicated.
2. Fittings: Insulation shall be preformed for fitting or fabricated from cut to fit strips of fiberglass. Field cut strips shall be secured in place with adhesive as recommended by the manufacturer.
3. Manufacturers: Subject to compliance with requirements, provide fiberglass pipe insulation from one of the following:
 - a. Certainteed Corp.
 - b. Knauf Fiber Glass.
 - c. Owens-Corning Fiberglass Corp.
 - d. Johns Manville Corp.
4. Service:
 - a. Cold piping systems:
 - 1) Refrigerant suction piping: 1" thickness.
 - 2) Condensate drain piping: ½" thickness

B. Flexible Unicellular Pipe Insulation:

1. Flexible, one-piece expanded closed-cell elastomeric pipe insulation, complying with requirements of ASTM C 518, with a maximum vapor transmission rating of 0.10 perm-in. when tested in accordance with ASTM E 96. Thermal conductivity (K value) shall not exceed 0.27 BTU•in./hr.•ft²•°F at 75°F mean temperature, and insulation and jacket shall be rated for operating temperatures from -20°F to 220°F. Provide insulation thickness as indicated.
2. Flexible, one-piece expanded closed-cell elastomeric pipe insulation, self sealing, with a maximum vapor transmission rating of 0.20 perm-in. when tested in accordance with ASTM E 96. Thermal conductivity (K value) shall not exceed 0.27 BTU•in./hr.•ft²•°F at 75°F mean temperature, and insulation and jacket shall be rated for operating temperatures from 40°F to 180°F. Provide insulation thickness as indicated.
3. Manufacturers: Subject to compliance with requirements, provide flexible unicellular pipe insulation from one of the following:
 - a. Armstrong World Industries, Inc.
 - b. IMCOA.
 - c. Rubatex Corporation.
4. Service:
 - a. Cold piping systems:
 - 1) Refrigerant suction piping: 1" thickness.

2.2 DUCTWORK SYSTEM INSULATION:

A. Flexible Fiberglass Insulation:

1. Flexible blanket-type insulation composed of glass fibers bonded together with a thermosetting resin, complying with requirements of ASTM C 553, Type II, with factory

applied kraft bonded to aluminum foil, reinforced with fiber glass yarn vapor jacket with a 2" wide stapling and taping tab on one edge. Jacketing shall conform to ASTM C 1136, Type II (1.0PCF density), and shall have a maximum vapor transmission rating of 0.02 perm when tested according to ASTM E 96, Procedure A. Thermal conductivity (K value) shall not exceed 0.26 BTU•in./hr.•ft²•°F at 75°F mean temperature, and insulation and jacket shall be rated for operating temperatures from 35°F to 250°F. Provide insulation thickness as indicated.

2. Manufacturers: Subject to compliance with requirements, provide flexible fiberglass insulation from one of the following:
 - a. Certainteed Corp.
 - b. Knauf Fiber Glass.
 - c. Owens-Corning Fiberglass Corp.
 - d. Johns Manville Corp.

B. Composite grease duct fire protection insulation:

1. Flexible blanket-type insulation composed of a needled alumina-silica fiber blanket encapsulated in an aluminum foil scrim, providing a noncombustible wrap encased in foil to provide a vapor and dust barrier. The duct wrap system shall have a flame-spread index of not more than 5 and a smoke-developed index not exceeding 5, when tested per ASTM E 84 (NFPA 255) method. Thermal conductivity (K value) shall not exceed 0.23 BTU•in./hr.•ft²•°F at 100°F mean temperature, and insulation and jacket shall be rated for operating temperatures up to 2300°F. The duct wrap system shall be listed by Underwriters Laboratories Inc, classified under Grease Duct Enclosures, and the duct firestop system shall be classified as UL System C-AJ-7004. Fabricate 3" duct wrap enclosure (2 layers) to provide 2-hour fire rating, with zero clearance to combustibles.
2. Manufacturers: Subject to compliance with requirements, provide composite grease duct fire protection insulation from one of the following:
 - a. 3M Fire Protection Products (FireMaster).
 - b. Premier Refractories and Chemicals, Inc. (Pyroscat FP).
 - c. Unifrax Corporation (FyreWrap).
3. Service:
 - a. Kitchen grease exhaust ducts.

2.3 INSULATION ACCESSORIES:

- A. Provide staples, bands, screws, wire, wire netting, tape, corner angles, anchors, and stud pins as recommended by insulation manufacturer for application.
- B. Provide adhesives, cement, sealers, and protective finishes as recommended by insulation manufacturer for application.
- C. Insulation Inserts: 12" long high density rigid polyurethane, 125 PSI compressive strength pipe insulation, covering bottom 180 degrees of pipe, same thickness as adjoining pipe insulation. Vapor barrier and jacket shall be maintained continuously through the hanger.

PART 3 - EXECUTION

3.1 GENERAL:

- A. Install insulation products in accordance with manufacturer's written installation instructions, and in accordance with recognized industry practices to ensure that insulation serves its intended purpose.

3.2 INSTALLATION OF PIPING INSULATION:

- A. Insulation Omitted: Omit insulation at the following locations:
 - 1. Exposed plumbing fixture run-outs from faces of wall or floor to fixture.
- B. Install insulation on pipe systems subsequent to installation of heat tracing, testing, and acceptance of tests.
- C. Install insulation materials with smooth and even surfaces. Insulate each continuous run of piping with full-length units of insulation, with a single cut piece to complete run. Do not use cut pieces or scraps abutting each other.
- D. Clean and dry pipe surfaces prior to insulating. Butt insulation joints firmly together to ensure a complete and tight fit over surfaces to be covered.
- E. Maintain integrity of vapor-barrier jackets and protect to prevent puncture or other damage.
- F. Extend piping insulation without interruption through walls, floors and similar piping penetrations, except where otherwise indicated.
- G. Apply wet coat of vapor barrier lap cement on exposed ends of insulation. The vapor barrier at butt joints between pieces of insulation shall be maintained by sealing with a vapor barrier tape or band, etc, as recommended by the manufacturer.
- H. Provide insulation inserts at each pipe support location, and elsewhere as required to prevent compression of insulation.
- I. Pipe supports on vertical risers that penetrate insulation shall be insulated and covered with a vapor barrier as required to match pipe insulation.

3.3 INSTALLATION OF DUCTWORK INSULATION:

- A. Insulation Omitted: Except as otherwise indicated, omit insulation on ductwork where internal insulation or sound absorbing lining has been installed.
- B. Install insulation materials with smooth and even surfaces.
- C. Clean and dry ductwork prior to insulating. Butt insulation joints firmly together to ensure complete and tight fit over surfaces to be covered.
- D. Maintain integrity of vapor-barrier on ductwork insulation, and protect it to prevent puncture and other damage.
- E. Extend ductwork insulation without interruption through walls, floors and similar ductwork penetrations, except where walls or floors are fire rated.
- F. Wrapped ductwork insulation:
 - 1. Application Requirements: Insulate the following ductwork as follows:
 - a. HVAC supply ductwork between fan discharge, or HVAC unit discharge, and room terminal outlet.
 - b. HVAC return ductwork between room terminal inlet and return fan inlet, or HVAC unit inlet.
 - 2. Insulate each ductwork system specified above with 1-1/2 inches thick insulation and vapor barrier jacket, application limited to concealed locations.

- G. Install insulation products in accordance with manufacturer's written instructions, and in accordance with recognized industry practices to ensure that insulation serves its intended purpose and as follows:
1. Install insulation on pipe and ductwork systems subsequent to painting, testing, and acceptance of tests.
 2. Install insulation materials with smooth and even surfaces. Insulate each continuous run of piping with full-length units of insulation, with a single cut piece to complete run. Do not use cut pieces or scraps abutting each other.
 3. Clean and dry pipe or duct surfaces prior to insulating. Butt insulation joints firmly together to ensure a complete and tight fit over surfaces to be covered.
 4. Maintain integrity of vapor-barrier jackets on pipe and ductwork insulation, and protect to prevent puncture or other damage.
 5. Extend pipe and ductwork insulation without interruption through walls, floors and similar piping penetrations, except where otherwise indicated.
 6. Protect outdoor insulation from weather by installing outdoor protective finish or jacketing as recommended by manufacturer.
 7. Replace damaged insulation that cannot be repaired satisfactorily, including units with vapor barrier damage and moisture saturated units.
 8. Insulation installer shall advise Contractor of required protection for insulation work during remainder of construction period, to avoid damage and deterioration.

3.4 INSTALLATION OF KITCHEN EXHAUST DUCTWORK INSULATION:

- A. Install insulation products in accordance with manufacturer's written instructions and UL listing, and in compliance with recognized industry practices to ensure that insulation serves intended purpose.
- B. Install insulation materials with smooth and even surfaces and on clean and dry surfaces. Redo poorly fitted joints. Do not use mastic or joint sealer as filler for gapping joints and excessive voids resulting from poor workmanship.
- C. Maintain integrity of vapor-barrier and protect it to prevent puncture and other damage.
- D. Apply insulation using the staggered joint method for both single and double layer construction, where feasible. Apply each layer of insulation separately.
- E. Provide manufacturer's duct firestop system at all fire wall and floor penetrations, in strict compliance with manufacturer's instructions.

3.5 INSTALLATION OF PROTECTIVE COVERS:

- A. Install over piping and ductwork insulation located outdoors, in accordance with industry practice and manufacturer's instructions. Overlap joints and make watertight.

3.6 PROTECTION AND REPLACEMENT:

- A. Protection: Advise others of required protection for insulation Work during remainder of construction period, to avoid damage and deterioration.
- B. Replacement: Replace damaged insulation that cannot be repaired satisfactorily, including units with vapor barrier damage and moisture saturated units.

END OF SECTION 230713.

SECTION 231123
NATURAL GAS SYSTEMS

PART 1 -GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to work of this Section.
- B. The requirements as set forth in Division 23 **Basic Materials and Methods Sections** shall apply to work of this Section.

1.2 DESCRIPTION OF WORK:

- A. Extent of natural gas system work is indicated on drawings and schedules, and by requirements of this Section.
- B. Refer to other Division 23 Sections for the following work:
 - 1. Basic piping requirements for natural gas systems.
 - 2. Supports and anchors for natural gas systems.
 - 3. Identification of natural gas systems.

1.3 QUALITY ASSURANCE:

- A. Manufacturers Qualifications: Firms regularly engaged in manufacturer of natural gas piping products, of types, materials, and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.
- B. Codes and Standards:
 - 1. NFPA Compliance: Fabricate and install natural gas systems in accordance with NFPA 54 "National Fuel Gas Code".
 - 2. Utility Compliance: Fabricate and install natural gas systems in accordance with local gas utility company.
 - 3. Code Compliance: Fabricate and install natural gas systems in accordance with applicable mechanical and plumbing codes.

1.4 SUBMITTALS:

- A. Product Data: Submit manufacturer's technical product data and installation instructions for natural gas systems materials and products.
- B. Maintenance Data: Submit maintenance data and parts lists for natural gas systems materials and products.

1.5 OPERATION AND MAINTENANCE MANUALS:

- A. Include product data and maintenance data in operation and maintenance manual.

1.6 RECORD DRAWINGS:

- A. At project closeout, submit record drawings of installed natural gas systems, in accordance with requirements of Division 1 and 23.

PART 2 - PRODUCTS

2.1 MATERIALS AND PRODUCTS:

- A. Provide piping materials and factory-fabricated piping products of sizes, types, pressure ratings, and capacities as indicated. Provide materials and products complying with ANSI B31.2 where applicable. Base pressure rating on natural gas piping system maximum design pressures. Provide sizes and types matching piping and equipment connections. Provide fittings and materials that match pipe materials used in natural gas systems.

2.2 NATURAL GAS PIPING:

- A. Provide pipe and pipe fittings complying with Division 23 Basic Mechanical Materials and Methods Sections, in accordance with the following listing.
 - 1. Provide black steel pipe, standard weight.
 - 2. Provide malleable iron threaded fittings.

2.3 VALVES:

- A. Gas Cocks:
 - 1. Gas Cocks 2" and Smaller: 150 PSI non-shock WOG, bronze straightway cock, flat or square head, threaded ends.
 - 2. Gas Cocks 2½" and Larger: 150 PSI non-shock WOG, iron body, bronze mounted straightway cock, square head, flanged ends.
- B. Manufacturer: Subject to compliance with requirements, provide gas cocks from one of the following:
 - 1. A.Y. McDonald Manufacturing.
 - 2. Brass Products Company.
 - 3. Conbraco.
 - 4. Jenkins Brothers.
 - 5. Lunkenheimer Co.
 - 6. William Powell Company.
 - 7. Stockham Valves and Fittings.
 - 8. Milwaukee Valve Company, Inc.

2.4 GAS PRESSURE REGULATING VALVES:

- A. General: Provide pressure regulating valves at locations indicated on the drawings, and elsewhere as required.
- B. Gas Pressure Regulating Valves: Provide single stage, steel jacketed, corrosion-resistant gas pressure regulating valves with vent and elevation compensator. Regulating valves shall be designed for inlet and outlet gas pressures, specific gravity, and volume flow indicated. Provide threaded ends.
- C. Manufacturers: Subject to compliance with requirements, provide gas pressure regulating valves from one of the following:
 - 1. Maxitrol Company.

PART 3 - EXECUTION

3.1 INSPECTION:

- A. General: Examine areas and conditions under which natural gas systems materials and products are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.2 INSTALLATION OF NATURAL GAS PIPING:

- A. Use appropriate Teflon thread tape or sealants on metal gas piping threads, which are chemically resistant to natural gas. Use sealants sparingly, and apply only to male threads of metal joints.
- B. Remove cutting and threading burrs before assembling piping.
- C. Do not install defective piping or fittings. Do not use pipe with threads that are chipped, stripped or damaged.
- D. Plug each gas outlet, including valves, with threaded plug or cap immediately after installation. Keep plugs installed until continuing piping, or making equipment connections.
- E. Ground gas piping electrically and continuously within project, and bond tightly to grounding connection.
- F. Provide minimum 6" drip-legs in gas piping drops to equipment, at service entrance, and where required by code or regulation.
- G. Provide "tee" fitting with bottom outlet plugged or capped at bottom of pipe risers.
- H. Use dielectric unions where dissimilar metals are joined together.
- I. Provide piping with 1/64" per foot (1/8%) downward slope in direction of flow.
- J. All piping in concealed spaces or passing through active plenums shall be welded construction.
- K. All piping exposed to atmosphere or directly buried shall be plastic coated steel piping. Buried piping shall be approved by the gas utility.

3.3 INSTALLATION OF GAS COCKS:

- A. Provide at connection to gas train for each gas-fired equipment item, and on risers and branches where indicated. Provide unions for equipment disconnection. Install gas shutoff valve upstream of each pressure-regulating valve.
- B. Install gas cocks in accessible locations, and where they will be protected from damage.

3.4 INSTALLATION OF GAS PRESSURE REGULATING VALVES:

- A. Provide as indicated on the drawings. Comply with local utility requirements. Pipe atmospheric vent to outdoors, full size of outlet.
- B. Vents shall have insect screen cover and terminate 10'-0" away from or 3'-0" above windows, doors, or outdoor air inlets.

3.5 EQUIPMENT CONNECTIONS:

- A. Connect gas piping to each gas-fired equipment item, with union, drip leg and gas cock, as indicated on the drawings. Comply with equipment manufacturer's instructions.

3.6 FIELD QUALITY CONTROL:

- A. Piping Tests: Inspect, test, and purge natural gas systems in accordance with NFPA 54, and local utility requirements.

3.7 SPARE PARTS:

- A. Valve Wrenches: Furnish to Owner and obtain receipt for 2 valve wrenches for each type of gas valve installed.

END OF SECTION 231123

SECTION 232300**REFRIGERANT PIPE, PIPE FITTINGS, AND SPECIALTIES****PART 1 - GENERAL****1.1 RELATED DOCUMENTS:**

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to Work of this Section.
- B. The requirements as set forth in Division 23 **Basic Materials and Methods Sections** shall apply to Work of this Section.

1.2 DESCRIPTION OF WORK:

- A. The extent of refrigerant piping Work required is indicated on the drawings and by requirements of this Section.
- B. Products installed but not furnished under this Section include refrigerant accessories furnished with packaged air conditioning equipment.

1.3 QUALITY ASSURANCE:

- A. Qualify brazing processes and brazing operators in accordance with ASME "Boiler and Pressure Vessel Code", Section IX, "Welding and Brazing Qualifications".
- B. Codes and Standards: Comply with the provisions of the following:
 - 1. ANSI B31.5, "ASME Code for Pressure Piping - Refrigerant Piping."
 - 2. ANSI/ASHRAE Standard 15, "Safety Code for Mechanical Refrigeration."

1.4 SUBMITTALS:

- A. Submit product data, including rated capacities, furnished options and accessories, and installation instructions for each type of refrigerant specialty.
- B. Submit maintenance data and parts list for each type of refrigerant specialty.
- C. Submit shop drawings showing layout of refrigerant piping, specialties, and fittings including, pipe and tube sizes, valve arrangements and locations, slopes of horizontal runs, wall and floor penetrations, and equipment connection details. Show interface and spatial relationship between piping and equipment.
- D. Submit Brazer Certificates signed by Contractor certifying that brazers comply with ASME "Boiler and Pressure Vessel Code", Section IX, "Welding and Brazing Qualifications".

1.5 OPERATION AND MAINTENANCE MANUALS:

- A. Include maintenance data and parts lists, product data, shop drawings, and record drawings in Operation and Maintenance Manual.

1.6 RECORD DRAWINGS:

- A. At project closeout, submit record drawings of installed refrigerant piping and piping products, in accordance with requirements of Division 1 and 23.

PART 2 - PRODUCTS

2.1 MANUFACTURERS:

- A. Subject to compliance with requirements, provide products by one of the following:
 - 1. Refrigerant Valves and Specialties:
 - a. Alco Controls Div., Emerson Electric.
 - b. Danfoss Electronics, Inc.
 - c. Eaton Corporation, Control Div.
 - d. Henry Valve Company.
 - e. Parker-Hannifin Corporation, Refrigeration and Air Conditioning Division.
 - f. Sporlan Valve Company.

2.2 PIPE AND TUBING MATERIALS:

- A. General: Provide pipe and pipe fittings complying with Division 23 Basic Mechanical Materials and Methods Sections, in accordance with the following listing:
 - 1. Provide copper Type ACR refrigeration tube.

2.3 REFRIGERANT PIPING SPECIALTIES:

- A. Moisture/liquid Indicators: 500 PSIG maximum operation pressure, 200°F maximum operating temperature; forged brass body, with replaceable polished optical viewing window, and solder end connections.
- B. Suction Line Filter-Drier: 350 PSIG maximum operation pressure, 225°F maximum operating temperature; steel shell, and wrought copper fittings for solder end connections. Permanent filter element shall be molded felt core surrounded by a desiccant for removal of acids and moisture for refrigerant vapor.
- C. Flexible Connectors: 500 PSIG maximum operating pressure; seamless tin bronze or stainless steel core, high tensile bronze braid covering, solder connections, and synthetic covering; dehydrated, pressure tested, minimum 7" in length.
- D. Expansion Valves: Machined brass bar body w/brass or stainless seat brass piston pin, stainless steel push rods, solder ends, and coarse mesh strainer disc at inlet. Provide equalizing line combined for multiple circuits and individual remote sensing bulbs with sufficient tubing from evaporator outlet piping to valve.
- E. Solenoid Valves: Provide normally closed with manual lift stems, pilot operated, solder connections, voltage as required. Rated for system pressure.

2.4 REFRIGERANT:

- A. Refrigerant shall be as required by the equipment manufacturer in accordance with ASHRAE Standard 34.

PART 3 - EXECUTION

3.1 PIPING INSTALLATIONS:

- A. General: Install refrigerant piping in accordance with ASHRAE Standard 15 - "Safety Code for Mechanical Refrigeration."
- B. Install piping in as short and direct arrangement as possible to minimize pressure drop.
- C. Install piping for minimum number of joints using as few elbows and other fitting as possible.
- D. Arrange piping to allow normal inspection and servicing of compressor and other equipment. Install specialties in accessible locations to allow for servicing and inspection.
- E. Install copper tubing in rigid or flexible conduit in locations where copper tubing will be exposed to mechanical injury.
- F. Slope refrigerant piping as follows:
 - 1. Install horizontal hot gas discharge piping with 1/2" per 10' downward slope away from the compressor.
 - 2. Install horizontal suction lines with 1/2" per 10 feet downward slope to the compressor, with no long traps or dead ends, which may cause oil to separate from the suction gas and return to the compressor in damaging slugs.
 - 3. Install traps and double risers where indicated, and where required to entrain oil in vertical runs.
 - 4. Liquid lines may be installed level.
 - 5. Make reductions in pipe sizes using eccentric reducer fittings installed with the level side down.
 - 6. Install moisture/liquid indicators in liquid lines between filter/dryers and thermostatic expansion valves and in liquid line to receiver.
 - 7. For pipes larger than 2-1/8" outside diameter, moisture/liquid indicators shall be installed in a bypass line.

3.2 PIPE JOINT CONSTRUCTION:

- A. Brazed Joints: Comply with the procedures contained in the AWS "Brazing Manual."
- B. Some filler metals contain compounds, which produce highly toxic fumes when heated. Provide adequate ventilation.
- C. Remove seats and accessible internal parts of refrigerant specialties before brazing, to prevent damage to the accessories. Do not apply heat near the bulb of expansion valves.
- D. Fill the pipe and fittings during brazing, with an inert gas (i.e., nitrogen or carbon dioxide) to prevent formation of scale.
- E. Heat joints using oxy-acetylene torch. Heat to proper and uniform brazing temperature.

3.3 FIELD QUALITY CONTROL:

- A. Inspect, test, and perform corrective action of refrigerant piping in accordance with ASME Code B31.5, Chapter VI.

- B. Repair leaking joints using new materials, and retest for leaks.

3.4 ADJUSTING AND CLEANING:

- A. Verify actual evaporator applications and operating conditions, and adjust thermostatic expansion valve to obtain proper evaporator superheat requirements.
- B. Clean and inspect refrigerant piping systems.
- C. Adjust controls and safeties. Replace damaged or malfunctioning controls and equipment with new materials and products.

3.5 COMMISSIONING:

- A. Charge system using the following procedure:
 1. Install core in filter dryer after leak test but before evacuation.
 2. Evacuate refrigerant system with vacuum pump, until temperature of 35°F is indicated on vacuum dehydration indicator.
 3. During evacuation, apply heat to pockets, elbows, and low spots in piping.
 4. Maintain vacuum on system for minimum of 5 hours after closing valve between vacuum pump and system.
 5. Break vacuum with refrigerant gas, and allow pressure to build up to 2 PSI.
 6. Complete charging of system, using new filter dryer core in charging line. Provide full operating charge.

END OF SECTION 232300

SECTION 233113**DUCTWORK****PART 1 - GENERAL****1.1 RELATED DOCUMENTS:**

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to Work of this Section.
- B. The requirements as set forth in Division 23 **Basic Materials and Methods Sections** shall apply to Work of this Section.

1.2 DESCRIPTION OF WORK:

- A. Extent of Work required by this Section is indicated on the drawings and by the requirements of this Section.
- B. Types of ductwork specified in this Section include the following:
 - 1. Sheet Metal Duct.
 - 2. Flexible Duct.
 - 3. Flexible Duct Connectors
 - 4. Duct Sealant.
 - 5. Duct Liner.
 - 6. Duct Support Materials.
- C. Refer to other Division 23 Sections for the following:
 - 1. Testing and balancing of ductwork systems.

1.3 QUALITY ASSURANCE:

- A. Codes and Standards:
 - 1. SMACNA Standards: Comply with SMACNA's "HVAC Duct Construction Standards", latest edition, for fabrication and installation of metal ductwork and duct liner.
 - 2. NFPA Compliance:
 - a. Comply with NFPA 90A "Standard for the Installation of Air Conditioning and Ventilating Systems", latest edition.
 - b. Comply with NFPA 96 "Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations", latest edition.

1.4 SUBMITTALS:

- A. Shop Drawings: Submit scaled layout drawings of metal ductwork and fittings including, but not limited to, duct sizes, locations, elevations, slopes of horizontal runs, wall and floor penetrations, and connections. Scaled drawings shall be drawn at not less than 1/4" = 1'-0". Show interface and spatial relationship between ductwork, piping, and proximate equipment. Show modifications of indicated requirements, made to conform to local shop practice, and how these modifications ensure that free area, materials, and rigidity are not reduced.

- B. Product Data: Submit manufacturer's technical product data and installation instructions for factory fabricated duct and duct fittings.

1.5 RECORD DRAWINGS:

- A. At project closeout, submit record drawings of installed metal ductwork and accessories.

PART 2 - PRODUCTS

2.1 SHEET METAL DUCT:

- A. General: Except as otherwise indicated on the drawings, ductwork, fittings, metal gauges, reinforcing, etc. shall be constructed in accordance with SMACNA "HVAC Duct Construction Standards," latest edition, for a 3 inch WG static pressure class.
- B. Ductwork Materials:
 - 1. Exposed Ductwork Materials: Where ductwork is indicated to be exposed to view in occupied spaces, provide materials that are free from visual imperfections including pitting, seam marks, roller marks, stains and discoloration, and other imperfections, including those that would impair painting. Ductwork and hangers exposed to view in occupied spaces shall be mill phosphatized.
 - 2. Galvanized Steel Sheet: Except as otherwise indicated, fabricate ductwork from minimum 26 gauge galvanized sheet steel complying with ASTM A 527, lock-forming quality, with G90 zinc coating in accordance with ASTM A 525.
 - 3. Carbon Steel Sheet: Where indicated, provide carbon steel sheet complying with ANSI B32.3.
 - 4. Aluminum Sheet: Where indicated, provide aluminum sheet complying with ASTM B 209, Alloy 3003, Temper H14. Fabricate per SMACNA gauge equivalent.
 - 5. Stainless Steel Sheet: Where indicated, provide stainless steel sheet complying with ASTM A 240, Type 304, with 2B finish.
- C. Duct Sizes: Duct sizes shown on the drawings are inside clear dimensions. Sheet metal sizes shall be increased to allow for duct liner, where applicable.
- D. Rectangular Duct:
 - 1. Provide 90° and 45° rectangular radius elbows with centerline radius of not less than 1.5 times duct width, or provide 90° rectangular elbows with double wall streamline turning vanes. All elbows less than 90° shall be radius elbows.
 - 2. Return air acoustical elbows and sound boots shall be rectangular elbows with no turning vanes.
 - 3. Slopes for transitions or other changes in dimensions shall be minimum 1 to 3.
- E. Round Longitudinal Seam Duct: Use for rigid metal duct extension to flexible duct run to grilles, unless otherwise indicated.
- F. Round Spiral Seam Duct: Use for all round rigid duct exposed to view in occupied spaces, medium and high pressure duct, and optionally in place of round longitudinal seam duct. Seams shall be type RL-1.
- G. Factory Fabricated Duct and Duct Fittings:

1. General: At contractor's option, provide factory fabricated ductwork and ductwork fittings in lieu of shop fabricated ductwork and fittings.
 2. Factory Fabricated Duct: Provide ductwork constructed in accordance with SMACNA and ASHRAE standards, fabricated from G90 galvanized steel meeting ASTM A 527, and having spiral seam construction.
 3. Factory Fabricated Duct Fittings: Provide fittings constructed in accordance with SMACNA and ASHRAE standards, fabricated from G90 galvanized steel meeting ASTM A 527, and having welded seam construction. All welds shall be protected after fabrication to prevent corrosion.
 4. Manufacturers: Subject to compliance with requirements, provide factory fabricated duct and duct fittings from one of the following:
 - a. Lindab, Inc.
 - b. Semco Manufacturing, Inc.
 - c. United McGill Corporation.
 - d. Wesco Manufacturing Company.
- H. Kitchen Exhaust Ducts: Fabricate kitchen exhaust ducts and supports used for grease and vapor removal from cooking equipment, of minimum 16 gauge carbon steel where concealed, and of minimum 16 gauge stainless steel where exposed. Seams shall be continuously welded liquid tight.

2.2 FLEXIBLE DUCT:

- A. General: Provide flexible air duct listed by UL under UL Standard 181 as a Class 1 flexible air duct.
- B. Low and Medium Pressure Flexible Air Duct: Flexible duct shall have CPE liner bonded to a coated spring steel helix, supporting minimum 1" thick fiberglass insulating blanket, and having a fiberglass reinforced metalized film vapor barrier. Flexible duct shall be designed for minimum 6" W.G. positive pressure, and velocity of 4000 FPM. Maximum vapor transmission rating shall be 0.1 Perm when tested in accordance with ASTM E96.
- C. Flexible Duct Clamps: Provide cadmium plated stainless steel band with swivel action and slotted hex head bolt.
- D. Manufacturers: Subject to compliance with requirements, provide flexible duct from one of the following:
 1. Atco Rubber Products, Inc. (30 Series)
 2. Automation Industries, Inc; Thermaflex (M-KE).
 3. Wiremold (WCK).

2.3 FLEXIBLE DUCT CONNECTORS:

- A. Provide flexible connectors at the discharge and inlet of fans, air handlers, rotating mechanical equipment, and where shown on the Drawings for proper vibration isolation.
- B. Neoprene impregnated glass cloth with 24-gauge galvanized metal frame. Minimum dimensions: 3-inch metal, 3-inch fabric, 3-inch metal.
- C. Duro Dyne #MFN4, Ventfabrics "Ventglas", Q Industries, Consolidated Kinetics, Elgen, or equal.

2.4 DUCT SEALANT:

- A. General: All ductwork shall be sealed in accordance with SMACNA Seal Class A.

- B. Solvent based duct sealant: Provide solvent based brush on permanent high velocity duct sealant. Sealant shall have a solvent of toluene and heptane, minimum solids content of 60%, minimum shore hardness of 60, water resistant, mold and mildew resistant.
- C. Two Part Tape Sealing System: Provide a two part tape sealing system, consisting of woven fiber tape impregnated with a gypsum mineral compound, and a modified acrylic/silicone activator that reacts exothermically with the tape. Two part tape sealing system must be rated for both indoor and outdoor application. Tape shall not contain asbestos.
- D. Water based duct sealant: Provide water based synthetic latex emulsion permanently flexible high velocity duct sealant. sealant to be capable of 15" w.g., NFPA 90a and 90b approved, ul 181B-M listed and UL 723 classified. install per manufacturer instructions. sealant shall be approved for plenum installations and meet flame spread and smoke developed ratings for plenum applications.

2.5 DUCT LINER:

- A. General: All components of the insulation including liner, mastics, and adhesives shall have a fire hazard classification with a flame spread rating not to exceed 25, a fuel contributed rating not to exceed 50, and a smoke developed rating not to exceed 50. Ratings shall be as established by tests conducted in accordance with NFPA 255-1972, per NFPA 90A.
- B. Duct Liner: Provide long textile fiber type duct liner, 3 PCF density, with a coating on the air stream side conforming to the requirements of NFPA 90A. Duct liner shall have a "K" factor of 0.23 at 75°F. Duct liner shall have EPA registered antimicrobial agents in the coating, and shall have a durable cleanable surface.

C. Duct Liner Schedule:

<u>DUCT</u>	<u>THICKNESS</u>
Rectangular return air duct vertical drops from rooftop units	1"
Rectangular toilet exhaust duct, within 10 feet of exhaust fan	1"

- D. Duct Liner Adhesives: Duct liner adhesive shall be as recommended by the duct liner manufacturer, and shall comply with ASTM C916.
- E. Duct Liner Fasteners: Fasteners shall comply with SMACNA "HVAC Duct Construction Standards", latest edition.
- F. Manufacturers: Subject to compliance with requirements, provide duct liner from one of the following:
 - 1. Owens Corning.
 - 2. Schuller International.
 - 3. Certainteed.

2.6 DUCT SUPPORT MATERIALS:

- A. Except as otherwise indicated, provide hot-dipped galvanized steel fasteners, anchors, rods, straps, trim, channel, and angles for support of ductwork.
- B. Ductwork shall be supported from trapeze type hangers consisting of galvanized steel threaded rod and galvanized steel channel with double nut and washer connections, anchored to structure above.

PART 3 - EXECUTION

3.1 INSTALLATION OF METAL DUCTWORK:

- A. General: Assemble and install ductwork in accordance with recognized industry practices which will achieve air-tight systems (maximum 5% leakage), with no objectionable noise, and capable of performing indicated service. Install each run with minimum number of joints. Align ductwork accurately with internal surfaces smooth. Support ducts rigidly. Duct hangers shall hold ducts true-to-shape and prevent buckling. Support vertical ducts at every floor.
- B. Ductwork is generally diagrammatically indicated on the Drawings and shall be generally installed as indicated. Do not scale Drawings for exact location of ducts.
- C. Install ducts to best suit field conditions and to coordinate with other building components. Do not cut Structural members without consent of Construction Manager. Check with Structural Drawings prior to locating penetrations.
- D. Duct sizes are indicated as net inside dimensions on the Drawings. The indicated dimensions shall be altered at the job site for the purpose of avoiding interference and clearance difficulties to other dimensions producing the same air handling characteristics, provided such altered dimensions are approved by the Construction Manager.
- E. Shop fabricate ductwork in standard lengths, unless otherwise indicated or required to complete runs.
- F. Fabricate duct fittings to match adjoining ducts, and to comply with duct requirements as applicable to fittings.
- G. Fabricate ductwork with duct liner in each Section of duct where indicated. Laminate liner to internal surfaces of duct in accordance with instructions by manufacturers of lining and adhesive, and fasten with mechanical fasteners. Coat all edges with liberal amount of adhesive. Spray on adhesive is acceptable if applied as heavy as hand painted.
- H. Inserts: Install concrete inserts for support of ductwork in coordination with form work, as required to avoid delays in Work.
- I. Auxiliary steel: Provide auxiliary steel as required to adequately support ductwork. Where rectangular duct width is 24" or larger, provide trapeze support only. All support shall meet SMACNA requirements.
- J. Ductwork Routing: Route ductwork runs, except as otherwise indicated, vertically and horizontally and avoid diagonal runs wherever possible. Locate runs as indicated by diagrams, details and notations, or if not otherwise indicated, route ductwork in shortest route that does not obstruct usable space or block access for servicing building and its equipment. Hold ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of the building. Wherever possible in finished and occupied spaces, conceal ductwork from view, by locating in mechanical shafts, hollow wall construction, or above suspended ceilings. Do not encase horizontal runs in solid partitions, except as specifically shown. Coordinate layout with suspended ceiling and lighting layouts and similar finished Work. Provide coordination of drainage piping and fire protection piping.
- K. Electrical Equipment Spaces: Do not route ductwork through transformer vaults and other electrical equipment spaces and enclosures, unless indicated otherwise.

- L. Penetrations:
 - 1. Where ducts pass through interior partitions or exterior walls, and are exposed to view, conceal space between opening and duct or duct insulation with sheet metal flanges of same gauge as duct. Overlap opening on 4 sides by at least 1-1/2". Fasten to duct and wall.
 - 2. Where ducts pass through fire-rated floors, walls, or partitions, provide fire stopping between duct and wall.
- M. Coordination: Coordinate duct installations with installation of accessories, dampers, coil frames, equipment, controls, and other associated Work of the duct system.
- N. Exterior joints: Seal water and to air-tight condition with sealant.
- O. Ductwork Painting, General - Where the interior surfaces of ductwork are visible through the blades of supply outlets, return inlets, and exhaust inlets, paint interior visible surfaces with one coat of flat black paint. See Section 099100 - Painting.
- P. Cleaning - Clean the inside of plenums, casings, enclosures, fans, and accessible ductwork before starting fans.

3.2 HANGERS AND SUPPORTS:

- A. Securely fasten all ducts to building construction by means of hangers, supports, guides, anchors, and sway braces to maintain duct alignment, to prevent sagging, and to prevent noise and excessive strain on ducts due to movement under operating conditions.
- B. Adequately mount and anchor all material and equipment as required. Include lateral bracing as required to prevent horizontal, seismic movement. Refer to applicable Mechanical Code requirements and details on Drawings for seismic requirements.
- C. Do not support ducts from fans or other equipment.
- D. Power-driven fasteners shall not be used to support ducts.
- E. Support round duct, 30-inch and larger, with two hangers at each support point.
- F. Hangers and supports shall conform to SMACNA section, "Hangers and Supports". Support horizontal ducts with in 2 feet of each elbow and within 4 feet of each branch intersection using double strap hangers on each side of fitting.
- G. Support vertical ducts, passing through roofs with two continuous angles screwed to the duct and bearing to the roof structure, and conforming to SMACNA section "Riser Support-From Floor."

3.3 SEISMIC SUPPORTS AND BRACING:

- A. Where required, all ductwork and equipment shall be seismically supported and braced per the SMACNA "Guidelines for Seismic Restraints of Mechanical Systems and Plumbing Piping Systems", including Appendix E.

3.4 JOINTS SEALING, GENERAL:

- A. Duct tape shall not be used on duct joints.
- B. Transverse joints: All transverse joints including Ductmate type joints on all supply, return, exhaust and outside air intake ducts, sealed using Hardcast Arabol.

- C. Interior exposed joints: Seal using water based sealer, Hardcast Iron Grip.
- D. Interior concealed joints (above 1-inch W.G. pressure ductwork): Seal using gypsum impregnated tape and adhesive.
- E. Interior concealed joints (to 1-inch W.G. pressure ductwork): Seal using water based sealer, Hardcast Iron Grip.
- F. Exterior joints (above 1-inch W.G. pressure ductwork): Seal using gypsum impregnated tape and adhesive.
- G. Exterior joints (to 1-inch W.G. pressure ductwork): Seal using oil based sealer, Hardcast Galva Grip or equal.
- H. Exterior joints: Seal water and to air-tight condition with sealant.

3.5 INSTALLATION OF DUCT LINER:

- A. Install duct liner in accordance with SMACNA "HVAC Duct Construction Standards", latest edition.

3.6 INSTALLATION OF FLEXIBLE DUCTS:

- A. Install flexible ductwork in accordance with SMACNA "HVAC Duct Construction Standards", latest edition. The flexible duct core shall be secured by the use of a metal clamp or non-metallic drawband, suitable for the pressures encountered. Duct tape shall not be acceptable. Secure the insulation over the drawband with an additional drawband. Round metal duct 12" and larger shall incorporate a bead on end of sheet metal to prevent flexible duct from sliding off. Sheet metal collars for attachment of flexible duct shall be a minimum of 4" in length. Flexible duct shall not be crimped, and turns shall be made with a minimum of 3 duct diameter radius, with a maximum turn of 90°. Provide minimum 4" collar for diffuser and duct connection.
- B. Maximum extended length for flexible duct shall not exceed 5'-0".

3.7 INSTALLATION OF KITCHEN EXHAUST DUCTS:

- A. Install kitchen exhaust ducts in accordance with NFPA 96. Provide for thermal expansion of ductwork through 2000°F temperature range. Install without dips or traps that may collect residues. Provide cleanouts at all offsets, elbows, rises, and elsewhere as required by local code.
- B. Contractor shall test kitchen exhaust ducts for leaks prior to installation of duct enclosure or insulation. Leaks shall be repaired prior to installation of duct enclosure or insulation.
- C. Heliarc weld all exposed stainless steel duct, and grind welds smooth and seamless. Seam composition shall be 304 grade stainless steel.

3.8 EQUIPMENT CONNECTIONS:

- A. Connect metal ductwork to equipment as indicated. Provide flexible connectors for each ductwork connection to equipment mounted on vibration isolators, and/or equipment containing rotating machinery. Omit flexible connectors at equipment connections to kitchen exhaust ductwork.

3.9 ADJUSTING AND CLEANING:

- A. Clean ductwork internally, unit by unit as it is installed, of dust and debris. Clean external surfaces of foreign substances that might cause corrosive deterioration of metal, and where duct is to be painted.
- B. Temporary Closure: Provide temporary closure at ends of ducts that are not connected to equipment or air distribution devices at time of ductwork installation. Closure shall be polyethylene film or other covering that will prevent entrance of dust and debris until connections are completed.
- C. Seal leaks in ductwork that become apparent in balancing process.
- D. Remove all marks and labels from all exposed ductwork.

END OF SECTION 233113.

SECTION 233300
DUCTWORK ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to Work of this Section.
- B. The requirements as set forth in Division 23 **Basic Materials and Methods Sections** shall apply to Work of this Section.

1.2 DESCRIPTION OF WORK:

- A. Extent of Work required by this Section is indicated on the drawings and by the requirements of this Section.
- B. Types of ductwork accessories specified in this Section include the following:
 - 1. Duct Access Doors.
 - 2. Volume and Splitter Dampers.
 - 3. Multi-Louver Volume Dampers.
 - 4. Backdraft Dampers.
 - 5. Turning Vanes.
- C. Refer to other Division 23 Sections for the following:
 - 1. Flexible duct connectors.
 - 2. Testing and balancing of ductwork systems.

1.3 QUALITY ASSURANCE:

- A. Codes and Standards:
 - 1. SMACNA Standards: Comply with SMACNA's "HVAC Duct Construction Standards", latest edition, for fabrication and installation of ductwork accessories.
 - 2. NFPA Compliance:
 - a. Comply with NFPA 90A "Standard for the Installation of Air Conditioning and Ventilating Systems", latest edition.
 - b. Comply with NFPA 96 "Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations", latest edition.
 - 3. UL Compliance:
 - a. Construct, test, and label ceiling dampers in accordance with UL Standard 555C "Ceiling Dampers"

1.4 SUBMITTALS:

- A. Product Data: Submit manufacturer's technical product data and installation instructions for each type of ductwork accessory.

1.5 OPERATION AND MAINTENANCE MANUALS:

- A. Include product data in Operation and Maintenance Manuals.
- B. Include receipt from Owner's acceptance of extra fusible links in Operation and Maintenance Manuals.

PART 2 - PRODUCTS

2.1 DUCT ACCESS DOORS:

- A. General: Provide where indicated, and for access to inspect ductwork.
- B. Duct Access Doors: Access doors shall be constructed in accordance with SMACNA "HVAC Duct Construction Standards", latest edition. Construct of same or thicker gauge sheet metal as duct in which it is installed. Provide insulated access doors for insulated ductwork. Provide flush frames for uninsulated ductwork, and extended frames for externally insulated ducts. Provide continuous hinge on one side, with one handle-type latch for doors 12" high and smaller, and two handle-type latches for larger doors.
- C. Manufacturers: Subject to compliance with requirements, provide duct access doors from one of the following:
 - 1. Aeronca Inc., Buensod/Agitair Div.
 - 2. Air Balance, Inc.
 - 3. Cesco Products, Inc.
 - 4. Duro-Dyne Corp.
 - 5. Ruskin Manufacturing.
 - 6. Ventfabrics, Inc.

2.2 VOLUME AND SPLITTER DAMPERS:

- A. General: Provide volume dampers of size, type, and capacity as indicated on the drawings.
- B. Galvanized sheetmetal blade and frame with Ventfabrics Inc., Ventlok operating hardware.
- C. For accessible dampers, provide #641 self-locking dial regulators and #644 self-locking dial regulators for insulated ductwork, #637 square end bearing, and #635 spring end bearing, as applicable.
- D. For inaccessible dampers, provide #666 or #677 concealed locking damper regulator with bearings as above. For static pressures above 3-inch W.G., provide #640 HiVel dial regulator and #609 HiVel end bearing for accessible dampers.

2.3 MULTI-LOUVER VOLUME DAMPERS:

- A. 16-gauge galvanized steel frame. Opposed, 6-inch wide, 16-gauge galvanized steel blades. Concealed linkage in frame.
- B. Titus #AG-35-B, Ruskin #CD35/OBD or equal.

2.4 BACKDRAFT DAMPERS:

- A. General: Provide backdraft dampers of size, type, and capacity as indicated on the drawings.

- B. Provide counterweight type complete with frame, end bearings, counterbalance assembly, blades, and linkage.
- C. Install at outside air intakes, exhaust outlets, and where shown on Drawings.
- D. Pacific Air Products #PRD-100AL, Ruskin #CBS-7 or equal by Swartwout, American Warming, or Vent Products.

2.5 TURNING VANES:

- A. Turning Vanes: Provide fabricated turning vanes and vane runners, constructed in accordance with SMACNA "HVAC Duct Construction Standards". Provide turning vanes constructed of curved blades, supported with bars perpendicular to blades, and set into side strips suitable for mounting in ductwork. Follow SMACNA guidelines for spacing support, and construction. All blades are to be double thickness airfoil type.
- B. Subject to compliance with requirements, provide turning vanes from one of the following:
 - 1. Aero Dyne Co.
 - 2. Air Filter Co.
 - 3. Anemostat Products Div., Dynamics Corp. of America.
 - 4. Dura-Dyne Corp.

PART 3 - EXECUTION

3.1 GENERAL ITEMS:

- A. Provide duct-mounted balancing dampers or attached opposed blade dampers so that each diffuser, grille and register may be individually balanced.
- B. Provide unit opposed blade damper where individual duct mounted balancing dampers are not provided.
- C. Provide turning vanes in all mitered elbows in all ducts, so that tips are parallel with the sides of the ducts. Vanes shall be single thickness type with extended trailing edge. Tips of acoustical turning vanes on outside radius shall be flush with acoustical lining.
- D. Provide flexible connections to completely isolate fans from direct contact with all sheet metal work.

3.2 INSTALLATION OF ACCESS DOORS

- A. Provide access doors at all, backdraft dampers, and other equipment mounted in the ductwork for access to maintain the equipment.
- B. Install access doors to open against system air pressure, with latches operable from either side, except outside only where duct is too small for person to enter.

3.3 INSTALLATION OF TURNING VANES:

- A. Install turning vanes in square and rectangular duct turns greater than 60° in supply air systems and exhaust air systems, and elsewhere as indicated.
- B. Turning vanes are not required on radius elbows.

END OF SECTION 233300.

SECTION 233423**POWER AND GRAVITY VENTILATORS****PART 1 - GENERAL****1.1 RELATED DOCUMENTS:**

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to Work of this Section.
- B. The requirements as set forth in Division 23 **Basic Materials and Methods Sections** shall apply to Work of this Section.

1.2 DESCRIPTION OF WORK:

- A. Extent of power and gravity ventilator Work is indicated by drawings and schedules, and by requirements of this Section.
- B. Types of power ventilators required for project include the following:
 - 1. Centrifugal Roof Exhausters.
- C. Refer to other Division 23 Sections for the following Work:
 - 1. Vibration isolation of power ventilators.
 - 2. Mechanical identification of power ventilators.
 - 3. Testing, adjusting, and balancing of power ventilators.
- D. Refer to Division 26 Sections for the following Work:
 - 1. Power supply wiring and conduit from power source to power connection on unit. Include wiring starters, disconnects, and required electrical devices.
- E. Provide the following electrical Work as Work of this Section, complying with requirements of Division 26 Sections:
 - 1. Control wiring between field-installed controls, indicating devices, and power ventilators.
 - 2. Control wiring specified as Work of Division 23 for Automatic Temperature Controls is Work of that Section.

1.3 QUALITY ASSURANCE:

- A. **Manufacturer's Qualifications:** Firms regularly engaged in manufacture of power and gravity ventilators with characteristics, sizes, and capacities required, whose products have been in satisfactory use in similar service for not less than 5 years.
- B. **Codes and Standards:**
 - 1. **AMCA Compliance:** Test and rate power ventilators in accordance with AMCA standards. Provide fans that have the AMCA Certified Ratings Seal for sound and air performance.
 - 2. **NEC Compliance:** Comply with ANSI/NFPA 70 as applicable to installation and electrical connections of ancillary electrical components of packaged air handling units.
 - 3. **UL Compliance:** Provide units that are tested by UL, and carry a UL label.

PART 2 - PRODUCTS

2.1 POWER VENTILATORS:

- A. Centrifugal Roof Exhausters: Provide electrically powered centrifugal roof exhausters, suitable for mounting on roof curb, of type, size, and capacity as indicated on the drawings.
- B. .Manufacturers: Subject to compliance with requirements, provide power ventilators from Stratovent:

2.2 VENTILATOR ACCESSORIES:

- A. Prefabricated Roof Curbs shall be obtained through Stratovent.
- B. Backdraft Dampers: Provide gravity operated backdraft dampers designed for horizontal or vertical installation as applicable.

PART 3 - EXECUTION

3.1 INSTALLATION OF POWER VENTILATORS:

- A. Install power ventilators in accordance with manufacturer's installation instructions.
- B. Install fans level and plumb, in accordance with manufacturer's written instructions. Secure roof-mounted fans to roof curbs with cadmium-plated hardware.
- C. Provide access space around fans for service and maintenance, as indicated on the Drawings and in compliance with applicable Mechanical Code.
- D. Clean unit cabinet interiors to remove foreign material and construction dirt and dust.
- E. Coordinate with Electrical Contractor to provide electrical power wiring as specified in Division 26 - Electrical.
- F. Coordinate ventilator work with work of roofing, walls and ceilings, for proper interfacing.
- G. Access Doors: Provide access doors in duct at power ventilators to service dampers.
- H. Electrical Wiring: Install electrical devices furnished by manufacturer but not factory-mounted. Furnish copy of manufacturer's wiring diagram submittal to Division 26.
- I. Start up: Verify that electrical wiring installation is in accordance with manufacturer's submittal and installation requirements of Division 26. Verify proper rotation of fan wheels. Remove shipping bolts and temporary supports within ventilators. Adjust dampers for free operation.

3.2 INSTALLATION OF ROOF CURBS:

- A. Install roof curbs in accordance with NRCA standards. Coordinate with roofing contractors and provide flashing as required.

3.3 CONTROL SYSTEMS INSTALLATION

- A. Installation:
 - 1. Install systems and materials in accordance with manufacturer's instructions and recommendations, rough-in drawings, and details indicated on the Drawings.
 - 2. Coordinate with Electrical Contractor to install electrical components and use electrical products complying with requirements of applicable requirements specified in Division 16 - Electrical.
 - 3. Mount controllers at convenient locations and heights.
- B. Control Wiring - The term "control wiring" shall be defined to include providing of wire, conduit and miscellaneous materials as required for mounting and connecting electric control devices.
- C. Wiring System:
 - 1. Install complete control wiring system for electric control systems.
 - 2. Conceal wiring except in mechanical rooms and areas where other conduit and piping are exposed.
 - 3. Provide multi-conductor instrument harness (bundle) in place of single conductors where number of conductors can be run along common path.
 - 4. Fasten flexible conductors bridging cabinets and doors, neatly along hinge side, and protect against abrasion. Tie and support conductors neatly.
- D. Start-Up - Start, test and adjust electric control systems in presence of manufacturer's authorized representative. Replace damaged or malfunctioning controls and equipment.
- E. Cleaning - Clean factory-finished surfaces. Repair marred or scratched surfaces with manufacturer's touch-up paint.
- F. Final Adjustment - After completion of installation, adjust thermostats, control valves, motors and similar equipment specified in this Section. Final adjustment shall be performed by specially trained personnel in direct employ of manufacturer of primary temperature control system.
- G. Control Sequences:
 - 1. Power Ventilators:
 - a. Energize exhaust fans during occupied cycle and de-energize during unoccupied cycle via electronic time clock control. Unoccupied: Maintain outside air damper closed. Cycle unit fan and unit's heating to maintain reduced room temperature of 60 degrees F with unoccupied thermostat.

3.4 FIELD QUALITY CONTROL:

- A. Testing: After installation of ventilators has been completed, test each ventilator to demonstrate proper operation of unit at performance requirements specified. Field correct malfunctioning units, then retest to demonstrate compliance. Replace units that cannot be satisfactorily corrected.

END OF SECTION 233423.

SECTION 233713
AIR OUTLETS AND INLETS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to Work of this Section.
- B. The requirements as set forth in Division 23 **Basic Materials and Methods Sections** shall apply to Work of this Section.

1.2 DESCRIPTION OF WORK:

- A. Extent of outlets and inlets Work is indicated by drawings and schedules, and by requirements of this Section.
- B. Types of outlets and inlets required for project include the following:
 - 1. Ceiling air diffusers.
 - 2. Wall, ceiling, and duct mounted registers and grilles.
- C. Refer to other Division 23 Sections for the following:
 - 1. Ductwork and duct accessories required in conjunction with air outlets and inlets.
 - 2. Balancing of air outlets and inlets.

1.2 QUALITY ASSURANCE:

- A. Manufacturers Qualifications: Firms regularly engaged in manufacture of air outlets and inlets of types and capacities required, whose products have been in satisfactory use in similar service for not less than 5 years.
- B. Codes and Standards:
 - 1. ARI Compliance: Test and rate air outlets and inlets in accordance with ARI 650 "Standard for Air Outlets and Inlets".
 - 2. ASHRAE Compliance: Test and rate air outlets and inlets in accordance with ASHRAE 70 "Method of Testing for Rating the Air Flow Performance of Outlets and Inlets".
 - 3. ADC Seal: Provide air outlets and inlets bearing ADC Certified Ratings Seal.
 - 4. NFPA Compliance: Install air outlets and inlets in accordance with NFPA 90A "Standard for the Installation of Air Conditioning and Ventilating Systems".

1.3 SUBMITTALS:

- A. Product Data: Submit manufacturer's data on outlets and inlets including the following:
 - 1. Schedule of air outlets and inlets indicating drawing designation, room location, number furnished, model number, size, and accessories furnished.
 - 2. Data sheet for each type of air outlet and inlet, and accessory furnished indicating construction, finish, and mounting details.

3. Performance data for each type of air outlet and inlet furnished, including aspiration ability, temperature and velocity traverses, throw and drop, and noise criteria ratings. Indicate selections on data.
- B. Samples: Submit samples as requested by Architect or Engineer.
 - C. Shop Drawings: Submit manufacturer's assembly-type shop drawing for each type of air outlet and inlet, indicating materials and methods of assembly of components.
 - D. Maintenance Data: Submit maintenance data, including cleaning instructions for finishes, and spare parts lists.
- 1.4 OPERATION AND MAINTENANCE MANUALS:
- A. Include product data, shop drawings, and maintenance data in Operation and Maintenance Manuals in accordance with requirements of Division 1.
- 1.5 PRODUCT DELIVERY, STORAGE AND HANDLING:
- A. Deliver air outlets and inlets wrapped in factory-fabricated fiber-board type containers. Identify on outside of container type of outlet or inlet and location to be installed. Avoid crushing or bending and prevent dirt and debris from entering and settling in devices.
 - B. Store outlets and inlets in original cartons and protect from weather and construction traffic. Where possible, store indoors. When necessary to store outdoors, store above grade and enclose with weatherproof wrapping.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with requirements, provide registers and grilles per drawing Air Device Schedule.
- B. Acceptable Manufacturer's:
 1. Titus.
 2. Krueger.
 3. Metalaire.

2.2 CEILING AIR DIFFUSERS-GENERAL:

- A. General: Except as otherwise indicated, provide manufacturer's standard ceiling air diffusers where shown, of size, shape, capacity and type indicated, constructed of materials and components equal to the models indicated, and as required for complete installation. Provide accessories and finishes as listed on diffuser schedule.
- B. Diffuser Performance: Provide ceiling air diffusers that have, as a minimum, temperature and velocity traverses, throw and drop, and noise criteria ratings for each size device as listed in manufacturer's current data.
- C. Diffuser Ceiling Compatibility: Provide diffusers with border styles that are compatible with adjacent ceiling systems, and that are specifically manufactured to fit into ceiling module with accurate fit and adequate support. Refer to general construction drawings and specifications for types of ceiling systems.

2.3 ROUND CEILING DIFFUSERS

- A. Type: Round, stamped or spun, multi-core diffuser to discharge air in 360 degree pattern, with sectorizing baffles where indicated. Diffuser collar shall project not more than one inch above ceiling. Core shall be adjustable for vertical or horizontal throw.
- B. Fabrication: Steel with baked enamel off-white finish.
- C. Accessories: Radial opposed blade damper and multi-louvered equalizing grid with damper adjustable from diffuser face.
- D. Acceptable Product: Refer to schedule on Drawings.

2.4 RECTANGULAR CEILING DIFFUSERS

- A. Type: Square, stamped, multi-core diffuser to discharge air in 360 degree pattern with sectorizing baffles where indicated.
- B. Frame: Inverted T-bar type.
- C. Fabrication: Aluminum with baked enamel off-white finish.
- D. Accessories: Opposed blade damper and multi-louvered equalizing grid with damper adjustable from diffuser face.
- E. Acceptable Products: Refer to schedule on Drawings.

PART 1 EXECUTION

2.5 WALL AND CEILING AIR DEVICES:

- A. General: Except as otherwise indicated, provide manufacturer's standard wall and ceiling registers and grilles where shown, of size, shape, capacity and type indicated, constructed of materials and components as indicated, and as required for complete installation. Provide accessories and finishes as listed on the register and grille
- B. Register and Grille Performance: Provide wall and ceiling registers and grilles that have, as minimum, temperature and velocity traverses, throw and drop, and noise criteria ratings for each size device as listed in manufacturer's current data.
- C. Register and Grille Wall and Ceiling Compatibility: Provide registers and grilles with border styles that are compatible with adjacent wall and ceiling systems, and that are specifically manufactured to fit into wall construction with accurate fit and adequate support. Refer to general construction drawings and specifications for types of wall and ceiling construction.
- D. Check location of outlets and inlets and make necessary adjustments in position to conform with architectural features, symmetry, and lighting arrangement.
- E. Install diffusers to ductwork with air tight connection.
- F. Provide balancing dampers on duct take-off to diffusers, and grilles and registers, despite whether dampers are specified as part of the diffuser, or grille and register assembly.
- G. Paint ductwork visible behind air outlets and inlets matte black. Refer to Section 09 9100.

PART 3 - EXECUTION

3.1 INSPECTION:

- A. Examine areas and conditions under which air outlets and inlets are to be installed. Do not proceed with Work until unsatisfactory conditions have been corrected.

3.2 INSTALLATION:

- A. General: Install air outlets and inlets in accordance with manufacturer's written instructions and in accordance with recognized industry practices to ensure that products serve intended functions.
- B. Wet or damp locations: Install diffusers, grilles and registers constructed of entirely aluminum in areas subject to corrosion such as kitchens, dishwashing rooms, showers, etc.
- C. Coordinate with other Work, including ductwork and duct accessories, as necessary to interface installation of air outlets and inlets with other Work.
- D. Locate ceiling air diffusers, registers, and grilles, as indicated on general construction "Reflected Ceiling Plans". Unless otherwise indicated, locate units in center of acoustical ceiling modules.
- E. Provide airtight connections between diffusers and ductwork.
- F. Paint ductwork visible behind air outlets and inlets matte black.

3.3 SPARE PARTS:

- A. Furnish to Owner, with receipt, 3 operating keys for each type of air outlet and inlet that require them.

END OF SECTION 233713.

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OUTDOOR CENTRAL STATION
AIR HANDLING UNITS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to Work of this Section.
- B. The requirements as set forth in Division 23 **Basic Materials and Methods Sections** shall apply to Work of this Section.

1.2 DESCRIPTION OF WORK:

- A. Extent of outdoor central station air handling unit Work is indicated by drawings and schedules, and by requirements of this Section.
- B. Refer to other Division 23 Sections for the following Work:
 - 1. Vibration isolation for central station air handling units.
 - 2. Mechanical identification of central station air handling units.
 - 3. Adjustable frequency drives for central station air handling units.
 - 4. Testing, adjusting, and balancing of central station air handling units.
- C. Refer to Division 26 Sections for the following Work:
 - 1. Power supply wiring and conduit from power source to power connection on unit. Include wiring starters, disconnects, and required electrical devices.
- D. Provide the following electrical Work as Work of this Section, complying with requirements of Division 26 Sections:
 - 1. Control wiring between field-installed controls, indicating devices, and unit control panels.
 - 2. Control wiring specified as Work of Division 23 for Automatic Temperature Controls is Work of that Section.

1.3 NATIONAL ACCOUNT

- A. YUM! Brands, Inc. has entered into a national account agreement with Trane for furnishing the HVAC roof top units specified in this section. Complete installation shall be by the Contractor. For pricing quotations, placing orders, and further information, contact Trane at number indicated on the drawings.

1.4 QUALITY ASSURANCE:

- A. Installers Qualifications: Firm with at least 5 years of successful installation experience with projects utilizing air handling units similar to those required for this project.
- B. Codes and Standards:
 - 1. ARI Compliance: Test and rate central station air handling units in accordance with ARI 430, "Standard for Central-Station Air Handling Units". Test and rate coils in accordance with ARI

OUTDOOR CENTRAL STATION
AIR HANDLING UNITS

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- 410, "Forced-Circulation Air-Cooling and Air-Heating Coils". Install central station air handling units in accordance with ARI 435, "Application of Central-Station Air Handling Units."
2. AMCA Compliance: Test and rate central station air handling units in accordance with AMCA standards.
3. NFPA Compliance: Provide internal insulation having flame spread rating not to exceed 25 and smoke developed rating not to exceed 50, and complying with NFPA 90A "Standard for the Installation of Air Conditioning and Ventilating Systems".
4. NEC Compliance: Comply with ANSI/NFPA 70 as applicable to installation and electrical connections of ancillary electrical components of packaged air handling units.
5. UL Compliance: Provide packaged air handling units that are UL listed and labeled.

1.5 STRUCTURE AND SPACE CONDITIONS

- A. All work shall avoid obstructions and interference with other trades, preserve headroom and keep openings and passageways clear and free.

1.6 VIBRATION AND NOISE

- A. Install each of the various pieces of equipment to operate without objectionable vibration or noise.

1.7 CLEAN-UP

- A. At the completion of the work, clean the area of all debris such that the Project is left in a neat and clean manner as deemed acceptable by the Owner.

1.8 WARRANTY

- A. In addition to honoring all Contractor supplied equipment manufacturers' warranties, the Contractor shall warrant and correct all defects in Contractor supplied material and all workmanship for a period of one (1) year after acceptance of Project by the Owner. Warranty costs shall include all labor and material associated with the correction of work covered under this Contract.

1.9 SUBMITTALS:

- A. Product Data: Submit manufacturer's technical product data for central station air handling units showing dimensions, weight, capacities, ratings, fan performance with operating point clearly indicated, motor electrical characteristics, heater characteristics, cabinet materials, and installation instructions.
- B. Shop Drawings: Submit assembly-type shop drawings showing unit dimensions, required clearances, construction details, and field connection details.
- C. Wiring Diagrams: Submit manufacturer's electrical requirements for power supply to central station air handling units. Submit manufacturer's ladder-type wiring diagrams for interlock and control wiring. Clearly differentiate between portions of wiring that are factory-installed and portions to be field-installed.
- D. Maintenance Data: Submit maintenance instructions, including instructions for lubrication, filter replacement, motor and drive replacement, and isolation and supports. Include spare parts lists.

1.10 OPERATION AND MAINTENANCE MANUALS:

- A. Include product data, shop drawings, wiring diagrams, and maintenance data in Operation and Maintenance Manuals.
- B. Provide a typed summary of all filter and belt sizes for the custom rooftop units, and include in Operation and Maintenance Manuals.

- C. Include signed receipts for spare belts and spare filters in Operation and Maintenance Manuals.

1.11 DELIVERY, STORAGE AND HANDLING:

- A. Deliver central station air handling units with factory-installed shipping skids and lifting lugs. Pack components in factory-fabricated protective containers.
- B. Handle central station air handling units carefully to avoid damage to components, enclosures, and finish. Do not install damaged components. Replace damaged units and return damaged components to air handling unit manufacturer.
- C. Store central station air handling units in clean dry place and protect from weather and construction traffic.
- D. Comply with manufacturer's rigging and installation instructions for unloading central station air handling units, and moving to final locations.

PART 2 - PRODUCTS

2.1 OUTDOOR CENTRAL STATION AIR HANDLING UNITS:

- A. General: Provide factory-fabricated and factory-tested draw-through central station air handling units of sizes, configuration, and capacities as indicated on the drawings, and as specified herein. Provide single side access to units.
- B. Factory Mounted Controls: The control system contractor shall furnish controls to the unit manufacturer.
- C. Provide central station air handling units as indicated on the drawings, including listed schedule note accessories and options, in the HVAC Unit Schedule:
- D. The manufacturer shall include the following items.
 - 1. 5-year compressor warranty - parts only.
 - 2. 10-year heat exchanger warranty - parts only.
 - 3. Factory installed hinged access panels.
 - 4. Through the base gas and electrical connections to minimize roof penetrations.
 - 5. Factory installed circuit breaker.
 - 6. Factory installed unpowered convenience outlet.
 - 7. Factory provided supply and or return (as indicated on drawings) air smoke detector.

PART 3 - EXECUTION

3.1 INSPECTION:

- A. Examine areas and conditions under which air handling units are to be installed. Do not proceed with Work until unsatisfactory conditions have been corrected in a manner acceptable to Installer.

3.2 INSTALLATION OF OUTDOOR AIR HANDLING UNITS:

- A. Install in accordance with manufacturer's instructions and comply with the following requirements:

1. General: Install air handling units where indicated, in accordance with equipment manufacturer's installation instructions, and with recognized industry practices, to ensure that units comply with requirements and serve intended purposes.
2. Coordination: Coordinate with other Work, including ductwork, floor construction, roof deck construction, and piping, as necessary to interface installation of air handling units with other Work.
3. Access: Provide access space around air handling units for service as indicated, but in no case less than that recommended by manufacturer.
4. Electrical Wiring: Install electrical devices furnished by manufacturer but not specified to be factory-mounted. Furnish copy of manufacturer's wiring diagram submittal to Electrical Installer. Verify that electrical wiring installation is in accordance with manufacturer's submittal and installation requirements of Division 26 Sections. Do not proceed with equipment startup until wiring installation is acceptable to Equipment Installer.
5. Piping Connections: Provide piping, valves, accessories, supports, and connectors as indicated.
6. Duct Connections: Provide ductwork, accessories, and flexible connections as indicated.
7. Grounding: Provide positive equipment ground for air handling unit components.
8. Provide layout drawings of units, locations and power requirements to electrical installer.
9. Install minimum 30 percent efficiency air filters in unit during installation phase. Do not operate the unit without filters in place.
10. Mount rooftop unit on factory built roof-mounting frame. Install roof mounting frame level. Secure frame to structural framing and rooftop unit on frame as indicated on the Drawings.
11. Install 3-inch long flexible duct connection at inlets and outlets of units.
12. Install condensate drain piping and traps in accordance with manufacturer's instructions and as shown on the Drawings. If metal piping and supports shall be of same material to prevent electrolysis.
13. Control installers shall install thermostat and all wiring associated with control signals into the units. All thermostats shall be located in manager's office with remote sensors located in appropriate locations in return ductwork.
14. Install all line voltage power wiring and conduit as indicated on the Drawings and as specified in the electrical specifications.
15. Coordinate with Electrical Contractor to install a new set of filters three days prior to Substantial Completion review.

3.3 CONTROL SYSTEMS INSTALLATION

A. Installation:

1. Install systems and materials in accordance with manufacturer's instructions and recommendations, rough-in drawings, and details indicated on the Drawings.
2. Coordinate with Electrical Contractor to install electrical components and use electrical products complying with requirements of applicable requirements specified in Division 16 - Electrical.
3. Mount controllers at convenient locations and heights.

B. Control Wiring - The term "control wiring" shall be defined to include providing of wire, conduit and miscellaneous materials as required for mounting and connecting electric control devices.

C. Wiring System:

1. Install complete control wiring system for electric control systems.
2. Conceal wiring except in mechanical rooms and areas where other conduit and piping are exposed.
3. Provide multi-conductor instrument harness (bundle) in place of single conductors where number of conductors can be run along common path.

4. Fasten flexible conductors bridging cabinets and doors, neatly along hinge side, and protect against abrasion. Tie and support conductors neatly.
- D. Start-Up - Start, test and adjust electric control systems in presence of manufacturer's authorized representative. Replace damaged or malfunctioning controls and equipment.
- E. Cleaning - Clean factory-finished surfaces. Repair marred or scratched surfaces with manufacturer's touch-up paint.
- F. Final Adjustment - After completion of installation, adjust thermostats, control valves, motors and similar equipment specified in this Section. Final adjustment shall be performed by specially trained personnel in direct employ of manufacturer of primary temperature control system.
- G. Control Sequences:
 1. Rooftop Packaged Units:
 - a. Occupied: Energize rooftop units during occupied cycle via manufacturer supplied thermostat. Modulate outside air and return air dampers in sequence and in conjunction with unit's mechanical refrigeration to maintain desired room temperature via manufacturer supplied thermostat.
 - b. Unoccupied: Maintain outside air damper closed. Cycle unit fan and unit's heating to maintain reduced room temperature of 60 degrees F with unoccupied thermostat.

3.4 FIELD QUALITY CONTROL:

- A. Testing: Upon completion of installation of the air handling units, startup and operate equipment to demonstrate capability and compliance with requirements. Field correct malfunctioning units, then retest to demonstrate compliance.

3.5 EXTRA STOCK:

- A. Provide one complete extra set of filters for each air handling unit. Install new filters at completion of air handling system Work, prior to testing, adjusting, and balancing Work. Obtain receipt from Owner that new filters have been installed.
- B. Provide one spare set of belts for each belt-driven air handling unit. Obtain receipt from Owner that belts have been received.

END OF SECTION 237413

SECTION 260000**BASIC ELECTRICAL REQUIREMENTS**

PART 1- GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and General Provisions of Contract, including General and Supplementary Conditions, Instructions to Bidders, and Division 01 shall apply to Work of this Section.
- B. This Section is a Division 26 **Basic Materials and Methods Section**, and is a part of each Division 26 section making reference to electrical related Work specified herein.

1.2 DESCRIPTION OF WORK:

- A. The work covered by Division 26 consists of furnishing all labor, equipment, supplies, and materials (except as otherwise specified or shown on the drawings) required to perform all operations necessary for the installation of complete electrical systems. All work shall be in strict accordance with the specifications and drawings.
- B. The omission of an expressed reference to any parts necessary for, or reasonably incidental to, a complete installation shall not be construed as releasing the Contractor from furnishing such parts.
- C. By the act of submitting a bid, the Contractor represents that his bid is based solely upon the materials and equipment described in the bid documents (including addendums if any) and that he contemplates no substitutions.

1.3 WORK SPECIFIED IN OTHER SECTIONS:

- A. Painting of panelboards, terminal cabinets, pull boxes, front covers, exposed conduit and boxes in all finished areas by others.
- B. Kitchen equipment, stage equipment, shop equipment, science equipment, bleachers and motorized backstops by other.
- C. Concrete pad for transformer station and parking standard shall be by others.
- D. Installation of acoustical ceiling tiles to maintain one-hour fire rating for all recessed lighting fixtures, in areas called out on Architectural drawings and Specifications by others.
- E. Installation of sheet metal cover and flashing around all conduits penetrating roof deck as shown on Architectural drawings shall be by others.

BASIC ELECTRICAL REQUIREMENTS

F. Refer to Division 02 for Excavation and Backfill requirements for work required and performed under Division 26.

G. Division 015 is responsible for all wiring associated with the HVAC control system.

1.4 ALTERNATES:

A. Refer to the portion of Division 01 relating to alternates, for items affecting this work and shall coordinate bid proposals with the Architectural, Structural, Mechanical, and Electrical Alternates as described therein.

1.5 COORDINATION OF WORK:

A. Coordinate all work with other trades and existing conditions to prevent conflicts causing unnecessary expense or delays in the installation of Work. When conflicts arise, remove and relocate items causing such conflicts at no additional cost to the Owner.

B. Provide a job site representative whenever necessary to coordinate work with others.

C. Refer to other discipline's drawings, relevant equipment drawings, and shop drawings to determine available clearances and possible obstructions. Make any necessary offsets or transitions as required to clear structural members, existing equipment, etc. to facilitate installation of the work in the manner indicated.

D. Contractor shall be responsible for any resultant costs incurred for changes required to accommodate actual equipment furnished when the equipment has characteristics differing from that shown on the drawings.

1.6 QUALITY ASSURANCE:

A. All Work shall be performed by craftsman normally engaged in the respective craft required for each installation.

1.7 FEES, PERMITS, AND INSPECTION:

A. Provide all fees and permits that are required in connection with this work.

B. Secure all inspections as required by the authorities having jurisdiction.

C. Where applications are required for procuring of services for the building, prepare and file such application. Furnish all information required in connection with the application in the form required by the utility company and/or municipal department.

1.8 APPLICABLE CODES AND STANDARDS:

BASIC ELECTRICAL REQUIREMENTS

- A. All work shall comply with the locally adopted electrical code and all applicable laws, codes, recommendations, regulations, and interim amendments, of the governmental bodies having jurisdiction.
 - 1. Where there is not an adopted electrical code the latest edition of the National Electrical Code (NFPA 70) shall be used.
- B. All Electrical work shall be performed in compliance with all applicable governing safety regulations, including OSHA regulations. All safety lights, guards and signs required for the performance of the electrical work shall be provided by and operated by the Contractor.
- C. A reference to technical society, organization, or body in the Specification is in accordance with the following abbreviations, and all work shall be performed, as a minimum, in accordance with the latest editions of their publication:
 - 1. ANSI American National Standards Institute
 - 2. ASTM American Society for Testing and Materials
 - 3. ASME American Society of Mechanical Engineers
 - 4. ETL Environmental Testing Labs
 - 5. FIA Factory Insurance Association
 - 6. FM Factory Mutual Laboratories
 - 7. IEEE Institute of Electrical and Electronics Engineers, Inc.
 - 8. NEIS National Electrical Installation Standards
 - 9. NEMA National Electrical Manufacturer's Association
 - 10. NFPA National Fire Protection Association
 - 11. NRTL Nationally Recognized Testing Laboratory
 - 12. OSHA Occupational Safety & Health Administration
 - 13. NFPA 101 Life Safety Code
 - 14. NFPA 70 National Electrical Code
 - 15. NFPA 70E Standards for Electrical Safety
 - 16. UL Underwriter's Laboratories, Inc.
- D. All Work shall comply with rules and regulations of utilities and/or municipal departments affected by connection of services.
- E. Should these specifications and drawings conflict with any of the building codes, standards, laws, ordinances, utility company rules and regulations, etc. the more stringent requirements shall take precedence. The Architect shall be immediately notified of any conflicts.
- F. Include all items of labor and material required to comply with such standards and codes in accordance with the specification. Where quantities, sizes, or other requirements indicated on the drawings or herein specified are in excess of the standard or code requirements, the specifications and/or drawings shall govern.

1.9 GLOSSARY OF TERMS:

A. Terms:

BASIC ELECTRICAL REQUIREMENTS

1. **Contractor** - The particular sub-contractor who is directly responsible for the work specified herein.
2. **Shall** - Action that is required without option or qualification.
3. **May** - Action that is desirable or is at the Contractors choice or option.
4. **Should** - Recommendation for the Contractor to follow as an aid in performing the required work.
5. **Provide** - Contractor shall furnish and install specified item(s).
6. **Furnish** - Contractor shall be responsible for obtaining specified items.
7. **Install** - Contractor shall be responsible for all labor and construction equipment necessary to set in place, connect, calibrate and/or test the specified items furnished by him or others.
8. **Or Equal** - Item should possess the same performance qualities and characteristics as the one specified, and fulfill the function without any decrease in quality, durability or longevity.

B. Definitions:

1. EC – Electrical Contractor
2. FA – Fire Alarm
3. GC – General Contractor
4. MC – Mechanical Contractor
5. NC – Normally Closed
6. NO – Normally Open
7. PC – Plumbing Contractor
8. SPD – Surge Protection Device
9. SPDT – Single Pole, Double Throw
10. Refer to other sections and the Construction Documents for additional definitions.

1.10 SUBSTITUTIONS:

- A. The materials, products, and equipment described in the specifications or on the drawings establish a standard of required function, dimension, appearance, and quality to be met by any proposed substitution.
- B. Reference to any article, device, product, material, fixture, or type of construction by name, make, or catalog number shall be interpreted as having established a standard of quality and shall not be construed as limiting competition. Articles, fixtures, etc. of equal quality by manufacturers listed in this Specification for the applicable use, shall be acceptable to bid as outlined below, subject to spatial, structural, and electrical constraints of the project design.
- C. Refer to Division 01 requirements for substitution procedures.
- D. Wherever substitutions alter the design or space requirements indicated on the plans, include all items of cost of the revised design and construction, including cost of all allied trades involved.

1.11 SHOP DRAWINGS AND PRODUCT DATA:

BASIC ELECTRICAL REQUIREMENTS

- A. Shop drawings shall be submitted as specified in Division 01.
- B. Shop drawings shall be submitted electronically in PDF format. All electronic submittals shall be sent to the Architect and may not be sent directly to the Engineer without prior approval from the Engineer and Architect.
- C. **Each shop drawing shall include a letter indicating all deviations from the drawings and/or specifications.**
- D. Before submitting a shop drawing or any related material to Engineer for review, Contractor shall:
 - 1. Review each submission for conformance with the means, methods, techniques, sequences and operations of construction, safety precautions and programs incidental thereto, all of which are the sole responsibility of the Contractor.
 - 2. Approve each such submission before submitting it to the Engineer; and so stamp each such submission before submitting it. Engineer shall assume that no shop drawing or related submittal comprises a variation unless Contractor advises Engineer otherwise via a written instrument, which is acknowledged by Engineer in writing.
 - 3. Any shop drawing being resubmitted shall be flagged and clouded where changed.
- E. Checking of shop drawings is a gratuitous assistance by the Engineer and shall not relieve any responsibility for deviations, errors, or omissions which may exist in the shop drawings. Shop drawings submitted and rejected more than two times due to incomplete data or unacceptable material shall be reviewed by the Engineer at an additional cost to the Contractor at \$200.00 per hour, two-hour minimum. Contractor submitting shop drawing will be responsible for any additional cost.
- F. A letter listing the manufacturer's name and model number shall be sufficient for conduit, outlet boxes and rings, wire and cable, switches, receptacles, plates, and lamps.
- G. Shop drawing submittals shall include the following for each piece of equipment and material, as applicable:
 - 1. Product data listing and clearly marking the manufacturer, model number, materials, and miscellaneous data as required describing the equipment.
 - 2. Dimensional drawings showing layout, connection points and sizes, weights, etc.
 - 3. Accessories.
 - 4. Wiring diagrams, including power and control wiring, distinguish between factory and field wiring.
 - 5. Parts list.
 - 6. Installation and maintenance manuals.
 - 7. Warranty statement.
- H. Refer to each individual section in Division 26 for additional requirements.
- I. The following information shall be submitted in accordance with this Section:

BASIC ELECTRICAL REQUIREMENTS

1. Detailed drawings of fabrication and installation for metal fabrications, supports and anchorage for electrical materials and equipment.
- J. Contractor shall be responsible for all quantities and dimensions to be confirmed and correlated at the jobsite.
- K. Submit copies of his material list and each shop drawing within thirty days after award of the Contract. If any shop drawings cannot be obtained within thirty days, he shall notify the Architect/Engineer immediately upon receiving notice of that fact.
 1. Engineer requires up to 2-weeks to review all shop drawing submissions.
- L. **Switchgear manufacturer shall provide a complete "Coordination Study" of service entrance overcurrent protection with all down-stream overcurrent devices. This coordination study is to advise the Contractor of final settings of ground-fault equipment field adjustments.**
- M. **Switchgear manufacturer shall provide a complete "Arc Flash Study".**

1.12 WARRANTIES:

- A. Warrant all work performed and material & labor provided under the contract against defects in material and workmanship for one year from substantial completion. Provide all services as required to immediately repair or replace, at no additional cost, any defective part of the installation resulting from the supply of faulty workmanship or material. Lack of maintenance, accidents, or carelessness on the part of the Owner shall not be included in this warranty.
- B. The only exception to the above warranty is Light Fixture "LAMPS". All Lamps are to be warranted according to lamp manufacture, which is also based on average life data for each specific type of lamp. Provide labor to replace all defective lamps that are within lamp manufacturer's warranty period.
- C. All equipment, apparatus and appliances which are specified and/or come with warranties longer than one year; shall be registered with the manufacturer in the Owner's name.

1.13 RECORD DRAWINGS:

- A. Record drawings shall be kept and prepared in accordance with Division 01 and as specified herein.
 1. A complete "Record" set of prints, shall be kept at the project site and shall be corrected daily to show all changes in layout from the original drawings and specifications. This "Record" set shall be used for this purpose only.
 2. On completion of the project, two new sets of prints shall be obtained and all changes noted on the field record set shall be neatly transferred (in red pencil) to the two new sets of prints.

BASIC ELECTRICAL REQUIREMENTS

3. Two dimensions and the depth below grade shall locate all capped conduits. Changes in conduit routing, sizes and number of wires, additional pull or junction boxes shall be clearly noted. The original routing and layout shall be clearly marked out.
- B. Final payment will not be authorized until these Record drawings are received and checked for completeness by the Architect/Engineer.

1.14 OPERATIONS AND MAINTENANCE MANUALS:

- A. During the course of construction, collect and compile three (3) sets of operating instructions, wiring diagrams, catalog cuts, parts lists, lubrication and preventive maintenance instructions, etc. for all equipment furnished under this contract. All literature including warranties shall be included in the operation and maintenance manuals.
- B. All literature and instructions shipped with the equipment shall be saved for inclusion in the Operational and Maintenance Manuals.
- C. At completion of work, and prior to request for final inspection, submit Manuals to Architect in accordance with Division 01 and as specified herein. Manuals shall be bound in heavy duty, three ring, vinyl covered, hard-backed binder, with clear plastic pocket on spine. Spine of each binder shall have following typewritten lettering inserted:

**OPERATION
AND
MAINTENANCE
MANUAL
FOR ELECTRICAL SYSTEMS OF
"Taco Bell"**

D. Manuals shall include the following:

1. Provide a master index at beginning of Manual listing all items included. Use plastic tab indexes for each section of Manual.
2. Provide a directory, listing the name, address, and phone number of Architect, Mechanical and Electrical Engineers, General Contractor, and all Subcontractors.
3. Provide a directory, listing all equipment installed, and indicating the name, address, and phone number of each supplier.
4. A section for each system, which shall include the following:
 - a) General description of each system.
 - b) Control wiring diagram for each system. Each diagram shall include locations of controls, relays, etc.
5. A section for each piece of equipment shall include the following:
 - a) Manufacturer's catalog data indicating capacity, size, etc. by underlining the applicable data.
 - b) Manufacturer's installation and maintenance manuals.
 - c) Recommended list of spare parts to be stocked for preventive maintenance.
 - d) Equipment parts identification list for repair and replacement purposes.
 - e) Wiring diagram for the specific piece of equipment. Generalized diagrams are not acceptable.
 - f) Manufacturer's information for switchgear, switchboards and panelboards shall include a copy of the coordination study and arc flash study. Where these studies were not performed copies of time-curves shall be included for each breaker.
 - g) Provide a comprehensive recommended maintenance schedule for each item included in the O&M Manuals.
 - h) A copy of each approved shop drawing.**
 - i) A copy of the fire alarm certification.**

- E. In addition to the binders described above, provide PDF files of all information stated above on digital media (DVD or flash drive shall be accepted). Information shall be neatly organized in structural folders for easy navigation to specific information.

1.15 SYSTEM DEMONSTRATIONS:

- A. After systems have been tested and placed in proper working order, but before final acceptance of the electrical systems, demonstrate the systems to the Owner. All features and functions of all systems shall be explained and the Owner shall be instructed in proper operation and maintenance of the equipment and systems. Times to be allowed for those instructions are as follows:
- | | |
|-----------------------|---------|
| 1. Lighting and power | 4 hours |
| 2. Fire alarm | 4 hours |
| 3. Intercom | 4 hours |

BASIC ELECTRICAL REQUIREMENTS

- B. Furnish the necessary trained personnel to perform the demonstrations and instructions. The manufacturer's representatives for the equipment shall be present to assist with the demonstrations.
- C. Coordinate the dates and times for performing the demonstrations with the Owner.
- D. See individual sections for special requirement of systems.

1.16 MAINTENANCE MATERIALS:

- A. All special tools provided by the manufacturer for installation or maintenance of the equipment shall be delivered to the Architect before final acceptance.

1.17 TEMPORARY ELECTRICAL SERVICE:

- A. Provide temporary electrical service for power and lighting during construction. Maintain during construction and remove service after construction is completed.
- B. As a minimum, the temporary system shall consist of an electrical service, distribution system, load-center panel, grounding, 15 amp and/or 20 amp branch circuits, grounded type receptacles and lighting fixtures.
- C. Receptacles shall be installed as required to provide temporary power to all locations of the construction site. No extension cord or combination of cords used on the site should exceed 100 feet in total length. All receptacle circuits shall be protected with ground-fault type circuit breakers or individual receptacles must have ground-fault circuit interrupters built-in. Receptacles on the construction site shall not be installed on branch circuits which supply temporary lighting.
- D. Provide and install sufficient number of temporary light fixtures for a safe installation for all trades throughout the building. All lamps for general illumination shall be protected from accidental contact or breakage by suitable fixture or lamp-holder with a guard. (No Exceptions.)
- E. Electrical service, distribution equipment, receptacles, etc., shall be installed in a weatherproof installation.
- F. All utility charges resulting in obtaining Electrical Service and all energy charges for electrical current used shall be paid for by the General Contractor.
- G. Special power requirements by other trades shall be provided for at the expense of the other trade.
- H. When the permanent wiring for lighting and power is installed the Contractor may, with approval of the Architect, use the permanent system, provided he assumes full responsibility for all electrical materials, equipment, and devices contained in the systems and provided that roof drainage system and roofing is completed.

BASIC ELECTRICAL REQUIREMENTS

1.18 GRAPHIC REPRESENTATION AND JOB CONDITIONS:

- A. The drawings shall serve as working drawings for the general layout of the various items of equipment. However, layout of equipment, accessories, specialties, and conduit systems are diagrammatic unless specifically dimensioned; and do not necessarily indicate every required junction box, pull-box or other similar items required for a complete installation.
- B. All scale dimensions are approximate. Before proceeding with any work, carefully check and verify all dimensions, and take full responsibility for fitting the equipment which he intends to install into the spaces provided.
- C. The architectural and structural drawings take precedence over the electrical drawings in the representation of the general construction work, and the drawings of the various trades take precedence in the representation of the work of those trades. Refer to the architectural and structural drawings and the drawings of other trades to coordinate the electrical work with the other work on the premises.
- D. The drawings indicate the required sizes and points of termination of conduit and wiring and suggest proper routes to conform to the structure. Avoid obstructions and preserve clearances; however, it is not the intention of the drawings to show exact routing, all necessary offsets, etc. It shall be the responsibility of the Contractor to install all of his work to best suit actual conditions.
- E. All changes from the drawings necessary to make the work conform to the building, as constructed and to fit the work of other trades or to conform to laws and ordinances; and any reasonable changes and adjustments in location of fixtures, equipment, etc., prior to the installation, shall be made as required for a complete installation without incurring any additional expense to the Owner and shall be duly noted by the Contractor.
- F. Arrange electrical work in a neat, well organized manner with conduit and similar services running parallel with primary lines of the building construction, and with maximum overhead clearance, notwithstanding the fact that the locations indicated by drawings may be distorted for clarity in presentation. Coordinate work with other trades involved.
- G. Locate operating and control equipment properly to provide easy access, and arrange electrical work with adequate access for operation and maintenance.
- H. Give right-of-way to piping, which must slope for drainage.
- I. **Notify the Architect/Engineer immediately in writing of any differences between drawings, specifications, and conditions of the work, prior to commencing work**

PART 2 - PRODUCTS

2.1 MATERIALS:

BASIC ELECTRICAL REQUIREMENTS

- A. Deliver all materials to the project properly identified with names, model numbers, types, grades, compliance labels and other information needed for identification.
- B. Unless otherwise approved in writing, all materials furnished under this Specification shall be new and shall be standard products of manufacturers regularly engaged in the production of such equipment, and shall be the manufacturer's latest design.
- C. Equipment of any one type shall be by one manufacturer unless specifically indicated otherwise.
- D. Provide materials and equipment specified under this Division, and incidental materials and equipment not specifically mentioned but essential to make the installation complete, in accordance with the intent and requirements of the drawings and specifications.
- E. Where others furnish materials for installation under this Division, notify the supplier of dates that will be ready for delivery as specified in the General Conditions. Receive, unload, handle, store, protect, and insure the material until ready for actual installation. Upon receipt of material furnished by others, spot-check or check the entire shipment and promptly advise the Architect/Engineer in writing of any damage and/or missing components. Any material which is subsequently lost or damaged due to negligence on the part of the Contractor shall be promptly replaced (or repaired to the satisfaction of the Owner) at the Contractor's expense.

2.2 ELECTRICAL EQUIPMENT NAMEPLATE:

- A. NAMEPLATE: For each piece of Electrical equipment provide a permanent operational data nameplate indicating manufacturer, product name, model number, serial number, capacity, operating and power characteristics, labels of tested compliance, and similar essential data. Locate nameplates in an accessible location.

2.3 MISCELLANEOUS METALS:

- A. Steel plates, shapes, bars, and bar grating: ASTM A-36.
- B. Cold-Formed Steel Tubing: ASTM A-500.
- C. Hot-Rolled Steel Tubing: ASTM A-501.
- D. Steel Pipe: ASTM A 53, Schedule 40, welded.
- E. Non-shrink, Nonmetallic Grout: Premixed, factory-packaged, non-staining, non-corrosive, nongaseous grout, recommended for interior and exterior applications.
- F. Fasteners: Zinc-coated, type, grade, and class as required.

2.4 ACCESS DOORS:

BASIC ELECTRICAL REQUIREMENTS

- A. Manufacturers: Subject to compliance with requirements, provide access doors by one of the following:
1. J.L. Industries.
 2. Karp Associates, Inc.
 3. Milcor Div. Inryco, Inc.

- B. Steel Access Doors and Frames: Factory-fabricated and assembled units, complete with attachment devices and fasteners ready for installation. Joints and seams to be continuously welded steel, with welds ground smooth and flush with adjacent surfaces.
- C. Frames: 14-gage steel, with suitable means of anchoring frame to wall construction. Provide a 1-inch-wide exposed perimeter flange for units installed in unit masonry, pre-cast, cast-in-place concrete, ceramic tile, or wood paneling. Units shall be provided with perforated flanges with wallboard bead for installation in gypsum wallboard or plaster.
- D. Doors: Flush panel, 14-gage sheet steel, with concealed spring hinges or concealed continuous piano hinge set to open 175 degrees. Provide Locking device, which shall be a screwdriver-operated cam lock. Finish shall be factory applied prime coat.
- E. Fire-Rated Units: Self-closing mechanism and NRTL rated for the installation encountered. Provide NRTL label on each fire-rated access door.

2.5 FIRE STOP MATERIAL:

- A. Manufacturers: Subject to compliance with requirements, provide fire stop materials by one of the following:
 - 1. International Protective Coatings Corp.
 - 2. Specified Technologies, Inc.
 - 3. 3M Company, Inc.
 - 4. Hilti, Inc.
- B. Fire-Resistant Sealants: One-part elastomeric sealant or a two-part, foamed-in-place, silicone sealant, which are formulated for use in through-penetration fire-stopping around cables, conduit, pipes, and duct penetrations through fire-rated walls and floors. Sealants and accessories shall have fire resistance ratings as required for the installation. Fire ratings for the sealants shall be as established by testing identical assemblies in accordance with ASTM E814, by Underwriters' Laboratories, Inc., or other testing and inspecting agency acceptable to authorities having jurisdiction.
- C. Fire Safing: Mineral wool material manufactured for the specific purpose of fire safing.

PART 3 - EXECUTION

3.1 WORKMANSHIP:

- A. All work shall be performed by experienced mechanics in accordance with first class practice and the work shall be neat in appearance and complete to perform the intended function.

3.2 LOCAL CONDITIONS:

BASIC ELECTRICAL REQUIREMENTS

- A. Carefully examine the local conditions, existing installations, shall determine subsurface soil conditions as to what difficulties may be encountered in trenching and backfill, and shall thoroughly familiarize himself with all existing conditions which may affect his work.
- B. By the act of submitting a bid, the Contractor will be deemed to have made such examination, to have accepted such conditions, to have made allowance therefor, and included all costs in his proposal. Failure to determine existing conditions will not be considered a basis for the granting of additional compensation.

3.3 COOPERATION WITH OTHER TRADES:

- A. Examine areas and conditions under which the electrical systems and equipment are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected.
- B. Examine all drawings and specifications for Plumbing, Mechanical, Structural and Architectural work. He shall familiarize himself with any and all conditions related to other divisions which might affect the cost of his own work, and make proper allowances in his work schedule.
 - 1. Contractor is responsible for reviewing all of the drawings in the Construction Document set to see if additional electrical connections are required that are not specifically called for on the electrical drawings. Failure to check and bid the entire set and to ask pre-bid questions will not relieve the Contractor from performing this work.
- C. Cooperate with all other contractors doing work on this project in such a manner that all required services, facilities and equipment will be installed in the proper sequence of the work, and to result in a pleasing and harmonious finished appearance. Make any changes necessary to accomplish this.
- D. Differences between plans, specifications and conditions of the work shall be reported to the General Contractor and Architect in writing, together with a request that the difference be resolved before that portion of the work is started.

3.4 ROUGH-IN:

- A. Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected.
- B. Refer to equipment specifications in all other Divisions for rough-in requirements.

3.5 SAFETY:

- A. Provide warning lights, signs, and guards for safety as required.
- B. Safety of personnel on the project site shall be the responsibility of all divisions. Comply with all local, state, and federal regulations for safety.

BASIC ELECTRICAL REQUIREMENTS

3.6 EXCAVATION:

- A. Refer to Division 02 Sections for requirements related to the work specified herein.
- B. Provide all excavation and backfill as necessary to install the conduit systems as shown on the drawings.
- C. Care shall be taken in excavating that walls and footings and adjacent load bearing soils are not disturbed in any way. Where raceways must cross under a wall footing, the excavation shall be kept at a minimum.
- D. Slope sides of excavation as required for soil and local codes and ordinances. Provide shoring and bracing as required. Maintain shoring and bracing in excavation regardless of time period excavation is open. Remove shoring and bracing before backfilling.
- E. Excavation shall be kept free from water.
- F. Limit the length of open trench to that in which installation can be made and backfilled within the same day.
- G. Conduit shall be supported directly on undisturbed soil, do not excavate beyond indicated depth. If existing soil is unsuitable (soft spot or rock), excavate to solid subgrade, or 6" for rock, below bottom of work and provide sub-base material as required.
- H. Protect excavation bottoms against freezing when atmosphere temperature is less than 35°F.
- I. Immediately after installation, the trench shall be carefully backfilled with earth free from clods, brick, etc. to a depth one-half the raceway diameter and then firmly tamped in such a manner as not to disturb alignment or joints of the conduit. Thereafter the backfill shall be tamped every vertical foot.
- J. For raceways less than 24 inches below surface of roadways, provide 4-inch-thick concrete topping over conduit.
- K. Pavement or concrete damaged during excavation shall be restored to original condition.
- L. Locate existing underground utilities in excavation areas. Maintain and protect existing services that transit the area of an excavation trench.

3.7 HOUSEKEEPING:

- A. The premises shall be kept broom clean at all times.
- B. Stocks of material and equipment stored on the premises shall be stored in a neat and orderly manner in their shipping containers. Material and equipment shall be protected as recommended by the manufacturer.

BASIC ELECTRICAL REQUIREMENTS

- C. Remove from the premises all waste material present as a result of electrical Work.
- D. Exposed surfaces of fixtures, panels, and equipment shall be cleaned of all dirt, plaster, etc. before final acceptance of the Work.
- E. Finish and cleaning: At the completion of the Work, the following shall be completed:
 - 1. All temporary labels, stickers, etc., shall be removed from all fixtures and equipment. (Permanent nameplates, equipment model numbers, ratings, etc. shall not be removed).
 - 2. Clean all material and equipment installed. Dirt, dust, plaster, stains, and foreign matter shall be removed from all surfaces. Damaged finishes shall be touched-up and restored to their original condition.
 - 3. **All labeling done with permanent markers, pencils, etc. shall be cleaned from panels and labels installed per the Electrical Identification section.**

3.8 SCAFFOLDING AND HOISTING:

- A. Furnish and set all scaffolding and hoisting required for the work of this Division.

3.9 CUTTING AND PATCHING:

- A. Cutting and patching shall be performed in accordance with Division 01 and as specified herein.
- B. No structural members shall be cut, drilled, or penetrated without prior approval from the Architect.
- C. Coordinate the placing of the openings in the new structure as required for the installation of electrical Work.
- D. Furnish accurate locations and sizes of required openings for the electrical systems to the appropriate personnel. This shall not relieve the Contractor of the responsibility of checking to assure that proper size openings are provided. When additional patching is required due to failure to inspect this work, Contractor shall be responsible for the patching required to properly close the openings.
- E. When cutting and patching of the structures made necessary due to failure to install sleeves or equipment on schedule, or due to the failure to furnish, on schedule, the information required for the leaving of openings, then Contractor shall be responsible for the cutting and patching required.

BASIC ELECTRICAL REQUIREMENTS

- F. Provide cutting, patching, and patch painting in existing structures, as required for the installation of Work of this section. Extent of cutting shall be minimized. Use core drills, power saws, and other machines which will provide neat, minimal openings. Refer to structural drawings for lintels and supports to be furnished by others for the electrical work. All other lintels and supports required for the electrical work shall be furnished by Contractor. Patching shall match and equal adjacent materials and surfaces and shall be performed by craftsman skilled in the respective craft required. Patched finishes shall be approved by the Architect.
- G. All public and private property damaged as a result of work performed under this Contract shall be repaired and replaced, to the satisfaction of the authorities having regulatory jurisdiction and building Owner.

3.10 PROTECTION OF WORK:

- A. All conduit openings shall be kept closed by means of plugs or caps to prevent the entrance of foreign matter.
- B. Special care shall be taken for the protection of equipment furnished. All equipment and material shall be completely protected from weather elements, moisture, painting, plaster, etc. until the project is completed. Damage from rust, paint, scratches, etc. shall be repaired as required to restore equipment to original condition.
- C. Protection of equipment during the plastering and painting of the building shall be the responsibility of others, but this shall not relieve Contractor from the responsibility of checking to assure that adequate protection is provided.
- D. Where the installation or connection of equipment requires work in other areas previously finished by the Contractor shall be responsible that such areas are protected and are not marred, soiled, or otherwise damaged. Repairing and refinishing damaged areas shall be the responsibility of the Contractor and shall be approved by the Architect.
- E. Any such fixtures, equipment or apparatus damaged prior to final acceptance of the work shall be restored to its original condition or replaced by the Contractor at the Contractor's expense. At completion, fixtures and equipment shall be thoroughly cleaned.
- F. Provide and maintain temporary partitions or dust barriers adequate to prevent the spread of dust and dirt to adjacent finished areas, when required.
- G. All trenches and pits shall be maintained on a continuous basis, free of water for protection of work.

3.11 ERECTION OF SUPPORTS AND ANCHORAGE:

- A. Metal: Cut, fit, and place miscellaneous metal fabrications accurately in location, alignment, and elevation as required to support and anchor electrical materials and equipment.

BASIC ELECTRICAL REQUIREMENTS

1. Field Welding: Comply with AWS "Structural Welding Code."
2. Select fastener sizes that will not penetrate members where opposite side will be exposed to view, will receive finish materials, or may damage other surfaces, such as roofing. Make tight connections between members.
3. Attach anchors and fasteners to building structure as required to support applied loads.

3.12 APPLICATION OF SEALANTS:

- A. Install sealant as required by manufacturers' printed application instructions applicable to products and applications indicated.
- B. Installation of Fire-Stopping Sealant: Install sealant, including forming, packing, and other accessory materials, to fill openings around electrical services penetrating floors and walls, to provide fire-stops with fire-resistance ratings indicated for floor or wall assembly in which penetration occurs. Comply with installation requirements established by testing and inspecting agency.

3.13 INSTALLATION OF ACCESS DOORS:

- A. Furnish access doors as required for access to concealed equipment, controls, etc. Equipment above lay in ceilings shall not require an access door in the ceiling. Access doors shall be furnished by Contractor and installed by Division 09.

3.14 PAINTING:

- A. Painting, except as specified, shall be performed by Division 09.
- B. Equipment, which has damaged finish, shall be repainted to match the original factory finish.
- C. All exposed ferrous metal furnished by this Division, such as hangers, struts, structural steel, etc., shall be primed as specified in Section "PAINTING".

3.15 ELECTRICAL INSTALLATION:

- A. General: Sequence, coordinate, and integrate the various elements of electrical systems, materials, and equipment. Comply with the following requirements:
 1. Coordinate electrical systems, equipment, and materials installation with other building components.
 2. Verify all dimensions by field measurements.
 3. Arrange for chases, slots, and openings in other building components during progress of construction, to allow for electrical installations.
 4. Coordinate the installation of required supporting devices and sleeves to be set in poured-in-place concrete and other structural components, as they are constructed.
 5. Sequence, coordinate, and integrate installations of electrical materials and equipment for efficient flow of the Work. Give particular attention to large equipment requiring positioning prior to closing in the building.

BASIC ELECTRICAL REQUIREMENTS

6. Where mounting heights are not detailed or dimensioned, install systems, materials, and equipment to provide the maximum headroom possible.
7. Coordinate connection of electrical systems with exterior underground and overhead utilities and services.
8. Install systems, materials, and equipment to conform with approved shop drawings, including coordination drawings, to greatest extent possible. Conform to arrangements indicated by the Contract Documents, recognizing that portions of the Work are shown only in diagrammatic form. Where coordination requirements conflict with individual system requirements, refer conflict to the Architect.
9. Install systems, materials, and equipment level and plumb, parallel and perpendicular to other building systems and components, where installed exposed in finished spaces.
10. Install electrical equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations.
11. Install systems, materials, and equipment giving right-of-way priority to systems required to be installed at a specified slope.

3.16 ADJUSTING AND TESTING:

- A. All electrical equipment furnished by this Division and electrical equipment furnished by others for this Division to install shall be adjusted, aligned, and tested for proper operation by this Division.
- B. This Division shall be responsible for the installation of the proper size heaters in all manual and magnetic starters supplied by this Division. This Division shall be responsible for the operation, service, and maintenance of all new electrical equipment during construction and of all new electrical equipment during construction and prior to acceptance by the Owner of the completed project. The trade supplying equipment shall be responsible for maintaining proper lubrication.

3.17 WIRING AND CONNECTION OF EQUIPMENT BY OTHERS:

- A. Equipment, which is to be provided by others for connection and/or installation by this Division, will be delivered to him at the building in proper condition and complete with all accessories and instructions for the proper installation and connection.
- B. Outlets and wiring shown are relevant only, and the correct location, type of outlet, wiring and connection shall be as required for the equipment installed. Equipment connections may be with flexible metal conduit with maximum length of 6'-0" except where indicated otherwise.

3.18 OPERATION DURING CONSTRUCTION:

BASIC ELECTRICAL REQUIREMENTS

- A. This Division is responsible for the installation and operation, service and maintenance of all new electrical equipment during construction and prior to acceptance by the Owner of the completed project. The trade supplying equipment shall be responsible for maintaining proper lubrication. The services of trained factory personnel shall be obtained where required by this specification, and where required for successful startup of equipment. Warranty periods shall not commence until final acceptance by the Owner.

3.19 UTILITY SERVICES:

- A. Furnish and install the main electrical service from secondary side of utility pad-mounted transformer underground to the main switchboard. The cables shall be of sufficient length for connection by Power Company to the transformer. Provide PVC conduits from transformer to property line for primary service cables. Obtain from Power Company the exact location of conduits under the station. Primary cables, transformer, metering facilities and station ground will be furnished and installed by the Power Company.
- B. Telephone service shall be PVC conduits, underground from backboard, to the property line and terminated 24" below grade or as directed. Obtain from the Telephone Company the exact location of termination.
- C. The end of all power and telephone service conduits shall be sealed watertight after installation of the cables, and this location shall be documented as specified for the Record Documents.
- D. **The locations of existing underground utilities are shown in an approximate way only and have not been independently verified by the Owner or its representative. Determine the exact locations of all existing utilities and services before commencing work, and shall be fully responsible for any and all damages which might be caused by the failure to exactly locate and preserve any and all underground utilities and services.**
- E. Reimburse the Power Company and Telephone Company all cost chargeable to the Owner for these permanent services.

3.20 PHASED CONSTRUCTION:

- A. Construction phasing and sequencing requirements are indicated on the drawings and Division 01. All work shall be performed in accordance with these requirements.

3.21 OCCUPANCY ADJUSTMENT:

- A. After eleven months from date of substantial completion, provide a Master Electrician at the job site, to tighten all connectors, terminals, bus bar connections and set screws relating to electrical equipment connections. Items that are to be checked, but not limited to, are as follows:
 - 1. Panelboards
 - 2. Transformers

BASIC ELECTRICAL REQUIREMENTS

3. Service Entrance Equipment
 4. Switchboards
 5. Disconnect Switches
 6. Circuit Breakers
 7. Building Grounding Systems
 8. Contactors
- B. All connections shall be in accordance with equipment manufacturers published torque tightening values for equipment installed. Accomplish tightening by utilizing proper torquing tools, including torque screwdriver, beam-type torque wrench, and ratchet wrench with adjustable torque settings. Where manufacturer's torquing requirements are not available, tighten connectors and terminals to comply with torquing values contained in U.L.'s 4B6A.

END OF SECTION

SECTION 26 0513

CONDUCTORS AND CABLES

PART 1 GENERAL

1.1 REGULATORY REQUIREMENTS

- A. Conform to NFPA 70.
- B. Furnish products listed and classified by Underwriters Laboratories Inc. As suitable for the purpose specified and indicated.

PART 2 PRODUCTS

2.1 BUILDING WIRE

- A. Description: Single conductor insulated wire.
- B. Conductor: Copper.
- C. Insulation Voltage Rating: 600 volts.
- D. Insulation: NFPA 70; Type THW insulation for feeders and branch circuits larger than 4/0 AWG; Type THHN/THWN insulation for all others.

2.2 METAL CLAD CABLE

- A. Description: NFPA 70, Type MC.
- B. Conductor: Copper.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that interior of building has been protected from weather.
- B. Verify that mechanical work likely to damage wire and cable has been completed.
- C. Verify that raceway installation is complete and supported.

3.2 PREPARATION

- A. Completely and thoroughly swab raceway before installing wire.

3.3 WIRING METHODS

- A. Concealed Dry Interior Locations, Exposed Dry Interior Locations, Above Accessible Ceilings, Wet or Damp Interior Locations and Exterior Locations use only building wire, Type THHN/THWN insulation, in raceway.

3.4 INSTALLATION

- A. Route wire and cable as required to meet Project Conditions.

- B. Install cable in accordance with the NECA "Standard of Installation."
- C. Use solid conductor for feeders and branch circuits 10 AWG and smaller.
- D. Use stranded conductors for control circuits and all motor connections.
- E. Use conductor not smaller than 12 AWG for power and lighting circuits.
- F. Use conductor not smaller than 14 AWG for control circuits.
- G. Pull all conductors into raceway at same time.
- H. Use suitable wire pulling lubricant for building wire.
- I. Protect exposed cable from damage.
- J. Support cables above accessible ceiling, using plastic cable ties to support cables from structure. Do not rest cable on ceiling panels.
- K. Use suitable cable fittings and connectors.
- L. Neatly train and lace wiring inside boxes, equipment, and panelboards.
- M. Clean conductor surfaces before installing lugs and connectors.
- N. Make splices, taps, and terminations to carry full ampacity of conductors with no perceptible temperature rise.
- O. Identify all wire and cable. Identify each conductor with its circuit number or other designation indicated.

3.5 FIELD QUALITY CONTROL

- A. Inspect and test in accordance with NFPA 70 and applicable local codes.

END OF SECTION

SECTION 26 0526

GROUNDING AND BONDING

PART 1 GENERAL

1.1 GROUNDING SYSTEM DESCRIPTION

- A. Motor Frames.
- B. Metal frame of the building.
- C. Noncurrent-carrying metallic parts of electrical equipment.
- D. Rod electrode.
- E. Buried metallic water piping.

1.2 PERFORMANCE REQUIREMENTS

- A. Grounding System Resistance: 25 ohms maximum.

1.3 REGULATORY REQUIREMENTS

- A. Conform to requirements of NFPA 70 and applicable local codes.
- B. Products: Listed and classified by Underwriters Laboratories, Inc. or testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.

PART 2 PRODUCTS

2.1 ROD ELECTRODES

- A. Material: Copper-clad steel.
- B. Diameter: 5/8 inch.
- C. Length: 8 feet.

2.2 WIRE

- A. Material: Stranded copper.
- B. Grounding Electrode Conductor: Size to meet NFPA 70 requirements.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install rod electrodes at locations indicated.
- B. The minimum size of grounding conductors shall be in accordance NFPA 70 or local code requirements.

END OF SECTION

GROUNDING AND BONDING

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SECTION 26 0529**HANGERS AND SUPPORTS****PART 1 GENERAL****1.1 REGULATORY REQUIREMENTS**

- A. Conform to requirements of NFPA 70 and applicable local codes.
- B. Products: Listed and classified by Underwriters Laboratories, Inc. or testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.

PART 2 PRODUCTS**2.1 PRODUCT REQUIREMENTS**

- A. Materials and Finishes: Corrosion resistant, galvanized or powder coated.
- B. Select materials, sizes, and types of anchors, fasteners and supports to carry the loads of equipment and conduit, including weight of wire in conduit.
- C. Anchors and Fasteners:
 - 1. Concrete Structural Elements: Use precast inserts, expansion anchors, and powder actuated anchors.
 - 2. Steel Structural Elements: Use beam clamps and welded fasteners.
 - 3. Concrete Surfaces: Use expansion anchors.
 - 4. Hollow Masonry, and Gypsum Board Partitions: Use toggle bolts.
 - 5. Sheet Metal: Use sheet metal screws.
 - 6. Wood Elements: Use wood screws.

2.2 FORMED STEEL CHANNEL

- A. Description: Galvanized or Powder Coated steel.
- B. Acceptable Product:
 - 1. Unistrut Model P 1000.

PART 3 EXECUTION**3.1 INSTALLATION**

- A. Locate and install anchors, fasteners, and supports in accordance with NFPA 70 "Standard of Installation".
 - 1. Do not fasten supports to pipes, ducts, mechanical equipment, or conduit.
 - 2. Do not use spring steel clips and clamps.
 - 3. Do not use perforated strap, wire ties, plumbers strap or similar items.
 - 4. Obtain permission from the Architect before using powder-actuated anchors.
 - 5. Obtain permission from the Architect before drilling or cutting structural members.

- B. Fabricate supports from structural steel or formed steel members. Rigidly weld members or use hexagon-head bolts to present neat appearance with adequate strength and rigidity. Use spring lock washers under all nuts.
- C. Install surface-mounted cabinets and panelboards with minimum of four anchors.
- D. In wet and damp locations use steel channel supports to stand cabinets and panelboards 1 inch off wall.
- E. Use sheet metal channel to bridge studs above and below cabinets and panelboards recessed in hollow partitions.
- F. Rigid steel, IMC and EMT raceways shall be supported at intervals not over 10 feet and within 3 feet of each box, cabinet or fitting. Provide one support not over 12 inches from each change in direction.

END OF SECTION

SECTION 26 0533**RACEWAY AND BOXES****PART 1 GENERAL****1.1 REGULATORY REQUIREMENTS**

- A. Conform to requirements of the National Electrical Code.
- B. Provide Products listed and classified by Underwriters Laboratories, Inc., or testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.

PART 2 PRODUCTS**2.1 CABINETS, BOXES, AND FITTINGS, GENERAL**

- A. Electrical Cabinets, Boxes, and Fittings: Of indicated types, sizes, and NEMA enclosure classes. Where not indicated, provide units of types, sizes, and classes appropriate for the use and location. Provide all items complete with covers and accessories required for the intended use. Provide gaskets for units in damp or wet locations.

2.2 OUTLET, DEVICE, AND SMALL WIRING BOXES

- A. General: Conform to UL 514A, "Metallic Outlet Boxes, Electrical," and UL 514B, "Fittings for Conduit and Outlet Boxes." Boxes shall be of type, shape, size, and depth to suit each location and application.
- B. Steel Boxes: Conform to NEMA OS 1, "Sheet Steel Outlet Boxes, Device Boxes, Covers, and Box Supports." Boxes shall be sheet steel with stamped knockouts, threaded screw holes and accessories suitable for each location including mounting brackets and straps, cable clamps, exterior rings and fixture studs.
- C. Service Fittings for Floor Outlet Boxes: Surface mounted horizontal, cast aluminum type 3 inches high, suitable for finished spaces and finished in satin aluminum, except as otherwise indicated. Provide duplex receptacle or 1 inch bushed opening for telephone or other communications service as indicated. Equip fitting for attaching flat to floor box cover.

2.3 PULL AND JUNCTION BOXES

- A. General: Comply with UL 50, "Electrical Cabinets and Boxes", for boxes over 100 cubic inches volume. Boxes shall have screwed or bolted on covers of material same as box and shall be of size and shape to suit application.
- B. Steel Boxes: Sheet steel with welded seams. Where necessary to provide a rigid assembly, construct with internal structural steel bracing.
- C. Hot-Dipped Galvanized Steel Boxes: Sheet steel with welded seams. Where necessary to provide a rigid assembly, construct with internal structural steel bracing. Hot-dip galvanized after fabrication. Cover shall be gasketed.
- D. Boxes Approved for Classified Locations: Cast metal of cast nonmetallic boxes conforming to UL 886, "Outlet Boxes and Fittings for Use in Hazardous (Classified) Locations," listed

and labeled for use in the specific location classification, and with the specific hazardous material encountered. Conduit entrances shall be integral threaded type.

- E. In-Ground Cast Metal Box: NEMA 250, Type 6, outside flanged, recessed cover box for flush mounting:
 - 1. Material: Cast aluminum.
 - 2. Cover: Nonskid cover with neoprene gasket and with suitable stainless steel cover screws.
 - 3. Cover Legend:
- F. Fiberglass Handholes: Die molded glass fiber hand holes:
 - 1. Cable Entrance: Pre-cut 6 inch x 6 inch cable entrance at center bottom of each side.
 - 2. Cover: Glass fiber weatherproof cover with nonskid finish.

PART 3 EXECUTION

3.1 INSTALLATION OF OUTLET BOXES

- A. Install boxes in accordance with NEC "Standard of Installation."
- B. Install in locations as shown on Drawings, and as required for splices, taps, wire pulling, equipment connections and compliance with regulatory requirements.
- C. Set wall mounted boxes at elevations to accommodate mounting heights indicated.
- D. Electrical boxes are shown on Drawings in approximate locations unless dimensioned. Adjust box location up to 10 feet if required to accommodate intended purpose.
- E. Orient boxes to accommodate wiring devices oriented as specified in Section 16140.
- F. Maintain headroom and present neat mechanical appearance.
- G. Install pull boxes and junction boxes above accessible ceilings and in unfinished areas only.
- H. Inaccessible Ceiling Areas: Install outlet and junction boxes no more than 6 inches from ceiling access panel or from removable recessed luminaire.
- I. Coordinate mounting heights and locations of outlets mounted above counters, benches, and backsplashes.
- J. Locate outlet boxes to allow luminaries positioned as shown on reflected ceiling plan.
- K. Align adjacent wall mounted outlet boxes for switches, thermostats, and similar devices.
- L. Use flush mounting outlet box in finished areas.
- M. Locate flush mounting box in masonry wall to require cutting of masonry unit corner only. Coordinate masonry cutting to achieve neat opening.
- N. Do not install flush mounting box back-to-back in walls; provide minimum 6 inches separation. Provide minimum 24 inches separation in acoustic rated walls.

- O. Secure flush mounting box to interior wall and partition studs. Accurately position to allow for surface finish thickness.
- P. Use stamped steel bridges to fasten flush mounting outlet box between studs.
- Q. Install flush mounting box without damaging wall insulation or reducing its effectiveness.
- R. Use adjustable steel channel fasteners for hung ceiling outlet box.
- S. Do not fasten boxes to ceiling support wires.
- T. Support boxes independently of conduit.
- U. Use gang box where more than one device is mounted together. Do not use sectional box.
- V. Use gang box with plaster ring for single device outlets.
- W. Use cast outlet box in exterior locations [exposed to the weather] and wet locations.
- X. Use cast floor boxes for installations in slab on grade; formed steel boxes are acceptable for other installations.
- Y. Set floor boxes level.

3.2 INSTALLATION OF PULL AND JUNCTION BOXES

- A. **Box Selection:** For boxes in main feeder conduit runs, use sizes not smaller than 8 inches square by 4 inches deep. Do not exceed 6 entering and 6 leaving raceways in a single box. **Cable Supports:** Install clamps, grids, or devices to which cables may be secured. Arrange cables so they may be readily identified. Support cable at least every 30 inches inside boxes.
- B. Mount pull boxes in inaccessible ceilings with covers flush with the finished ceiling.
- C. **Size:** Provide pull and junction boxes for telephone, signal, and other systems at least 50 percent larger than would be required by Article 370 of NEC, or as indicated. Locate boxes strategically and provide shapes to permit easy pulling of future wires or cables of types normal for such systems.

END OF SECTION

SECTION 26 0553**ELECTRICAL IDENTIFICATION****PART 1 GENERAL****1.1 REGULATORY REQUIREMENTS**

- A. Conform to requirements of NFPA 70 and applicable local codes.
- B. Products: Listed and classified by Underwriters Laboratories, Inc. as suitable for the purpose specified and indicated.

PART 2 PRODUCTS**2.1 NAMEPLATES AND LABELS**

- A. Nameplates: Engraved three-layer laminated plastic, black letters on white background.
- B. Locations:
 - 1. Each electrical distribution and control equipment enclosure.
 - 2. Communication cabinets.
 - 3. Starters.
 - 4. Disconnect Switches.
- C. Letter Size:
 - 1. 3/8-inch letters for identifying equipment.
- D. Note: Embossed adhesive tape shall not be used.

2.2 WIRE MARKERS

- A. Description: Tubing type wire markers.
- B. Locations: Each conductor at panelboard gutters, pull boxes, and junction boxes and each load connection.
- C. Legend:
 - 1. Power and Lighting Circuits: Branch circuit or feeder number indicated.
 - 2. Control Circuits: Control wire number indicated on shop drawings.

2.3 UNDERGROUND WARNING TAPE

- A. Description: 2-inch wide plastic tape, detectable type, colored yellow with suitable warning legend describing buried electrical lines.
- B. Location: Along length of each underground conduit.

PART 3 EXECUTION

3.1 PREPARATION

- A. Degrease and clean surfaces to receive nameplates and labels.

3.2 INSTALLATION

- A. Install nameplate parallel to equipment lines.
- B. Secure nameplate to equipment front using rivets.
- C. Secure nameplate to inside surface of door on panelboard that is recessed in finished locations.

END OF SECTION

SECTION 26 0583**WIRING CONNECTIONS****PART 1 GENERAL****1.1 REGULATORY REQUIREMENTS**

- A. Conform to requirements of NFPA 70 and applicable local codes.
- B. Products: Listed and classified by Underwriters Laboratories, Inc. for testing firm acceptable to the authority having jurisdiction, as suitable for the purpose specified and indicated.

PART 2 PRODUCTS**2.1 CORDS AND CAPS**

- A. Attachment Plug Construction: Conform to NEMA WD 1.
- B. Configuration: NEMA WD 6; match receptacle configuration at outlet provided for equipment.
- C. Cord Construction: NFPA 70, Type SO multiconductor flexible cord with identified equipment grounding conductor, suitable for use in damp locations.
- D. Size: Suitable for connected load of equipment, length of cord, and rating of branch circuit overcurrent protection.

PART 3 EXECUTION**3.1 EXAMINATION**

- A. Verify that equipment is ready for electrical connection, wiring, and energization.

3.2 ELECTRICAL CONNECTIONS

- A. Make electrical connections in accordance with equipment manufacturer's instructions.
- B. Make conduit connections to equipment using flexible conduit. Use liquidtight flexible conduit with watertight connectors in damp or wet locations.
- C. Connect heat producing equipment using wire and cable with insulation suitable for temperatures encountered.
- D. Provide receptacle outlet to accommodate connection with attachment plug.
- E. Provide cord and cap where field-supplied attachment plug is required.
- F. Install suitable strain-relief clamps and fittings for cord connections at outlet boxes and equipment connection boxes.
- G. Install disconnect switches, controllers, control stations, and control devices to complete equipment wiring requirements.
- H. Install terminal block jumpers to complete equipment wiring requirements.

- I. Install interconnecting conduit and wiring between devices and equipment to complete equipment wiring requirements.

END OF SECTION

SECTION 26 2100

ELECTRICAL UTILITY SERVICES

PART 1 GENERAL

1.1 SYSTEM DESCRIPTION

- A. For Utility Supplied Services - System Characteristics: 120/208 volts, three phase, four-wire, 60 Hertz. System voltages shall match utility service.
- B. Self-generated voltages shall match system standard voltages.

1.2 QUALITY ASSURANCE

- A. Perform Work in accordance with Utility Company written requirements.
- B. Maintain one copy of each document on site.

1.3 REGULATORY REQUIREMENTS

- A. Conform to requirements of NFPA 70 and IEEE 141.
- B. Products: Listed and classified by Underwriters Laboratories, Inc. or testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.

PART 2 PRODUCTS

2.1 PAD FOR UTILITY TRANSFORMER

- A. Description: Transformer pad sized as required by utility company.

PART 3 EXECUTION

3.1 PREPARATION

- A. Arrange with Utility Company to obtain permanent electric service to the Project. Pay for all required permits and fees.

3.2 INSTALLATION

- A. Install meter base as required by Utility Company. All wire, conduits, pads, meter bases, weatherheads, and meter not installed by utility company and required for a complete and functional electrical service.

END OF SECTION

SECTION 26 2416**DISTRIBUTION PANELBOARDS****PART 1 GENERAL****1.1 REGULATORY REQUIREMENTS**

- A. Conform to requirements of NFPA 70.
- B. Products: Listed and classified by Underwriters Laboratories, Inc. as suitable for the purpose specified and indicated.

PART 2 PRODUCTS**2.1 MANUFACTURERS**

- A. Furnished by Owner.

2.2 SWITCHBOARD

- A. Description: NEMA PB 2 switchboard with electrical ratings and configurations as indicated and specified.
- B. Ratings:
 - 1. Voltage: 208Y/120 volts.
 - 2. Configuration: Three phase, four wire, grounded.
 - 3. Main Bus: As required for the facility.
 - 4. Integrated Equipment Rating: 200,000 rms amperes symmetrical.
- C. Main Section Devices: Individually mounted.
- D. Distribution Section Main Device: Individually mounted and compartmented.
- E. Auxiliary Section Devices: Panel mounted.
- F. Bus Material: Aluminum with tin plating, standard size.
- G. Bus Connections: Bolted, accessible from front for maintenance.
- H. Fully insulate load side bus bars. Do not reduce spacing of insulated bus. Use factory applied tape wrapping or spray applied 105 degrees C minimum insulating material.
- I. Ground Bus: Extend length of switchboard.
- J. Molded Case Circuit Breakers: NEMA AB 1, integral thermal and instantaneous magnetic trip in each pole.
 - 1. Provide circuit breakers UL listed as Type HACR for air conditioning equipment branch circuits.
 - 2. Include shunt trip, undervoltage release, and auxiliary contact where required.
- K. Line and Load Terminations: Accessible from the front only of the switchboard, suitable for the conductor materials and sizes indicated.

- L. Pull Section: Arrange as required for the facility.
- M. Enclosure: Type 1 - General Purpose NEMA 3R.
 - 1. Align sections at front and rear.
 - 2. Switchboard Height: 90 inches, excluding floor sills, lifting members and pull boxes.
 - 3. Finish: Manufacturer's standard light gray enamel over external surfaces. Coat internal surfaces with minimum one coat corrosion-resisting paint, or plate with cadmium or zinc.
 - 4. Mimic Bus: Show bussing, connections and devices in single line form on the front panels of the switchboard using black color lines on a white plastoid laminated panel, fastened flat against the panel face with rivets.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install switchboard in locations shown on Drawings, according to NEMA PB 2.1.
- B. Tighten accessible bus connections and mechanical fasteners after placing switchboard.

3.2 FIELD QUALITY CONTROL

- A. Inspect and test in accordance with NETA ATS, except Section 4.
- B. Perform inspections and tests listed in NETA ATS, Section 7.1.

END OF SECTION

SECTION 26 2419**ENCLOSED MOTOR CONTROLLERS****PART 1 GENERAL****1.1 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in manufacturing enclosed motor controllers with minimum 3 years documented experience.
- B. Acceptable Manufacturers:
 - 1. Square D.
 - 2. General Electric.
 - 3. Siemens.
 - 4. Cutler Hammer.

1.2 REGULATORY REQUIREMENTS

- A. Conform to requirements of NFPA 70 and NEMA ICS1, 2 and 6.
- B. Products: Listed and classified by Underwriters Laboratories, Inc. as suitable for the purpose specified and indicated.

PART 2 PRODUCTS**2.1 MANUAL CONTROLLERS**

- A. All motor controllers shall have an overall unit short circuit current rating that equals or exceeds of maximum fault current at the point of application.
- B. Manual Motor Controller: NEMA ICS 6, AC general-purpose, Class A, manually operated, full-voltage controller with overload element, red pilot light, N.O. auxiliary contact, and push button operator.
- C. Fractional Horsepower Manual Controller: NEMA ICS 6, AC general-purpose, Class A, manually operated, full-voltage controller for fractional horsepower induction motors, with thermal overload unit, red pilot light and toggle operator.
- D. Motor Starting Switch: NEMA ICS 2, AC general-purpose Class A manually operated, full-voltage controller for fractional horsepower induction motors, without thermal overload unit, with red pilot light and toggle operator.
- E. Enclosure: NEMA ICS 6, Type as required to meet conditions of installation.

2.2 AUTOMATIC CONTROLLERS

- A. Magnetic Motor Controllers: NEMA ICS 6, AC general-purpose Class A magnetic controller for induction motors rated in horsepower.
- B. Coil operating voltage: 120 or 208 volts, 60 Hertz.
- C. Overload Relay: NEMA ICS; melting alloy.

- D. Enclosure: NEMA ICS 6, Type as required to meet conditions of installation.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install enclosed controllers where indicated, in accordance with NECA "Standard of Installation."
- B. Install enclosed controllers plumb. Provide supports in accordance with Section 16070.
- C. Provide fuses for fusible switches.
- D. Select and install overload heater elements in motor controllers to match installed motor characteristics.
- E. Neatly type label inside each motor controller door identifying motor served, nameplate horsepower, full load amperes, code letter, service factor, and voltage/phase rating. Place label in clear plastic holder.

3.2 FIELD QUALITY CONTROL

- A. Inspect and test in accordance with NETA ATS, except Section 4.
- B. Perform inspections and tests listed in NETA ATS, Section 7.16.2.

END OF SECTION

SECTION 26 2726**WIRING DEVICES****PART 1 GENERAL****1.1 REGULATORY REQUIREMENTS**

- A. Conform to requirements of NFPA 70.
- B. Provide Products listed and classified by Underwriters Laboratories, Inc. as suitable for the purpose specified and indicated.

PART 2 PRODUCTS**2.1 WALL SWITCHES**

- A. Color: Stainless steel cover plate and grey device.
- B. Specification Grade.
- C. Manufacturers:
 - 1. Single Pole Switch:
 - a. Pass & Seymour Model 20 AC1-I.
 - 2. Double Pole Switch:
 - a. Pass & Seymour Model 20 AC2-I.
 - 3. Three-way Switch:
 - a. Pass & Seymour Model 20AC3-I.
 - 4. Four-way Switch:
 - a. Pass & Seymour Model 20AC4-I.
 - 5. Indicator Switch Pilot Gang:
 - a. Pass & Seymour Model 20AC1/3-CPL.
 - 6. Key Switch:
 - a. Pass & Seymour Model 20AC1/2/4-L.
 - 7. Momentary Switch:
 - a. Pass & Seymour Model 1250-I.

2.2 RECEPTACLES

- A. Color: Stainless steel cover plate and grey device.

- B. All devices to have 20A at 125V rating.
- C. Specification Grade.
- D. Manufacturers:
 - 1. Single Convenience Receptacle:
 - a. Pass & Seymour Model 5361
 - 2. Duplex Convenience Receptacle:
 - a. Pass & Seymour Model 5362.
 - 3. GFCI Receptacle:
 - a. Pass & Seymour Model 2091-S.
 - 4. Isolated Ground Receptacle:
 - a. Pass & Seymour Model IG6300.
 - 5. Telephone Jack:
 - a. Hubbell Model CX244.

2.3 WALL PLATES

- A. Decorative Cover Plate: Stainless steel.
- B. Weatherproof Cover Plate: Gasketed cast metal with hinged gasketed device cover.
- C. Shall be furnished and installed for the type of service involved.
- D. Manufacturers:
 - 1. Weatherproof Cover Plate: Gasketed cast metal with hinged gasketed device cover.
 - a. Hubbell Model WP826MP.

2.4 FLOOR MOUNTED SERVICE FITTINGS

- A. Flush Cover Convenience Receptacle:
 - 1. Material: Brass plate with steel box.
 - 2. Configuration: Duplex threaded opening.
 - 3. Manufacturers: Hubbell Model 132529 W/SF2525.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that outlet boxes are installed at proper height.
- B. Verify that wall openings are neatly cut and will be completely covered by wall plates.

- C. Verify that floor boxes are adjusted properly.
- D. Verify that branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.

3.2 INSTALLATION

- A. Install in accordance with NECA "Standard of Installation."
- B. Install devices plumb and level.
- C. Install switches with OFF position down.
- D. Install wall dimmers to achieve full rating specified and indicated after derating for ganging as instructed by manufacturer.
- E. Do not share neutral conductor on load side of dimmers.
- F. Install receptacles with grounding pole on bottom.
- G. Connect wiring device grounding terminal to outlet box with bonding jumper.
- H. Install decorative plates on switch, receptacle, and blank outlets in finished areas.
- I. Connect wiring devices by wrapping conductor around screw terminal.
- J. Install galvanized steel plates on outlet boxes and junction boxes in unfinished areas, above accessible ceilings, and on surface mounted outlets.
- K. Install protective rings on active flush cover service fittings.

3.3 FIELD QUALITY CONTROL

- A. Inspect each wiring device for defects.
- B. Operate each wall switch with circuit energized and verify proper operation.
- C. Verify that each receptacle device is energized.
- D. Test each receptacle device for proper polarity.
- E. Test each GFCI receptacle device for proper operation.

END OF SECTION

SECTION 26 5100**INTERIOR LIGHTING****PART 1 GENERAL****1.1 REGULATORY REQUIREMENTS**

- A. Conform to requirements of NFPA 70.
- B. Conform to requirements of NFPA 101.
- C. Products: Listed and classified by Underwriters Laboratories, Inc.

PART 2 PRODUCTS**2.1 LUMINAIRES**

- A. Refer to Lighting Fixture Schedule in Drawings. All fixtures are Owner furnished; Contractor installed.

PART 3 EXECUTION**3.1 INSTALLATION**

- A. Install suspended luminaires using pendants supported from swivel hangers. Provide pendant length required to suspend luminaire at indicated height.
- B. Support luminaires larger than 2 x 4 foot size independent of ceiling framing.
- C. Locate recessed ceiling luminaires as indicated on reflected ceiling plan.
- D. Install surface mounted luminaires and exit signs plumb and adjust to align with building lines and with each other. Secure to prevent movement.
- E. Exposed Grid Ceilings: Support surface mounted luminaires on grid ceiling directly from building structure Provide auxiliary members spanning ceiling grid members to support surface mounted luminaires Fasten surface mounted luminaires to ceiling grid members using bolts, screws, rivets, or suitable clips.
- F. Install recessed luminaires to permit removal from below.
- G. Install recessed luminaires using accessories and firestopping materials to meet regulatory requirements for fire rating.
- H. Install clips to secure recessed grid-supported luminaires in place.
- I. Install wall mounted luminaires and exit signs at height as indicated on Drawings.
- J. Install accessories furnished with each luminaire.
- K. Connect luminaires, emergency lighting units and exit signs to branch circuit outlets provided under Section 16130 using flexible conduit.

- L. Make wiring connections to branch circuit using building wire with insulation suitable for temperature conditions within luminaire.
- M. Bond products and metal accessories to branch circuit equipment grounding conductor.
- N. Install specified lamps in each emergency lighting unit, exit sign, and luminaire.

3.2 FIELD QUALITY CONTROL

- A. Operate each luminaire after installation and connection. Inspect for proper connection and operation.

3.3 ADJUSTING

- A. Aim and adjust luminaires as directed.

END OF SECTION

SECTION 26 5600

EXTERIOR LIGHTING

PART 1 GENERAL

1.1 REGULATORY REQUIREMENTS

- A. Conform to requirements of NFPA 70.
- B. Products: Listed and classified by Underwriters Laboratories, Inc. as suitable for the purpose specified and indicated.

PART 2 PRODUCTS

2.1 LUMINAIRES AND ACCESSORIES

- A. General: Furnished by Owner; installed by Contractor.
- B. Wiring: Provide electrical wiring within fixtures which is suitable for connection to branch circuit wiring as follows:
 - 1. NEC Type AF for 120 volt, minimum No. 18 AWG.

2.2 POLES

- A. General: Furnished by Owner; installed by Contractor.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install poles plumb. Provide double nuts to adjust plumb. Grout around each base.
- B. Install lamps in each luminaire.
- C. Bond luminaires, metal accessories and metal poles to branch circuit equipment grounding conductor. Provide supplementary grounding electrode at each pole.
- D. All perimeter lighting shall be automatically controlled.

3.2 FIELD QUALITY CONTROL

- A. Operate each luminaire after installation and connection. Inspect for improper connections and operation.
- B. Take measurements during night sky, without moon or with heavy overcast clouds effectively obscuring moon.

3.3 ADJUSTING

- A. Aim and adjust luminaires to provide illumination levels and distribution as directed.

END OF SECTION

SECTION 311000**SITE CLEARING****PART 1 - GENERAL**

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Removing existing vegetation.
 - 2. Clearing and grubbing.
 - 3. Removing above- and below-grade site improvements.
 - 4. Disconnecting, capping or sealing, and removing site utilities.
 - 5. Temporary erosion- and sedimentation-control measures.

1.3 DEFINITIONS

- A. Subsoil: All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms.
- B. Surface Soil: Soil that is present at the top layer of the existing soil profile at the Project site. In undisturbed areas, the surface soil is typically topsoil; but in disturbed areas such as urban environments, the surface soil can be subsoil.
- C. Topsoil: Top layer of the soil profile consisting of existing native surface topsoil or existing in-place surface soil and is the zone where plant roots grow.
- D. Plant-Protection Zone: Area surrounding individual trees, groups of trees, shrubs, or other vegetation to be protected during construction, and indicated on Drawings.
- E. Tree-Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction, and defined by a circle concentric with each tree with a radius 1.5 times the diameter of the drip line unless otherwise indicated.
- F. Vegetation: Trees, shrubs, groundcovers, grass, and other plants.

1.4 MATERIAL OWNERSHIP

- A. Except for stripped topsoil and other materials indicated to be stockpiled or otherwise remain Owner's property, cleared materials shall become Contractor's property and shall be removed from Project site.

1.5 SUBMITTALS

- A. Record Drawings: Identifying and accurately showing locations of capped utilities and other subsurface structural, electrical, and mechanical conditions.

1.6 PROJECT CONDITIONS

- A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.
 - 1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
 - 2. Provide alternate routes around closed or obstructed traffic ways if required by Owner or authorities having jurisdiction.
- B. Utility Locator Service: Notify utility locator service for area where Project is located before site clearing.
- C. Do not commence site clearing operations until temporary erosion and sedimentation control and plant protection measures are in place.
- D. The following practices are prohibited within protection zones:
 - 1. Storage of construction materials, debris, or excavated material.
 - 2. Parking vehicles or equipment.
 - 3. Foot traffic.
 - 4. Erection of sheds or structures.
 - 5. Impoundment of water.
 - 6. Excavation or other digging unless otherwise indicated.
 - 7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.
- E. Do not direct vehicle or equipment exhaust towards protection zones.
- F. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones.

- G. Soil Stripping, Handling, and Stockpiling: Perform only when the topsoil is dry or slightly moist.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Satisfactory Soil Material: Requirements for satisfactory soil material are specified in Division 31 sections discussing earthwork.
 - 1. Obtain approved borrow soil material off-site when satisfactory soil material is not available on-site.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Protect and maintain benchmarks and survey control points from disturbance during construction.
- B. Locate and clearly identify trees, shrubs, and other vegetation to remain or to be relocated. Flag each tree trunk at 54 inches above the ground.
- C. Protect existing site improvements to remain from damage during construction.
 - 1. Restore damaged improvements to their original condition, as acceptable to Owner.

3.2 TEMPORARY EROSION AND SEDIMENTATION CONTROL

- A. Provide temporary erosion- and sedimentation-control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to erosion- and sedimentation-control Drawings and requirements of authorities having jurisdiction.
- B. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross protection zones.
- C. Inspect, maintain, and repair erosion- and sedimentation-control measures during construction until permanent vegetation has been established.
- D. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

3.3 EXISTING UTILITIES

- A. Locate, identify, disconnect, and seal or cap utilities indicated to be removed.
 - 1. Arrange with utility companies to shut off indicated utilities.
- B. Locate, identify, and disconnect utilities indicated to be abandoned in place.
- C. Interrupting Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
 - 1. Notify Owner not less than two days in advance of proposed utility interruptions.
 - 2. Do not proceed with utility interruptions without Architect's written permission.
- D. Excavate for and remove underground utilities indicated to be removed.

3.4 CLEARING AND GRUBBING

- A. Remove obstructions, trees, shrubs, and other vegetation to permit installation of new construction.
 - 1. Do not remove trees, shrubs, and other vegetation indicated to remain or to be relocated.
 - 2. Grind down stumps and remove roots, obstructions, and debris to a depth of 18 inches below exposed subgrade.
 - 3. Use only hand methods for grubbing within protection zones.
 - 4. Chip removed tree branches and stockpile in areas approved by Architect.

3.5 SITE IMPROVEMENTS

- A. Remove existing above- and below-grade improvements as indicated and necessary to facilitate new construction.
- B. Remove slabs, paving, curbs, gutters, and aggregate base as indicated.
 - 1. Unless existing full-depth joints coincide with line of demolition, neatly saw-cut along line of existing pavement to remain before removing adjacent existing pavement. Saw-cut faces vertically.
 - 2. Paint cut ends of steel reinforcement in concrete to remain with two coats of antirust coating, following coating manufacturer's written instructions. Keep paint off surfaces that will remain exposed.

END OF SECTION

SECTION 31 2000

EARTHWORK

PART 1 - GENERAL

1.1 BASIS FOR BIDS

- A. Base bids on excavating and filling with materials encountered at site except where special fill or backfill materials are specified herein or indicated on Drawings. No allowance or extra payments will be made by reason of variation in types of soil encountered or variations in their moisture contents. Furnish additional fill material required and included as a part of the work. Include removal of excess or objectionable materials as a part of the work.

1.2 QUALITY ASSURANCE

- A. Shoring, sheeting, bracing and retention plans, details and other provisions necessary in order to safely excavate trenches for this project shall be prepared by a Professional Engineer registered in the jurisdiction where project is located and employed by Contractor.
- B. Contractor is solely responsible for retention plans, details, accessories and execution.
- C. Regulatory Requirements: Perform excavation work in compliance with applicable requirements of governing authorities having jurisdiction.
- D. Testing and Inspection Service: Owner will engage soil testing and inspection service for quality control testing during earthwork operations. Refer to Section 01450.

1.3 PROTECTION

- A. Protect trees, shrubs, lawns, rock out-croppings and other features remaining as a portion of final landscaping.
- B. Protect benchmarks, existing structures, fences, sidewalks, paving, and curbs from equipment and vehicular traffic.
- C. Protect above and below grade utilities which are to remain.
- D. Protect excavations by shoring, bracing, sheet piling, underpinning, or other methods required to prevent cave-in or loose soil from falling into excavation. Monitor shoring system and surrounding ground surface during construction to detect movement. If movement becomes significant, take contingency steps to brace excavation and adjacent utility lines.
- E. Notify Owner's Representative of unexpected subsurface conditions and discontinue affected work in area until notified to resume work.
- F. Grade excavation top perimeter to prevent surface water run-off into excavation.

PART 2 - PRODUCTS

2.1 STOCKPILING

- A. Material cut or excavated from building areas which is suitable for backfilling may be stored on site to be distributed later.

- B. Fill material required to be hauled in may be stockpiled at site until used, provided it is properly handled to prevent contamination with undesirable materials.
- C. Stockpile topsoil separate from excavated sub-soil.

2.2 SURPLUS MATERIALS

- A. Remove excavated materials not to be used in fills and backfills on this project from site immediately.
- B. Remove materials containing rubbish, debris, fracture limestone, or rocks.

2.3 SOIL MATERIALS

- A. General Fill and Backfill: Suitable existing excavated on-site soil free from vegetation, debris, and other deleterious matter, unless otherwise noted.
- B. Fill Beneath Structures: Select sandy clay, inert and non-expansive, having a plasticity index and a liquid limit as indicated in soils investigation report to replace unstable material below structure and to raise sub-grade level to elevations required.
 - 1. Base Material in Parking/Drive Areas: As recommended in soils investigation report.
- C. Top Soil:
 - 1. Clean natural topsoil free of vegetation, debris and other deleterious matter, and approved by Owner's Representative.
 - 2. Upper 6 inches of topsoil stripped may be used, if suitable, otherwise use imported natural, fertile, friable soil possessing characteristics representative of productive growing soils in the area.
- D. Granular Leveling Course Under Slabs, Walks, and Decks on Grade: Pit run cushion sand, free of organic matter, clays or other binder materials. Submit samples for approval.
- E. Impervious Clay Soil: Clayey material having a plasticity index in excess of 30.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Establish extent of excavation by area and elevation; designate and identify datum elevation.
- B. Set required lines and levels.
- C. Maintain bench marks, monuments and other reference points.

3.2 PREPARATION

- A. Existing Utilities:
 - 1. Before starting excavation, establish location and extent of underground utilities occurring in work area.
 - 2. Notify utility companies to remove and relocate lines which are in way of excavation.
 - 3. Maintain, reroute or extend as required, existing utility lines to remain which pass through work area.

4. Protect utility services uncovered by excavation.
5. Upon discovery of unknown utility or concealed condition, discontinue affected work and notify Owner's Representative.

3.3 ROUGH GRADING

- A. Excavation and rough grade to lines and grades shown.
- B. Overcut planting and lawn areas to allow a layer of topsoil not less than 6 inches thick.
- C. Maintain excavations to drain and be free of excess water. Ponding of water on site will not be permitted.
- D. Remove objectionable and excess materials from site when excavated.

3.4 EXCAVATION - GENERAL

- A. Excavation Classification:
 1. Unclassified and includes excavation to subgrade elevations indicated, regardless of character of materials and obstructions encountered.
- B. Unauthorized Excavation:
 1. Consists of material removal beyond indicated subgrade elevations or dimensions without specific direction of Owner's Representative.
 2. Correct unauthorized excavation, as well as remedial work directed by Owner's Representative, at no additional cost to Owner.
 3. Under footings, foundation bases, or retaining walls, fill unauthorized excavation by extending indicated bottom elevation of footing or base to excavation bottom without altering required top elevation.
 4. Lean concrete fill may be used to bring elevations to proper position, when acceptable to Owner's Representative.
 5. Backfill and compact other unauthorized excavations as specified for authorized excavations of same classification, unless otherwise directed by Owner's Representative.
- C. Additional Excavation:
 1. When excavation has reached required subgrade elevations, notify soils testing laboratory for examination of conditions.
 2. If unsuitable bearing materials are encountered at required subgrade elevations, excavate deeper and replace excavated material as directed by soils testing laboratory.
 3. Removal of unsuitable material and its replacement as directed will be paid on basis of Contract conditions relative to changes in Work.
- D. Dewatering:
 1. Prevent surface water and subsurface or ground water from flowing into excavations and from flooding Project site and surrounding area.
 2. Do not allow water to accumulate in excavations.
 3. If presence of subsurface water is encountered during excavation, provide interior drainage.

4. Remove water to prevent softening of foundation bottoms, undercutting footings, and soil changes detrimental to stability of subgrades and foundations.
5. Provide and maintain pumps, well points, sumps, suction and discharge lines, and other dewatering system components necessary to convey water away from excavations.
6. Establish and maintain temporary drainage ditches and other diversions outside excavation limits to convey rain water and water removed from excavations to collecting or run-off areas.
7. Do not use trench excavations as temporary drainage ditches.

3.5 STRUCTURAL EXCAVATION

- A. Locate and mark existing underground utilities and services before beginning structural excavation.
- B. Provide excavation for structures and footings, as required for construction, bracing and removal of forms, applying waterproofing, and to permit inspection.
- C. Machine slope banks to angle of repose or less until shored. Do not allow excavation to interfere with normal 45 degree angle bearing splay of any foundation.
- D. Ensure bottom of excavation is reasonably level.
- E. Maintain excavations in as near their natural moisture conditions as possible.
- F. Fill over-excavated areas under structure bearing surfaces in accordance with Owner's Representative's direction.
- G. Do not allow construction equipment to create "pumping" of soils.
- H. Remove boulders or cobbles.

3.6 EXCAVATION BENEATH FLOOR SLABS ON GRADE

- A. If required by soils investigation report, excavate and remove existing soil to a depths below bottom of slab as recommended in report.

3.7 FILLS AND BACKFILLS – GENERAL

- A. Verify areas to be backfilled are free of debris, snow, ice or water, and ground surfaces are not frozen.
- B. Proofroll exposed subgrade in building and paving areas with heavily loaded dump truck or similar acceptable construction equipment, to detect unsuitable soil conditions. Commence proofrolling operations after a suitable period of dry weather to avoid degrading acceptable subgrade surfaces. Make 4 passes over each section with proofrolling equipment, with the last 2 passes perpendicular to the first 2 passes.
- C. Cut out soft areas of subgrade not readily capable of in-situ compaction. Backfill and compact to density equal to requirements for subsequent backfill material.
- D. Site backfill systematically, as early as possible, to allow maximum time for natural settlement. Do not backfill over porous, wet or spongy subgrade surfaces.

- E. Maintain optimum moisture content of backfill materials to attain required compaction density.
- F. Make gradual changes in grade. Blend slopes into level areas.

3.8 FILLS WITHIN STRUCTURE

- A. Select Fill Beneath Slabs on Grade:
 - 1. Scarify exposed sub-grade to a depth of 6 inches and re-compact to a density and moisture content as recommended in soils investigation report.
 - 2. Place Select Fill in loose lifts of 8 inches and compact each lift to a density and moisture content as recommended in soils investigation report.
 - 3. Place Select Fill to a minimum depth as indicated in soils investigation report.
 - 4. Prevent excessive loss of moisture during construction.

3.9 FILLS OUTSIDE STRUCTURE

- A. Roughen and loosen filled areas before placing of fill materials.
- B. Spread suitable fill materials in uniform layers over area not to exceed 8 inches thick compaction.
- C. Wet and work materials as required for proper compaction and thoroughly mix.
- D. Compaction: By tamping rollers or by utilizing excavation equipment to spread and compact fill to a uniform density equal to natural density of material before excavating.
- E. Areas adjacent to building, or where compacting equipment cannot work: Compact with hand tampers.
- F. Compact filled areas to 90 percent Standard Proctor and to lines and grades shown, with allowances for a final layer of topsoil in lawn and planter areas.
- G. Base Material Beneath Paving: Fill beneath paving with material, placed at density and moisture content as recommended in soils investigation report.

3.10 BACKFILL OUTSIDE STRUCTURE

- A. Ensure areas to be backfilled are free from debris, snow, ice and water and that ground surfaces are not in frozen condition.
- B. Do not backfill over existing subgrade surfaces which are porous, wet or spongy.
- C. Backfill areas to grades, contours, levels and elevations indicated.
- D. Backfill systematically and as early as possible to allow maximum time for natural settlement and compaction.
- E. After permanent construction is in place, forms and trash removed, sub-soil drainage and water-proofing complete and inspections complete, backfill with approved materials and compact to approximate density of natural ground.
- F. Place backfill in layers not exceeding 8 inches loose depth, and hand or machine tamp to compaction required.

- G. Water may be added to backfill material as an aid to compaction; however, do not allow material to become wet to form a mud or paste.

3.11 REMOVAL OF CONTAMINATED SOIL

- A. Prior to Finish Grading: Remove soil contaminated with lime from lawn and plant bed areas. Replace with clean, approved topsoil.

3.12 FINISH GRADING

- A. After completion of rough grading and site cleared of construction debris, cover areas disturbed by construction or graded to provide new finish grades with a layer of topsoil not less than 6 inches thick.
- B. Provide final grades as shown or as directed by Owner's Representative, slope away from building, and provide drainage for area.
- C. Degree of Finish: That ordinarily obtainable with blade grader or scraper operations.
- D. Finish Surfaces: No greater than 0.10 feet above or below established grade elevation.
- E. Provide uniform roundings at top and bottom of slopes and other breaks in grade. Correct irregularities and areas where water will stand.
- F. Uniformly distribute topsoil to required grades; feather back to where grades remain unchanged.
- G. Finish lawn and unpaved areas to 1 inch below top of walk and curbs.

3.13 FIELD QUALITY CONTROL

- A. Comply with requirements of Section 01450.
- B. Testing Laboratory Services:
 - 1. Owner will engage soil testing and inspection service for quality control testing during soil stabilization, fill and backfill operations.
 - 2. Submit soil materials proposed for fill and backfill to laboratory for testing.
 - a. Laboratory will determine suitability of materials to be used.
 - b. Laboratory will submit test results and recommendations.
 - 3. Advise testing laboratory 48 hours minimum in advance of operations.
 - 4. Tests will be executed immediately prior to covering of such compacted areas.
 - 5. When tests indicate compaction does not meet requirements, remove fill and backfill completely, dry out or moisten as necessary and recompact.
 - a. Retest recompact areas.
 - b. Repeat until test indicate compliance with specified requirements.
 - c. Provide reworking and retesting at no additional cost to Owner.
- C. Testing laboratory will inspect soil stabilization operations. Notify laboratory when operations are to begin.

- D. Testing laboratory will perform one field density test of each lift per 5000 square feet of compacted fill materials for building slab and paved areas.
- E. For each strata of soil on which footings will be placed, testing laboratory will conduct at least one test to verify required design bearing capacities. Subsequent verification and approval of each footing subgrade may be based on a visual comparison of each subgrade with related tested strata, when acceptable to Owner's Representative.
- F. Laboratory will perform one series of tests on area being evaluated in accordance with ASTM D 2922 and D 3017, or ASTM D 1556 and D 1557.
- G. If during progress of Work tests indicate that compacted materials do not meet specified requirements, remove defective work, replace and retest at no additional cost to Owner.
- H. Ensure compacted fills are tested before proceeding with placement of surface materials.

3.14 ADJUSTING

- A. Repair and re-establish grades in settled, eroded, and rutted areas to specified tolerances.
- B. Where completed compacted areas are disturbed by subsequent construction operations or adverse weather, scarify surface, re-shape, and compact to required density prior to further construction.
- C. Where settling is measurable or observable at excavated areas during general project warranty period, remove surface (pavement, lawn or other finish), add backfill material, compact, and replace surface treatment. Restore appearance, quality, and condition of surface or finish to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

END OF SECTION

SECTION 313116**TERMITE CONTROL****PART 1 - GENERAL**

- 1.1 RELATED DOCUMENTS
- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- 1.2 SUMMARY
- A. Section Includes:
1. Soil treatment with termiticide.
- 1.3 SUBMITTALS
- A. Product Data: For each type of termite control product.
1. Include the EPA-Registered Label for termiticide products.
- B. Qualification Data: For qualified Installer.
- C. Product Certificates: For termite control products, from manufacturer.
- 1.4 QUALITY ASSURANCE
- A. Installer Qualifications: A specialist who is licensed according to regulations of authorities having jurisdiction to apply termite control treatment and products in jurisdiction where Project is located.
- B. Regulatory Requirements: Formulate and apply termiticides and termiticide devices according to the EPA-Registered Label.
- C. Source Limitations: Obtain termite control products from single source from single manufacturer.
- 1.5 PROJECT CONDITIONS
- A. Environmental Limitations: To ensure penetration, do not treat soil that is water saturated or frozen. Do not treat soil while precipitation is occurring. Comply with requirements of the EPA-Registered Label and requirements of authorities having jurisdiction.
- B. Coordinate soil treatment application with excavating, filling, grading, and concreting operations. Treat soil under footings, grade beams, and ground-supported slabs before construction.
- 1.6 WARRANTY
- A. Soil Treatment Special Warranty: Manufacturer's standard form, signed by Applicator and Contractor, certifying that termite control work, consisting of applied soil termiticide treatment, will prevent infestation of subterranean termites. If subterranean termite activity or damage is discovered during warranty period, re-treat soil and repair or replace damage caused by termite infestation.
1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

- 2.1 SOIL TREATMENT
- A. Termiticide: Provide an EPA-Registered termiticide, complying with requirements of authorities having jurisdiction, in an aqueous solution formulated to prevent termite infestation. Provide quantity required for application at the label volume and rate for the maximum termiticide concentration allowed for each specific use, according to product's EPA-Registered Label.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. BASF Corporation, Agricultural Products; Termidor.
 - b. Bayer Environmental Science; Premise 75.
 - c. FMC Corporation, Agricultural Products Group; Dragnet FT Prevail.
 2. Service Life of Treatment: Soil treatment termiticide that is effective for not less than five years against infestation of subterranean termites.

PART 3 - EXECUTION**3.1 EXAMINATION**

- A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements for moisture content of soil per termiticide label requirements, interfaces with earthwork, slab and foundation work, landscaping, utility installation, and other conditions affecting performance of termite control.
- B. Proceed with application only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. General: Comply with the most stringent requirements of authorities having jurisdiction and with manufacturer's written instructions for preparation before beginning application of termite control treatment. Remove all extraneous sources of wood cellulose and other edible materials such as wood debris, tree stumps and roots, stakes, formwork, and construction waste wood from soil within and around foundations.
- B. Soil Treatment Preparation: Remove foreign matter and impermeable soil materials that could decrease treatment effectiveness on areas to be treated. Loosen, rake, and level soil to be treated except previously compacted areas under slabs and footings. Termiticides may be applied before placing compacted fill under slabs if recommended in writing by termiticide manufacturer.
 - 1. Fit filling hose connected to water source at the site with a backflow preventer, complying with requirements of authorities having jurisdiction.

3.3 APPLICATION, GENERAL

- A. General: Comply with the most stringent requirements of authorities having jurisdiction and with manufacturer's EPA-Registered Label for products.

3.4 APPLYING SOIL TREATMENT

- A. Application: Mix soil treatment termiticide solution to a uniform consistency. Provide quantity required for application at the label volume and rate for the maximum specified concentration of termiticide, according to manufacturer's EPA-Registered Label, to the following so that a continuous horizontal and vertical termiticidal barrier or treated zone is established around and under building construction. Distribute treatment evenly.
 - 1. Slabs-on-Grade and Basement Slabs: Under ground-supported slab construction, including footings, building slabs, and attached slabs as an overall treatment. Treat soil materials before concrete footings and slabs are placed.
- B. Avoid disturbance of treated soil after application. Keep off treated areas until completely dry.
- C. Protect termiticide solution, dispersed in treated soils and fills, from being diluted until ground-supported slabs are installed. Use waterproof barrier according to EPA-Registered Label instructions.
- D. Post warning signs in areas of application.
- E. Reapply soil treatment solution to areas disturbed by subsequent excavation, grading, landscaping, or other construction activities following application.

END OF SECTION

SECTION 31 3200
SOIL STABILIZATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Lime stabilization of subgrade beneath site paving.

1.2 COORDINATION

- A. Coordinate sub-grade preparation with earthwork trades.

1.3 INSPECTION, TESTING AND CONTROL

- A. Inspection, testing and control: Conducted by an independent testing laboratory as specified in Section 01 4000.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Lime Slurry Injection Material Under Building Slabs-on-Grade:

1. Lime: Hydrated lime or lime slurry conforming to requirements of local paving authority.
2. Fluid to consist of clean fresh water and surfactant.
3. Provide a nonionic surfactant (wetting agent) according to manufacturer's recommendations, but in no case shall proportions be less than one gallon (undiluted) per 3,500 gallons of water.

- B. Lime Stabilization for Paving Subgrade:

1. Hydrated Lime: Type A (dry): Per. TxDOT Item 264-2 or approved equal.
2. Dry Waste Lime: Equivalent amount to obtain, by laboratory tests, plasticity index equal to that specified and obtained for use of hydrated lime, Type A, lime stabilized subgrade.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Ensure that surfaces have been brought to approximate rough grades plus or minus 0.10 feet. Loosen and pulverize soil to a depth of 6 inches below bottom of designated paving or slab areas, including a distance of one foot outside perimeter of paving.

3.2 STABILIZATION OF PAVING SUBGRADE

- A. Lime Stabilization:

1. Prepare rough grade, treat top 6 inches of subgrade by mixing with hydrated lime equal to 6 percent lime or as otherwise required to achieve a soils Plasticity Index of not greater than 12.

2. Construction methods and equipment shall comply to TxDOT Item 260 for Type A treatment.
3. Extend lime stabilization 18 inches beyond exposed pavement edges to reduce shrinkage effects during extended dry periods.
4. Compact subgrade a minimum 95 percent of ASTM D 698 at or within 2 percent of optimum moisture content or as otherwise recommended in soils investigation report.

END OF SECTION

SECTION 31 6900

SPREAD AND CONTINUOUS FOOTINGS

PART 1 GENERAL

1.1 QUALITY ASSURANCE

A. Installation Tolerances:

1. Maximum lateral variation off of centerlines: 2 inches.
2. Plan Dimensions: Plus 3 inches, minus 1/2 inch.
3. Thickness: Not smaller than scheduled sizes.
4. Top of Footing Elevation: Plus 0 inches, minus 3 inches.

1.2 SCHEDULING/SEQUENCING

- A. Coordinate Work of this Section with work of other Sections as required to properly execute the Work and as necessary to maintain satisfactory progress of the work of other Sections.
- B. Schedule footing excavations such that reinforcing and concrete can be placed immediately after excavations are completed and inspected.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Formwork: Refer to Section 03 1000.
- B. Reinforcement: Refer to Section 03 2000.
- C. Concrete: Refer to Section 03 3000.

PART 3 EXECUTION

3.1 EXCAVATION

- A. Spread and continuous footings: Extend to and penetrate bearing materials shown on Drawings.
- B. Exposed subgrade soils: Examined in the field by a geotechnical engineer of the testing laboratory to verify the strength and bearing capacity.
- C. Excavations and footings:
 1. Size and shape as shown on the Drawings.
 2. Bottom of each excavation: Level, undisturbed, free of water, caving material or any other foreign substance.

3.2 FABRICATION AND PLACING OF REINFORCING

- A. Steel reinforcing mats: Fabricated in rigid fashion to permit expeditious placement into excavation with minimum time delay.

- B. Accurately place reinforcement in excavations, maintaining specified coverage. Secure to prevent displacement during concreting.

3.3 FIELD QUALITY CONTROL

- A. Testing Laboratory services: In accordance with Section 01 4000.
- B. Inspect each concrete wall and column footing excavation to determine that proper bearing stratum is obtained and utilized for bearing and that excavations are properly clean and dry before placing concrete.
- C. Furnish complete footing log showing location, elevation of top of bearing stratum, footing size and depth, condition of material, excavation properly clean and dry before placing concrete, reinforcement in compliance with Contract Documents and any and all observed irregularities, deficiencies or deviations from Contract Documents.

3.4 INSPECTION

- A. Schedule footing excavation such that the concrete can be placed immediately after inspection.

3.5 PLACING OF CONCRETE

- A. Place concrete so as to prevent segregation. Do not allow concrete to free fall over 5'-0"; provide tremie, chutes or other means of conveyance when drop exceeds this amount.
- B. Place concrete as soon as practical after the excavation has been completed.

END OF SECTION

SECTION 32 1216

ASPHALT PAVING

PART 1 - GENERAL

1.1 DESIGN REQUIREMENTS

- A. Comply with applicable provisions for design, materials, fabrication, and installation (construction) of component parts in addition to requirements shown or specified herein.
- B. Install pavement thicknesses, quantities, and locations of heavy duty and light duty asphalt pavements as recommended by the soils investigation report and as shown on the plan sheets.

1.2 REGULATORY REQUIREMENTS

- A. Conform to all local standards and applicable codes and requirements for paving work on public and private property during the execution of this work.
- B. Manufacture Hot Mix Asphalt (HMA) shall be manufactured from a state approved / certified HMA manufacturing facility.

1.3 TESTS REQUIRED of GENERAL CONTRACTOR

- A. Test materials during production to validate and / or control the mix supplied and shall be included in the bid cost for providing these HMA items.
- B. Submit Recent Quality Control testing of the mixture proposed to be used on the project to the Owner prior to acceptance of the proposed mix design.

1.4 ENVIRONMENTAL REQUIREMENTS

- A. Place HMA in acceptable weather conditions; avoid inclement weather.
- B. Adhere to local requirements for temperature constraints however in no case shall the base asphalt be placed when the temperature is below 40° and the surface asphalt when the temperature is below 45°. Additionally, the forecast shall be for rising temperatures for both efforts.

1.5 SUBMITTALS

- A. Approved vendor certificate for the state where work is being done.
- B. Provide Quality Control manual for material production over-site and testing measures being performed both at the asphalt plant as well as on the job site.
- C. List / Organizational Chart showing personnel responsible for use of equipment and actions of the crew on the grade while paving and compacting asphalt.

Mix Design Submittal Checklist

Project: _____

Date: _____

Supplier: _____

Mix Design: _____ Surface / Leveling / Base

Included	Missing	N/A	Required Information
			Contractor to select mix design method: (design shall be less than 24 months old)
			50 Blow Marshall
			50-Gyraton Superpave
			Hveem, Low Volume
			Other, Engineers Approval Req'd Before Bidding
			Proper Authorizing Signature for Mix Design
			All Aggregate Types, Gradations & % Crush
			FAA >= 40%
			Plot (0.45 Power Graph) of Final Aggregate Blend
			Bulk Specific Gravity of All Aggregates and Final Blend (Gsb), Include All Worksheets
			Optimum Binder Content (Pb)
			Mix Voids at Optimum (Va)
			VMA at Optimum
			Bulk Specific Gravity of Mix at Optimum (Gmb)
			Theoretical Maximum Specific Gravity at Optimum (Gmm)
			Dust to Total AC Ratio
			All Design Data and Associated Design Curves
			Recent Quality Control Production Charts
			Other Information per Specifications

1.6 DEFINITIONS

- A. Surface Course – The surface / wearing course shall be installed uniformly, to all finished lines and grades, smooth, durable, skid-resistant, impervious thus protecting lower layers, and stable. Workmanship of the finished surface course shall be of the highest industry standards possible prior to acceptance by the Owner. The surface course shall be built with a maximum aggregate particle size of between ½” and ¾”. Surface course shall be a nominal 1-½” compacted thickness with no thickness less than 2-times the maximum aggregate particle size (MAS).
- B. Leveling Course – The course and location of the parking area that requires placement of a variable thickness of HMA to ‘true up’ the lot prior to placement of the surface course. This course has an ‘MAS’ no greater than that of the surface course.
- C. Base Course – The lower courses of the pavement structure below the surface and leveling course with an ‘MAS’ of between ¾” and 1”.
- D. Tacking / Priming – The process of applying one coat of emulsified asphalt to all horizontal and vertical surfaces of either an existing pavement for an overlay or between lifts while building an improved or new structure (tacking), or upon the aggregate base (priming).

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Tack Coat and Prime Coat: AASHTO M140 or M208 (Reference the Asphalt Institute MS-19 for Handling, Storage and Application criteria).
 - 1. Prime Coat: Prime Coat materials of MS-2, CMS-2, or HFMS-2s.
 - 2. Tack Coat: SS-1, SS-1h, CSS-1 or CSS-1h diluted with an equal amount of water, or agency acceptable product.
- B. Performance Graded binder shall meet typical agency specification for low to medium volume roadways.
- C. Aggregates, mineral filler, and asphalt binder shall meet or exceed the requirements of local specifications for asphalt pavements placed under this contract for qualities and types.
- D. The coarse aggregate shall be sound, angular crushed stone, crushed gravel, or crushed slag as allowed by the local state agency. Coarse Aggregate fraction shall have a minimum of 75% crushed faces.
- E. The fine aggregate shall be well graded, moderately sharp to sharp sands that will prevent tender mixes and scuffing from occurring. Fine Aggregate Angularity (AASHTO T-304, Method A), shall be $\geq 40\%$.
- F. Base mixes shall have a minimum of 45% passing the #4 sieve.
- G. Surface and leveling mixes shall have a minimum of 45% passing the #8 sieve.
- H. Mix Designs shall include a breakdown factor, increase to minus #200, introduced during the design stage to mimic production values.
- M. VMA is based on the aggregate bulk (dry) specific gravity, G_{sb} , as determined by AASHTO T-84 & T-85.

- N. RAP may be used up to 20% in the HMA Binder and Surface Courses without approval by the engineer; mixes greater than 20% require engineer's approval. Use a softer grade of PG Binder per local requirements when using RAP.

2.2 HOT MIX ASPHALT (HMA)

- A. All HMA mix designs shall be performed in accordance with the Asphalt Institute MS-2 and SP-2, current edition. The HMA mix designs developed shall meet the requirements of one of the following for compactive effort:
1. Marshall, 50-Blow,
 2. Superpave, 50-Gyrations, or
 3. Hveem, Low Volume Mix.
 4. Alternate design with the Engineers approval prior to time of bidding.
- B. HMA Mix Designs shall be performed by qualified personnel with proven past experience and successes in the mix design and quality control of asphalt production. Resumes of the signing 'individual-in-charge' may be required by the Owner and shall be supplied if requested. The design shall meet the following requirements and be less than 24- months old. However, the mix design method used shall be the Contractors option, as stated previously, based on various methods which currently exist around the nation. A completed design shall require submittal of documentation as detailed, requested by the Owner in order for the producer to demonstrate knowledge of design and production criterion.
- C. Bidding documents shall include the Contractors proposed Asphalt Mixture Design sheets. Ref. Mix Design Submittal Checklist sheet at the end of this document. Designs will be for HMA to be placed for each of the uses anticipated on each project; patching, base, leveling, and / or surface course. Different asphalt suppliers shall require different design submittals.
- D. All submitted HMA mix designs shall contain at a minimum the following information:
1. All Aggregate Gradations
 2. Plot (0.45 power graph) of Final Aggregate Blend
 3. Bulk Specific Gravity of All Aggregates and Final Blend (Gsb) including Work sheets for natural as well as reclaimed asphalt pavement (RAP).
 4. Optimum % Asphalt Binder (Pb)
 5. Mix Air Voids at Optimum (Va)
 6. Bulk Specific Gravity of Mix at Optimum (Gmb)
 7. Theoretical Maximum Specific Gravity at Optimum (Gmm)
 8. Voids in the Mineral Aggregate (VMA) and Voids Filled with Asphalt (VFA)
 9. Dust to total AC Ratio
 10. All Design Data and associated Design Curves
- E. Mix Design Method Requirements Table:

Measures	Superpave	Marshall	Hveem
Stability, lbs.	n/a	1,200 min.	30 min.
Flow, 0.01 in.	n/a	8 to 16	n/a
Swell, in.	n/a	n/a	0.030 max.
Air Voids @ optimum AC	3.5%	3.5%	3.5%

VMA (base mix)	13.0 min.	13.0 min.	13.0 min.
VMA (surface mix)	14.5 min.	14.5 min.	14.5 min.
VFA	70 to 80	70 to 80	70 to 80
Dust to total AC (design)	0.6 to 1.0	0.6 to 1.0	0.6 to 1.0
Dust to total AC (production)	0.8 to 1.2	0.8 to 1.2	0.8 to 1.2

PART 3 - EXECUTION

3.1 INSPECTION

- A. Verify compacted sub-grade or granular base is dry and ready to support paving equipment and imposed loads. Proof roll to check for unstable areas and remove and replace loose material.
- B. Verify gradients and elevations of base are correct.

3.2 PREPARATION

- A. Repair pavement failures and perform crack repair according to their respective specification requirements prior to installation of any HMA surface course.
- B. Cold-milling and/or grinding may be necessary to ensure that the asphalt edges at concrete abutments such as approaches, sidewalks, curbing, and drainage basins have smooth transitions.
- C. After site review, detail whether wedge milling is necessary to assure positive drainage and transition. Install leveling course, if required, on the project per the site details and quantities shown on the plan sheets.
- D. Existing surfaces to receive HMA must be clean prior to the installation of any portion of the work. Clean the surface on which the asphalt concrete is to be placed, and keep it free of accumulations of materials that would, in the judgment of the Owner, contaminate the mixture, prevent bonding, or interfere with spreading operations. Methods used may include but not be limited to the use of a sweeper that can wet and vacuum the area free of dirt and debris, clay, and dust, or any other foreign material.
- E. Any oil or grease spots shall be scraped and treated to prevent bleeding through the tack coat. Bad oil spills may require removal with a wire brush or other suitable tool. Maintain clean pavements prior to applying emulsified tack coat. When approved sub-grade or pavement courses previously constructed under the Contract become loosened, rutted, or otherwise defective, the Contractor must correct the deficiency according to the contract item or items involved before the spreading of a subsequent pavement course.
- F. If shown on the plans, apply prime coat at the diluted rate of 0.30 gal / sy over newly placed aggregate base course prior to the installation of the base asphalt. Blotter sand may be used if the prime is applied at too heavy of an application rate to dry up the excess prime coat material.
- G. Tack / Prime Coat Distributor Truck must have an insulated tank, heating system and a distributor capable of maintaining a uniform application of emulsified asphalt under pressure throughout the area to be paved. This requires a pump in good working order, full circulating spray bars, and free flowing nozzles. Small, isolated areas may be tacked with a wand.

- H. Install tack / prime coat during appropriate weather conditions and protect the tack / prime coat from traffic so as not to wear and track. Allow each installation of the tack / prime coat to 'break', i.e. turn from brown to black prior to installation of the HMA.

3.3 PLACING ASPHALT PAVING

- A. Placement shall not occur when weather is inclement. Adhere to local requirements for temperature constraints however in no case shall the base asphalt be placed when the temperature is below 40° and the surface asphalt when the temperature is below 45°. Additionally, the forecast shall be for rising temperatures for both efforts.
- B. Detail and submit to the Owner a paving plan on the site plan sheet prior to placement of asphalt.
- C. Apply tack coat at the diluted rate of 0.05 gal / sy over newly constructed asphalt leveling or base mixes, 0.10 gal / sy over existing asphalt pavements and 0.15 gal / sy over milled surfaces. The higher rate shall be used on dry and brittle surfaces. All vertical edges abutting proposed asphalt surfaces shall receive a tack coat. Excessive asphalt applications, drooling, or pooling shall be swept with a broom to ensure proper bonding of the HMA. Immediately install the HMA after the asphalt emulsion has 'broken'.
- D. Trucks shall have smooth, clean and tight metal beds that do not have mixture sticking to the truck bed and from which the entire quantity of HMA can be discharged smoothly into the spreading equipment. Trucks shall have a tarp and insulation as needed to protect the asphalt mixture from wind, rain and cold temperatures. Trucks for hauling asphalt mixture shall be in good, safe working condition.
- E. Surface course longitudinal joints shall run with the traffic pattern. Therefore, pulling across the driving lanes shall not be allowed unless express permission is given by the Owner.
- F. The entire parking lot surface course shall be paved on the same day. The timing and process should be discussed with and approved by the Owner before proceeding with the work.
- G. Paving Equipment must be capable of placing, spreading and finishing courses of HMA to the specified thicknesses. HMA shall be free of marks, segregation and be placed to the required uniform elevation with a smooth texture not showing tearing, shoving, or gouging. Auger extensions are required if segregation occurs while pavers are extended beyond the basic screed width. Paving Equipment shall be LeeBoy or ProPaver type or the equivalent. Hand work shall be minimized to ensure the best possible finished surface.
- H. Place Hot Mix Asphalt at a minimum temperature of 250 degrees F.
- I. Rolling shall start as soon as the HMA can be compacted without displacement. Rolling shall continue until the HMA is thoroughly compacted and all roller marks have disappeared. Compact the HMA to a minimum in-place density of 92.0% of the Theoretical Maximum Specific Gravity, G_{mm} .
- J. Rollers shall conform to the manufacturer's specifications for all ballasting. At least one vibratory roller shall be required for each project. Rollers shall be of good condition and capable of compacting the HMA to the minimum in-place density required by this specification.

- K. For asphalt repairs work at an existing site, Work in such a manner as to not unduly limit parking or access to the site by customers or employees. Maintain access to at least 50% of usable parking spaces during paving.

3.4 CONSTRUCTION JOINTS

- A. Minimize construction, longitudinal and transverse joints left open for an extended period of time.
- B. Construct parking swale longitudinal joint by paving in a hot fashion with a temperature of not less than 180°F to ensure maximum performance.
- C. Compact all joints to provide for a neat, uniform and tightly bonded joint that will meet both surface tolerances and density requirements.
- D. Cut true construction or transverse joints if the material has cooled to less than 180°F prior to the placement of the next pass to ensure the best performing joint possible.

3.5 TOLERANCES

- A. Smoothness shall meet the requirements of no greater than 1/4" in 10 ft. for base and leveling courses and 3/16" in 10 ft. for surface course.
- B. Thickness of the overall mat shall be within 1/4" of the specified compacted plan thickness at all locations. The average thickness shall meet the plan thickness shown. The yield for the day and for the entire site shall meet calculated theoretical based on 92% of G_{mm} supplied from the Contractors mix design and daily test values. This item shall be calculated by the Contractor and supplied to YUM as final parking lot documentation prior to final payment.
- C. Deficient areas shall be defined, removed and replaced, or adjusted to the Design thickness, by methods approved by the Owner's Representative.
- D. Completed HMA placement must be laid in order to allow positive drainage away from buildings and towards drainage outlets. Any ponding of water is not acceptable and shall require replacement at the Contractor's expense. Flood the lot as directed by the Owner to determine positive drainage acceptability.

3.6 FIELD QUALITY CONTROL

- A. Hot Mix Asphalt (HMA) shall be manufactured from a state approved / certified HMA manufacturing facility. Work consists of one or more courses of HMA constructed on a prepared foundation. The asphalt concrete consists of a mixture of uniformly graded aggregate and specified type and grade of asphalt binder. The manufacturing facility shall be capable of producing HMA in accordance with the following requirements and all applicable local agency specifications on an ongoing and consistent basis.
- B. Ensuring uniform material is produced and selecting the vendor for these asphalt projects will require timely submittal of documents and qualifications to the satisfaction of the Owner. Contractor / material supplier shall demonstrate the existence of the following documents:
 - 1. Approved vendor certificate for the state where work is being done.
 - 2. Quality Control manual for material production over-site and testing measures being performed both at the asphalt plant as well as on the job site.

3. List / Organizational Chart showing personnel responsible for use of equipment and actions of the crew on the grade while paving and compacting asphalt.
- C. Calibrated equipment and qualified personnel must be accessible at all times during the construction of this HMA. The Contractor shall provide the necessary equipment, materials, and labor to complete the job acceptable to the Owner. Variations in the size and amount of equipment will depend on the size of the area being paved.
- D. It is imperative that all documents list a 'Person-in-Charge' who is responsible for the oversight of the previously listed activities. This individual will be the point of contact for the Owner and they shall work with the Owner to ensure timely project completion and specification compliance. This individual shall be knowledgeable in all aspects of asphalt design, production, and installation and shall be an employee of the company holding the contract with the Owner, even if the HMA is being produced and supplied by a separate vendor.
- E. Daily maximum theoretical specific gravity values must be made available to the Contractors density technician for verifying in-place density within four hours of start of production.
- F. Asphalt content, gradation, and bulk specific gravity (G_{mb}) testing shall be done a minimum of once every 400 tons of HMA supplied or every third day for low tonnages that when added together successively do not equal 400 tons.
- G. Acceptable average measures are made by use of a correlated nuclear density gauge, Pavement Quality Indicator or PaveTracker (non-nuclear) or by cutting (4) cores per lift, per day and testing per AASHTO T-166, Method C. Additional testing shall be performed on any given day once 400 tons of asphalt is placed.
- H. Any average in-place density measure for surface course mixtures that is less than required for the day will result in a reduction in HMA pay equal to the following chart. After reaching the 30% reduction mark the pavement shall be removed and replaced by the Contractor or left in place with no compensation due the Contractor. Base and leveling installation of asphalt shall meet local DOT specifications for in-place density measures. Surface course longitudinal joints shall be measured 6" from the joint, centered upon core or density gauge, and shall meet the mat density requirements minus 2.0% at a minimum. Base and leveling course longitudinal joint density measures shall achieve between 95% - 102% of maximum achievable individually, with an average of 98% on any given day.

In-Place Density Pay Schedule, Surface Course Mat Density

Pay Factors, % (percent)	In-Place Density, % Maximum Theoretical Specific Gravity, G_{mm}
100	> 92.0%
100 – 0.5 for each 0.1% below 92.0%	91.0% to 92.0%
95 – 1.0 for each 0.1% below 91.0%	90.0% to 91.0%
85 – 1.5 for each 0.1% below 90.0%	89.0% to 90.0%

- I. Process Control testing shall be in accordance with state standards for frequency and methods where the work being performed is done with a minimum of testing meeting the above QC requirements.
- J. Protect the HMA until such time that traffic can be placed upon the properly compacted asphalt and show no signs of deformation.

- K. If excessive segregation is occurring during placement operations, the Contractor will investigate the cause(s) and make appropriate changes to the satisfaction of the Owner.

3.7 WORK TIMELINES

- A. HMA Full-depth pavements: After placing base asphalt and immediately prior to placing the surface asphalt inspect the entire pavement for low spots, damaged areas, segregated materials, and testing measures taken. Remove and replace any and all deficient sections to meet these specification requirements prior to continuing with work. These efforts shall not delay the overall progress of construction nor delay the opening of the facility.
- B. Overlays (a/k/a Resurfacing): The pavement repairs, overlay, and striping shall be accomplished in such a manner as not to unduly limit parking or access to the site by customers or employees.
 - 1. There shall never be less than 50% of the usable parking spaces available unless work is performed during off hours or when completion of work is possible prior to hours of operation.
 - 2. Every attempt should be made to complete the surface course placement process in one continuous placement with no cold joints.
 - 3. The timing and process should be discussed with the Owner before proceeding with the work.

3.8 SITE SPECIFIC IDENTIFICATION

- A. Remove and store bumper blocks and other lot accessories during operations, reinstall after work is completed, and replace any and all broken bumper blocks.
- B. Remove all waste materials from the site and dispose of according to local ordinances.
- C. Complete all work in compliance with ADA requirements.
- D. Notify Owner and Store Manager when store traffic can return to lot.
- E. Supply Owner with Notarized Certificate of Compliance and total (tons, cu. yds., number) used for all products supplied to the project for each pay item.
- F. Supply Owner with yield calculations for all products used on the project. (Example: placement of 1,300 sq. yds. of Hot Mix Asphalt, 1-3/4" compacted thickness will require 128 tons when the unit weight = 150 pcf.)

References:

Asphalt Institute, Lexington, KY

National Asphalt Pavement Association, Lanham, MD

END OF SECTION

SECTION 32 1313
CONCRETE PAVING

PART 1 - GENERAL

1.1 QUALITY ASSURANCE

- A. Perform work in accordance with ACI 301.
- B. Obtain materials from same source throughout.

1.2 REGULATORY REQUIREMENTS

- A. Conform to applicable code for paving work on public property.

1.3 TESTS

- A. Testing and analysis performed under provisions of Section 01 4000.
- B. Testing firm will take cylinders and perform slump and air entrainment tests in accordance with ACI 301.
- C. Four concrete test cylinders will be taken for every 50 or less cubic yards of each class of concrete placed each day.
- D. One slump test will be taken for each set of test cylinders taken.

1.4 ENVIRONMENTAL REQUIREMENTS

- A. Do not place pavement when base surface or ambient temperature is less than 40 degrees F, or if base surface is wet or frozen.

PART 2 - PRODUCTS

2.1 CONCRETE MATERIALS

- A. Cement: ASTM C 150, Air Entraining-Type IA, Portland Cement, gray color.
- B. Fine and Coarse Aggregates: ASTM C 33.
- C. Water: Clean and not detrimental to concrete.

2.2 FORM MATERIALS

- A. Conform to ACI 301. If using metal, use material free of deformities. If using wood, use construction grade lumber, sound and free of warp, minimum 2 inch nominal thickness, except where short radii of curves require thinner forms.
- B. Contraction Joint Devices: Galvanized sheet metal, keyed profile, with knock-outs for reinforcing and dowel steel.

2.3 REINFORCEMENT

- A. Reinforcing Steel: ASTM A 615; 60 ksi yield grade; deformed billet steel bars, uncoated finish.
- B. Welded Steel Wire Fabric: Plain type, ANSI/ASTM A 185; in flat sheets; uncoated finish.
- C. Tie Wire: Annealed steel, minimum 16 gage size.
- D. Dowels: ASTM A 615; 40 ksi yield grade, plain steel, uncoated finish.
- E. Miscellaneous Reinforcing Accessories: Spacers, chairs, ties, and other devices necessary for properly placing, spacing, supporting, and fastening reinforcement in place.

2.4 ACCESSORIES

- A. Form Release Agent: Non-staining, paraffin-based oil.

2.5 JOINT FILLERS

- A. Wood: Construction grade, preservative treated yellow pine, sound and free of checks, splits or other defects, 3/4 inch thick.
- B. Backer Rod: As specified in Section 07 9200.
- C. Sealants: Two or three part polyurethane sealants, of grade as required to suit application, meeting ASTM C 920, in manufacturer's custom colors, and as follows: Refer to Section 07 9200 for traffic-bearing urethane sealant, Type U-TB.

2.6 ADMIXTURES

- A. Acceptable Manufacturers: Subject to compliance with requirements indicated, provide products of one of the following:
 - 1. W. R. Grace & Co.
 - 2. Euclid Chemical Company.
 - 3. Sika Corporation.
 - 4. Master Builders, Inc.
- B. Air Entrainment: ASTM C 260.
- C. Chemical Admixture: ASTM C 494, Type A - cement dispersing and water reducing. Use Type D - water reducing and retarding, or Type E - water reducing and accelerating as determined by climatic conditions and as approved by testing laboratory.

2.7 CONCRETE MIX

- A. Mix and deliver concrete in accordance with ASTM C 94, Alternate 2.
- B. Use accelerating admixtures in cold weather only when approved by testing laboratory. Use of admixtures will not relax cold weather placement requirements.
- C. Use set-retarding admixtures during hot weather only when approved by testing laboratory.

- D. Add air entraining agent to concrete mix for concrete work exposed to exterior, in amounts of 4 to 7 percent of total concrete volume or as otherwise recommended by testing laboratory.
- E. Maintain water-cement ratio to produce a minimum of 3 to maximum of 5 inch slump.
- F. Use of calcium chloride and fly ash are strictly prohibited.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Verify compacted subgrade or stabilized soil is ready to support paving and imposed loads, free of frost, smooth and properly compacted.
- B. Verify gradients and elevations of base are correct, and proper drainage has been provided so that water does not stand in the area to receive paving.

3.2 FORMING

- A. Construct and remove forms in accordance with ACI 347.
- B. Place and secure forms to correct location, dimension, and profile. Adequately brace to withstand loads applied during concrete placement.
- C. Assemble formwork to permit easy stripping and dismantling without damaging concrete.
- D. Place joint fillers vertical in position, in straight lines. Secure to formwork during concrete placement.

3.3 INSERTS AND ACCESSORIES

- A. Make provisions for installation of inserts, accessories, anchors, and sleeves.

3.4 REINFORCEMENT

- A. Accurately place reinforcement in middle of slabs-on-grade.
- B. Interrupt every other bar of reinforcement at control and expansion joints.
- C. Place reinforcement to achieve slab and curb alignment as detailed.
- D. Steel: Free of rust, mill scale, dirt and oil.
- E. Provide doweled joints at interruptions of concrete with one end of dowel set in capped sleeve to allow longitudinal movement. Provide support at both ends of dowels.
- F. Support reinforcing on bar chairs. Securely saddle tie at intersections. Rigidly secure in place to minimize displacement during concrete pour.

3.5 JOINTS

- A. Intentional stoppage of concrete placing allowed only at planned location of either an expansion joint or contraction joint.

- B. When stoppage occurs at an expansion joint, install joint assembly with a bulkhead of sufficient section drilled to accommodate required dowels. Provide expansion joints at maximum 40'-0" on center each way in parking lots, 40'-0" on center for curbs and maximum 20'-0" on center each way at pedestrian paving.
- C. When stoppage occurs at a contraction joint, install sheet metal joint assembly of sufficient section to prevent deflection, shaped to concrete section. Drill bulkhead to permit continuation of longitudinal reinforcing steel through construction joint.
- D. Stoppage at Unintentional Location
 - 1. Immediately upon unintended stoppage of concrete placing, place available concrete to a line and install bulkhead perpendicular to surface of pavement and at required elevation. Place and finish concrete to this bulkhead. Remove and dispose of concrete remaining on subgrade ahead of bulkhead.
 - 2. When placing of concrete is resumed before concrete has set to extent that concrete will stand on removal of bulkhead, rod new concrete with the first; otherwise, carefully preserve joint face.
 - 3. Provide a joint seal space at edges created by a construction joint of this type, as detailed on Drawings.
- E. Provide sawed contraction joints in vehicular paving and curbs spaced as detailed on Drawings, but in no case greater than 20 foot on center spacing.
 - 1. Saw joints after completion of finishing operations as soon as concrete has hardened to extent necessary to prevent revealing of joint or damage to adjacent concrete surfaces.
 - 2. Saw joints same day that concrete is placed except that sawing of joints in concrete placed late in day may be delayed until morning of following day.
 - 3. In any event, saw joints within 18 hours after placing concrete.
 - 4. Use a power-driven concrete saw made especially for sawing concrete and maintain in good operating condition.
 - 5. Saw Blades: Make a clean, smooth cut, producing a groove 1/8 inch to 3/16 inch wide and a depth equal to 1/4 of slab thickness, minimum 1 inch depth.
 - 6. Align joints in vehicular paving with joints in adjacent pedestrian paving.
 - 7. Cut joints through curbs at right angles to back of curb.
- F. Place joint filler between paving components and building or other appurtenances. Recess top of filler 1 inch for backing rod and sealant placement. Install sealant over backing rod in accordance with Section 07920 and manufacturer's recommendations.
- G. Provide 3/4 inch deep scored joints in sidewalks and plazas at intervals as indicated, but in no case spaced greater than width of walk.

3.6 PLACING CONCRETE

- A. Hot Weather Placement: ACI 305.
- B. Cold Weather Placement: ACI 306.
- C. Ensure reinforcement, inserts, embedded parts, and formed joints are not disturbed during concrete placement.
- D. Place concrete continuously between predetermined construction joints. Do not break or interrupt successive pours such that cold joints occur.

3.7 FINISHING AND CURING

- A. After consolidating and screeding, float concrete to gradients indicated. Use a straight edge to level and test surface in longitudinal direction to required grade. Finish edges to provide a smooth dense surface with 1/8 inch radius.
- B. Immediately after placement, protect concrete under provisions of Section 01500 from premature drying, excessive hot or cold temperatures, and mechanical injury.
- C. Place curing compound on exposed concrete surfaces immediately after finishing. Apply in accordance with manufacturer's instructions.
- D. Finishes:
 - 1. Vehicular Paving: Heavy broom.
 - 2. Sidewalk Paving: Light broom, radiused and trowel joint edges.
 - 3. Curbs and Gutters: Light broom.
 - 4. Inclined Pedestrian Ramps: Broom perpendicular to slope.
 - 5. Curb Ramps for the Disabled:
 - a. Stamped during final finishing to create raised truncated domes with a diameter of nominal 0.9 inches, a height of nominal 0.2 inches and a center-to-center spacing of nominal 2.35 inches, with a visual contrast to adjoining surfaces.

3.8 FIELD QUALITY CONTROL

- A. Field inspection and testing performed under provisions of Section 01450.
- B. Maintain records of placed concrete items. Record date, location of pour, quantity, air temperature, and test samples taken.

3.9 SCHEDULES (unless noted otherwise recommended by soils investigation report or if otherwise indicated on civil drawings, provide the following minimum strengths and thicknesses)

- A. Concrete Sidewalks: 3,000 psi 28 day concrete compression strength, 4 inches thick, 3 inch minimum and 5 inch maximum slump.
- B. Parking Area Pavement and Curbs: 3,000 psi 28 day concrete compressive strength, 5 inches thick, 3 inch minimum and 5 inch maximum slump.
- C. Fire Lane and Frequent Truck Traffic Pavement and Curbs: 4,000 psi 28 day concrete compressive strength, 6 inches thick, 3 inch minimum and 5 inch maximum slump.

END OF SECTION

SECTION 321714
PRECAST CONCRETE SITE ACCESSORIES

PART 1 - GENERAL

- 1.1 SUMMARY
- A. Section Includes: Providing precast concrete wheel stops where shown on the Drawings and as specified.
- 1.2 QUALITY ASSURANCE
- A. Reference Standards:
1. ASTM A 615 - Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
 2. ASTM C 94 - Ready-Mixed Concrete.

PART 2 - PRODUCTS

- 2.1 PRECAST CONCRETE WHEEL STOPS
- A. Qualities: Precast concrete wheel stops, with chamfered corners, drainage slots on underside, reinforced, and having 2 pre-drilled pin holes having 2 cast-in anchor pins.
1. Concrete: Normal weight concrete, minimum 5000 psi 28 day compressive strength.
 2. Reinforcing: ASTM A 615, Grade 40, two continuous No. 3 deformed reinforcement bars.
 3. Size: As indicated on Drawings.
- B. Anchor Pins: 5/8 in. deformed bar, 2 for each wheel stop, extending a minimum of 6 inches below bottom of wheel stop.
- 2.2 PRECAST CONCRETE SPLASH BLOCKS
- A. Precast concrete, reinforced with manufacturer's standard mesh or deformed bars.
- B. Concrete: Normal weight, minimum 4000 psi 28 day compressive strength.
- C. Size: As indicated on Drawings.
- 2.3 FABRICATION
- A. Use rigid molds, constructed to maintain precast units uniform in shape, size and finish. Maintain consistent quality during fabrication.
- B. Embed reinforcing steel, and drill or sleeve for two dowels.
- C. Cure units to develop concrete quality, and to minimize appearance blemishes such as non-uniformity, staining, or surface cracking.
- D. Minor patching in plant is acceptable, providing appearance of units is not impaired.

PART 3 - EXECUTION

- 3.1 PREPARATION
- A. Verify layout of wheel stop locations with pavement marking layout.
- B. Verify that paving and pavement marking is completed and ready for installation of wheel stops.
- C. Thoroughly clean surfaces to receive wheel stops free of dirt, sand, oil, grease or other foreign matter.
- 3.2 INSTALLATION – WHEEL STOPS
- A. Install a precast wheel stop at each parking space indicated.
- B. Install wheel stops with anchors in accordance with manufacturer's instructions.
- C. Recess head of dowel slightly beneath top surface of wheel stop.
- D. Leave wheel stops securely anchored and in proper alignment
- 3.3 INSTALLATION - SPLASH BLOCKS
- A. Place blocks and pads on smooth, even topsoil. Place level and solidly supported.

END OF SECTION

SECTION 321723**PAVEMENT MARKINGS****PART 1 - GENERAL**

- 1.1 RELATED DOCUMENTS
- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- 1.2 SUMMARY
- A. Section includes the following:
1. Preparation and application of painted parking lot pavement markings.
 2. Preparation and application of paint on asphalt paving, concrete paving, curbs, accessible ramps, and elsewhere as indicated.
- 1.3 SUBMITTALS
- A. Product Data: For each paint system specified. Include primers.
- B. Manufacturer's Information: Provide manufacturer's technical information, including label analysis and instructions for handling, storing, and applying each coating material proposed for use.
- 1.4 QUALITY ASSURANCE
- A. Applicator Qualifications: Engage an experienced applicator who has completed pavement marking applications similar in material and extent to that indicated for this Project with a record of successful in-service performance.
- B. Source Limitations: Obtain primers, and undercoat materials for each coating system from the same manufacturer as the finish coats.
- 1.5 DELIVERY, STORAGE, AND HANDLING
- A. Deliver materials to the 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 containers used in storage 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. Take necessary measures to ensure that workers and work areas are protected from fire and health hazards resulting from handling, mixing, and application.
- 1.6 PROJECT CONDITIONS
- A. Apply water-based paints only when the temperature of surfaces to be painted and surrounding air temperatures are between 50 and 90 deg F.
- B. Apply solvent-thinned paints only when the temperature of surfaces to be painted and surrounding air temperatures are between 45 and 95 deg F.
- C. Do not apply paint in snow, rain, fog, or mist; or when the 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.
- 1.7 PROJECT CONDITIONS
- A. Maintain access for vehicular and pedestrian traffic as required for other construction activities. Utilize flagmen, barricades, warning signs, and warning lights as required.

PART 2 - PRODUCTS**2.1 MANUFACTURERS**

- A. Material Compatibility: Provide undercoats and finish-coat materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
- B. Paint for Application on Concrete Paving: Non-bleeding, quick drying, alkyd-resin type, lead and chromate free traffic marking paint, suitable for use on traffic bearing surfaces.
 - 1. Acceptable Products:
 - a. Sherwin Williams set fast chlorinated rubber 8000-01927 for Yellow
 - b. Sherwin Williams set fast chlorinated rubber 8000-01877 for White
 - c. Sherwin Williams set fast chlorinated rubber [8000-____] for Black.
 - d. Sherwin Williams Primer set fast alkyd tint base mixed for blue
 - e. Sherwin Williams set fast alkyd 8000-02099 for Red.
 - 2. Substitutions: Under provisions of Section 012500.
- C. Paint for Application on Asphalt Paving: Latex, waterborne emulsion, lead and chromate free, ready mixed, complying with FS TT-P-1952, with drying time of less than 45 minutes.
 - 1. Acceptable Products:
 - a. Sherwin Williams latex 8000-02347 for Yellow
 - b. Sherwin Williams latex 8000-03238 for White
 - c. Sherwin Williams traffic grade latex base tinted to match 6401-14641 for Blue
 - d. Sherwin Williams set fast latex 6401-14666 for Red.
 - 2. Substitutions: Under provisions of Section 012500.
- D. All paints shall be mixed in accordance with manufacture's instructions before application for colors White, Yellow, Blue and Red.

PART 3 - EXECUTION**3.1 EXAMINATION**

- A. Examine the work area and correct conditions detrimental to timely and proper completion of the work. Do not proceed until unsatisfactory conditions have been corrected.
- B. Do not apply pavement-marking paint until layout, colors, and placement have been verified with Architect.

3.2 PREPARATION

- A. Sweep and clean surface to eliminate loose material and dust.
- B. Where existing pavement markings are indicated on Drawings to be removed or would interfere with adhesion of new paint, a motorized abrasive device shall be used to remove the markings. Equipment employed shall not damage existing paving or create surfaces hazardous to vehicle or pedestrian traffic. Within public rights-of-way, appropriate governing authority shall approve method of marking removal.
- C. New pavement surfaces shall be allowed to cure for a period of no fewer than 30 days before application of marking materials.

3.3 APPLICATION

- A. Apply paint with mechanical equipment to produce pavement markings, of dimensions indicated, with uniform, straight edges.
- B. Apply two coats of paint at manufacturer's recommended rate, without addition of thinner, with maximum of 100 square feet per gallon or as required to provide a minimum wet film thickness of 15 mils and dry film thickness of 7 ½ mils per coat. Paint shall be applied for a total dry film thickness of 15 mils. Apply with mechanical equipment to produce uniform straight edges. At sidewalk curbs and crosswalks, use straightedge to ensure uniform, clean, and straight stripe.
- C. Install pavement markings according to manufacturer's recommended procedures for the specified material.
- D. Following items shall be painted with colors noted below:
 - 1. Pedestrian Crosswalks: White.
 - 2. Fire Lanes: Red or per local code.
 - 3. Lane Striping where separating traffic moving in opposite directions: White.
 - 4. Lane Striping where separating traffic moving in the same direction: White.
 - 5. Accessibility Symbols: White on blue background.
 - 6. Parking Stall Striping: White, unless otherwise noted on Drawings.
 - 7. No Parking Areas: Yellow with Black Text "NO PARKING"

- A. After the paint has thoroughly dried, visually inspect the entire application and touch up as required to provide clean, straight lines and surfaces throughout.
- B. Testing of wet film thickness shall be performed a minimum of two (2) times on each parking row (including striped islands) and pedestrian cross walks, and a minimum of one (1) test on each lane/alignment striping. At least one test shall be performed after refilling paint striping machine, changing operators of striping machine, and changing paint types, brands, etc. (This shall be performed in addition to the testing stated above). These tests shall be performed on each coat applied. Testing shall be per ASTM D4414- 95 (2001).

3.5 CLEAN UP

- A. Waste materials shall be removed at the end of each workday. Upon completion of the work, all containers and debris shall be removed from the site. Paint spots upon adjacent surfaces shall be carefully removed by approved procedures that will not damage the surfaces and the entire job left clean and acceptable.

END OF SECTION

SECTION 323119
DECORATIVE METAL FENCES AND GATES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Decorative metallic-coated steel tubular picket fences.
 - 2. Swing gates.
 - 3. Horizontal-slide gates.
 - 4. Gate operators, including controls.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples: For each fence material and for each color specified.
 - 1. Provide Samples 12 inches in length for linear materials.
 - 2. Provide Samples 12 inches square for

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Fabricator of products.
- B. Welding Qualifications: Qualify procedures and personnel according to [AWS D1.1, "Structural Welding Code - Steel] [AWS D1.2, "Structural Welding Code - Aluminum]."
- 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. UL Standard: Provide gate operators that comply with UL 325.
- E. Emergency Access Requirements: Comply with requirements of authorities having jurisdiction for automatic gate operators on gates that must provide emergency access.
- F. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects.
 - 1. Include 10-foot/3-m length of fence complying with requirements.
 - 2. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

PART 2 - PRODUCTS

2.1 STEEL AND IRON

- A. Plates, Shapes, and Bars: ASTM A 36.
- B. Tubing: ASTM A 500, cold formed steel tubing.
- C. Uncoated Steel Sheet: [Hot-rolled steel sheet, ASTM A 1011, Structural Steel, Grade 45/Grade 310] [or] [cold-rolled steel sheet, ASTM A 1008, Structural Steel, Grade 50].
- D. Galvanized-Steel Sheet: ASTM A 653, structural quality, Grade 50, with G90/Z275 coating.
- E. Castings: Either gray or malleable iron unless otherwise indicated.
 - 1. Gray Iron: ASTM A 48, Class 30.
 - 2. Malleable Iron: ASTM A 47.

2.2 COATING MATERIALS

- A. Epoxy Zinc-Rich Primer for Steel: Complying with MPI #20 and compatible with coating specified to be applied over it.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - 2. Use primer with a VOC content of 400 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- B. Polyurethane Topcoat: Complying with MPI #72 and compatible with undercoat.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - 2. Use product with a VOC content of 400 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.3 MISCELLANEOUS MATERIALS

- A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
 - 1. For aluminum, provide type and alloy as recommended by producer of metal to be welded and as required for strength and compatibility in fabricated items.
- B. Concrete:
 - 1. Normal-weight, air-entrained, ready-mix concrete complying with requirements in Division 03, Section "Cast-in-Place Concrete".
 - 2. Minimum 28-day compressive strength of 3000 psi, 3-inch slump, and 1-inch maximum aggregate size or dry, packaged, normal-weight concrete mix.
 - 3. Complying with ASTM C 387.
 - 4. Mixed with potable water, according to manufacturer's written instructions.

2.4 DECORATIVE METALLIC-COATED STEEL TUBULAR PICKET FENCES

- A. Decorative Metallic-Coated Steel Tubular Picket Fences: Comply with ASTM F 2408, for light industrial (commercial) application (class) unless otherwise indicated.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Ameristar Fence Products.
 - b. Fortress Iron; a division of Woodmark International, LP.
 - c. Master Halco.
 - d. Merchants Metals; a division of MMI Products, Inc.
- B. Metallic-Coated Steel Sheet: Galvanized-steel sheet or aluminum-zinc alloy-coated steel sheet.
- C. Interior surface of tubes formed from uncoated steel sheet shall be hot-dip zinc coated same as exterior.
- D. Posts:
 - 1. End and Corner Posts: Square tubes [2-1/2 by 2-1/2 inches] [3 by 3 inches] formed from 0.108- inch nominal-thickness, metallic-coated steel sheet or formed from 0.105-inch nominal-thickness steel sheet and hot-dip galvanized after fabrication.
 - 2. Swing Gate Posts: Square tubes 3 by 3 inches formed from 0.108-inch nominal-thickness, metallic-coated steel sheet or formed from 0.105-inch nominal-thickness steel sheet and hot-dip galvanized after fabrication.
 - 3. Swing Gate Posts: Square steel tubing [3 by 3 inches] [4 by 4 inches] with [3/16-inch] [Insert thickness] wall thickness, hot-dip galvanized.
 - 4. Horizontal-Slide Gate Post, Openings up to 12 Feet: Square steel tubing [3 by 3 inches] [4 by 4 inches] [Insert size] with [3/16-inch] [Insert thickness] wall thickness, hot-dip galvanized.
 - 5. Horizontal-Slide Gate Post, Openings Wider Than 12 Feet: Square steel tubing 4 by 4 inches with [3/16-inch] [Insert thickness] wall thickness, hot-dip galvanized.
 - 6. Guide Posts for Class 1 Horizontal-Slide Gates: Square tubes 3 by 3 inches formed from 0.108- inch nominal-thickness, metallic-coated steel sheet or formed from 0.105-inch nominal-thickness steel sheet and hot-dip galvanized after fabrication; installed adjacent to gate post to permit gate to slide in space between.
 - 7. Guide Posts for Class 1 Horizontal-Slide Gates: Square steel tubing [3 by 3 inches] [4 by 4 inches] [Insert size] with [3/16-inch] [Insert thickness] wall thickness, hot-dip galvanized; installed adjacent to gate post to permit gate to slide in space between.
- E. Post Caps: Formed from steel sheet and hot-dip galvanized after forming.
- F. Rails: Square tubes.
- G. Pickets: Square tubes.
 - 1. Terminate tops of pickets at top rail for flush top appearance.
 - 2. Picket Spacing: [6 inches] [4 inches] [1-3/4 inches] [Insert spacing] clear, maximum.
- H. Fasteners: Manufacturer's standard concealed fastening system.
- I. Galvanizing: For components indicated to be galvanized and for which galvanized coating is not specified in ASTM F 2408, hot-dip galvanize to comply with ASTM A 123. For hardware items, hot-dip galvanize to comply with ASTM A 153.
- J. Finish: Powder coating.

2.5 SWING GATES

- A. Gate Configuration: [Single leaf] [Double leaf] [As indicated].
- B. Gate Frame Height: [72 inches] [As indicated] [Insert height].
- C. Gate Opening Width: [36 inches] [As indicated] [Insert width].
- D. Steel Frames and Bracing: Fabricate members from square steel tubing [1-1/2 by 1-1/2 inches] [2 by 2 inches] [2-1/2 by 2-1/2 inches] [Insert size] with [1/8-inch] [Insert thickness] wall thickness. [Hot-dip galvanize frames after fabrication.]
- E. Frame Corner Construction: [Welded] [or] [assembled with corner fittings] [and 5/16-inch- diameter, adjustable truss rods for panels 5 feet wide or wider].

- F. Additional Rails: Provide as indicated, complying with requirements for fence rails.
- G. Infill: Comply with requirements for adjacent fence.
- H. Picket Size, Configuration, and Spacing: Comply with requirements for adjacent fence.
 - 1. Treillage: Provide iron castings of pattern indicated between each pair of pickets. Finish as specified for [adjacent fence] [gates].
- I. Hardware: Latches permitting operation from both sides of gate, hinges, and keepers for each gate leaf more than 5 feet wide. Provide [center gate stops] [and] [cane bolts] for pairs of gates. [Fabricate latches with integral eye openings for padlocking; padlock accessible from both sides of gate.]
 - 1. [Insert requirements for padlocks and chains if not Owner furnished].
- J. Spring Hinges: BHMA A156.17, Grade 1, suitable for exterior use.
 - 1. Function: 320 - Gate spring pivot hinge. Adjustable tension.
 - 2. Material: Malleable iron.
- K. Cane Bolts: Provide for inactive leaf of pairs of gates. Fabricated from 1/2-inch-diameter, round steel bars, hot-dip galvanized after fabrication. Finish to match gates. Provide galvanized-steel pipe strikes to receive cane bolts in both open and closed positions.
- L. Finish exposed welds to comply with NOMMA Guideline 1, Finish #2 - completely sanded joint, some undercutting and pinholes okay.
- M. Galvanizing: For items other than hardware that are indicated to be galvanized, hot-dip galvanize to comply with ASTM A 123 unless otherwise indicated. For hardware items, hot-dip galvanize to comply with ASTM A 153.
- N. Metallic-Coated Steel Finish: High-performance coating.

2.6 HORIZONTAL-SLIDE GATES

- A. Gate Configuration: [Single leaf] [Double leaf] [As indicated].
 - 1. Type: Cantilever slide, with external roller assemblies.
- B. Gate Frame Height: [72 inches] [As indicated] [Insert height].
- C. Gate Opening Width: [36 inches] [As indicated] [Insert width].
- D. Steel Frames and Bracing: Fabricate members from square tubing.[Hot-dip galvanize frames after fabrication.]
 - 1. Frame Members: Steel tubing [1-1/2 by 1-1/2 inches] [2 by 2 inches] [2-1/2 by 2-1/2 inches] [Insert size] with [1/8-inch] [Insert thickness] wall thickness.
 - 2. Bracing Members: Steel tubing [1-1/2 by 1-1/2 inches] [2 by 2 inches] [2-1/2 by 2-1/2 inches] [Insert size] with [1/8-inch] [Insert thickness] wall thickness.
- E. Frame Corner Construction:
 - 1. Welded frame [with panels assembled with bolted or riveted corner fittings [and 5/16-inch-diameter, adjustable truss rods for panels 5 feet wide or wider].
- F. Additional Rails: Provide as indicated, complying with requirements for fence rails.
- G. Infill: Comply with requirements for adjacent fence.
- H. Picket Size, Configuration, and Spacing: Comply with requirements for adjacent fence.
 - 1. Treillage: Provide iron castings of pattern indicated between each pair of pickets. Finish as specified for [adjacent fence] [gates].
- I. Hardware: Latches permitting operation from both sides of gate, [locking devices] [hangers] [roller assemblies] [Insert hardware items and accessories] and stops fabricated from [galvanized steel] [galvanized malleable iron] [mill-finished, Grade 319 aluminum-alloy casting with stainless-steel fasteners].[Fabricate latches with integral eye openings for padlocking; padlock accessible from both sides of gate.]
 - 1. [Insert requirements for padlocks and chains if not Owner furnished].
- J. Finish exposed welds to comply with NOMMA Guideline 1, Finish #2 - completely sanded joint, some undercutting and pinholes okay.
- K. Galvanizing: For items other than hardware that are indicated to be galvanized, hot-dip galvanize to comply with ASTM A 123 unless otherwise indicated. For hardware items, hot-dip galvanize to comply with ASTM A 153.

2.7 GATE OPERATORS

- A. General: Provide factory-assembled automatic operating system designed for gate size, type, weight, and operation frequency. Provide operation control system with characteristics suitable for Project conditions, with remote-control stations, safety devices, and weatherproof enclosures; coordinate electrical requirements with building electrical system.
 - 1. Provide operator designed so motor may be removed without disturbing limit-switch adjustment and without affecting auxiliary emergency operator.
 - 2. Provide operator with UL [approval] [-approved components].
 - 3. Provide electronic components with built-in troubleshooting diagnostic feature.

4. Provide unit designed and wired for both right-hand/left-hand opening, permitting universal installation.
 5. Provide controllers, electrical devices, and wiring that comply with requirements specified in Division 26 Sections.
- B. Motors: Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Division 11 Section "Common Motor Requirements for Equipment."
1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
 2. Horsepower: Not less than [1/4] [1/3] [1/2] [3/4] [Insert horsepower].
 3. Enclosure: [Open drip-proof] [Totally enclosed] [Manufacturer's standard].
 4. Duty: Continuous duty at ambient temperature of 105 deg F and at altitude of 3300 feet 1005 m above sea level.
 5. Service Factor: 1.15 for open drip-proof motors; 1.0 for totally enclosed motors.
 6. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in Division 26 Sections.
- C. Gate Operators: Concrete base mounted and as follows:
1. Hydraulic Swing Slide Gate Operators:
 - a. Duty: Heavy duty, commercial/industrial.
 - b. Gate Speed: Minimum [45 feet] [60 feet] per minute.
 - c. Maximum Gate Weight: [Insert weight].
 - d. Frequency of Use: [10 cycles per hour] [25 cycles per hour] [Continuous duty] [Insert cycles].
 - e. Locking: Hydraulic in both directions.
 - f. [Insert feature].
 - g. Operating Type: [Crank arm] [Wheel and rail drive] [Roller chain] [with manual release].
 - h. [Insert feature].
 2. Mechanical Swing Slide Gate Operators:
 - a. Duty: Heavy duty, commercial/industrial.
 - b. Gate Speed: Minimum [45 feet per minute] [60 feet per minute] [variable speed] [Insert speed].
 - c. c.Maximum Gate Weight: [600 lb] [800 lb] [Insert weight].
 - d. Frequency of Use: [10 cycles per hour] [25 cycles per hour] [60 cycles per hour] [Continuous duty] [Insert cycles].
 - e. Operating Type: [Crank arm] [Wheel and rail drive] [Roller chain], [with manual release].
 - f. Drive Type: Enclosed worm gear [and chain-and-sprocket] reducers, roller-chain drive.
 - g. Drive Type: V-belt and [worm gear] [chain-and-sprocket] reducers, roller-chain drive.
 - h. [Insert feature].
- D. Remote Controls: Electric controls separated from gate and motor and drive mechanism, with [NEMA ICS 6, Type 1] [NEMA ICS 6, Type 4] [Insert type of enclosure] enclosure for [surface] [recessed or flush] [concrete base] [pedestal] [Insert mounting] mounting, and with space for additional optional equipment. Provide the following remote-control device(s):
1. Control Station: Momentary-contact, [single] [three]-button-operated with open, [stop], and close function; located remotely from gate [Key switch to lock out open and close buttons].
 2. Card Reader: Functions only when authorized card is presented. Programmable, [multiple] [single]-code system, [permitting four different access time periods] [; face-lighted unit fully visible at night].
 - a. Reader Type: [Touch plate] [Swipe] [Insertion] [Proximity].
 - b. Features: [Timed anti-passback] [Limited-time usage] [Capable of monitoring and auditing gate activity].
 3. Telephone Entry System: Hands-free, voice-communication system for connection to building telephone system with digital-entry code activation of gate operator [and auxiliary keypad entry].
 4. Vehicle Loop Detector: System including automatic closing timer with adjustable time delay before closing, [timer cutoff switch,] and loop detector designed to [open and close gate] [hold gate open until traffic clears] [reverse gate] [Insert functions]. Provide electronic detector with adjustable detection patterns, adjustable sensitivity and frequency settings, and panel indicator light designed to detect presence or transit of a vehicle over an embedded loop of wire and to emit a signal activating the gate operator. Provide number of loops consisting of multiple strands of wire, number of turns, loop size, and method of placement at location shown on Drawings, as recommended in writing by detection system manufacturer for function indicated.
 - a. Loop: Wire, in size indicated for field assembly, for [pave-over] [saw cut with epoxy-grouted] installation.
 - b. Loop: Factory preformed in size indicated; style for [pave-over] [saw cut with epoxy-grouted] installation.

5. Vehicle Presence Detector: System including automatic closing timer with adjustable time delay before closing, [timer cutoff switch,] and presence detector designed to [open and close gate] [hold gate open until traffic clears] [reverse gate] [Insert functions]. Provide [retro-reflective] [emitter/receiver] detector with adjustable detection zone pattern and sensitivity, designed to detect the presence or transit of a vehicle in gate pathway when infrared beam in zone pattern is interrupted, and to emit a signal activating the gate operator.
 - E. Obstruction Detection Devices: Provide each motorized gate with automatic safety sensor(s). Activation of sensor(s) causes operator to immediately function as follows:
 1. Action: Reverse gate in both opening and closing cycles and hold until clear of obstruction.
 2. Photoelectric/Infrared Sensor System: Designed to detect an obstruction in gate's path when infrared beam in the zone pattern is interrupted.
 - F. Limit Switches: Adjustable switches, interlocked with motor controls and set to automatically stop gate at fully retracted and fully extended positions.
 - G. Emergency Release Mechanism: Quick-disconnect release of operator drive system of the following type of mechanism, permitting manual operation if operator fails. Design system so control-circuit power is disconnected during manual operation.
 1. Type: Integral fail-safe release, allowing gate to be pushed open without mechanical devices, keys, cranks, or special knowledge.
 2. Type: Mechanical device, key, or crank-activated release.
 - H. Operating Features:
 1. Digital Microprocessor Control: Electronic programmable means for setting, changing, and adjusting control features [with capability for monitoring and auditing gate activity]. Provide unit that is isolated from voltage spikes and surges.
 2. Automatic Closing Timer: With adjustable time delay before closing [and timer cutoff switch].
 - I. Accessories:
 1. Battery Backup System: Battery-powered drive and access-control system, independent of primary drive system:
 - a. Fail Safe: Gate opens and remains open until power is restored.
 - b. Fail Secure: Gate cycles on battery power, then fail safe when battery is discharged.
 2. Fire [strobe] [siren] alarm.
 3. Intercom System: [Insert requirements].
- 2.8 METALLIC-COATED STEEL FINISHES
- A. Surface Preparation: Clean surfaces with non-petroleum solvent so surfaces are free of oil and other contaminants. After cleaning, apply a [zinc-phosphate] conversion coating suited to the organic coating to be applied over it. Clean welds, mechanical connections, and abraded areas and repair galvanizing to comply with ASTM A 780.
 - B. Powder Coating: Immediately after cleaning and pre-treating, apply 2-coat finish consisting of [zinc-rich] epoxy prime coat and TGIC polyester topcoat, with a minimum dry film thickness of 2 mils 0.05 mm for topcoat. Comply with coating manufacturer's written instructions to achieve a minimum total dry film thickness of 4 mils 0.10 mm.
 1. Comply with surface finish testing requirements in ASTM F 2408 [except change corrosion-resistance requirement to 3000 hours without failure].
 - C. High-Performance Coating: Apply epoxy primer, epoxy intermediate coat, and polyurethane topcoat to prepared surfaces. Comply with coating manufacturer's written instructions and with requirements in SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting. Apply at spreading rates recommended by coating manufacturer.
 1. Match approved Samples for color, texture, and coverage. Remove and refinish, or recoat work that does not comply with specified requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions, with Installer present, for compliance with requirements for site clearing, earthwork, pavement work, construction layout, and other conditions affecting performance of the Work.
- B. Do not begin installation before final grading is completed unless otherwise permitted by Architect.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Stake locations of fence lines, gates, and terminal posts. Do not exceed intervals of 500 feet or line of sight between stakes. Indicate locations of utilities, lawn sprinkler system, underground structures, benchmarks, and property monuments.

1. Construction layout and field engineering are specified in Division 01 Section "Execution"
- 3.3 DECORATIVE FENCE INSTALLATION
- A. Install fences according to manufacturer's written instructions.
 - B. Post Excavation: Drill or hand-excavate holes for posts in firm, undisturbed soil. Excavate holes to a diameter of not less than 4 times post size and a depth of not less than 24 inches plus 3 inches for each foot m or fraction of a foot that fence height exceeds 4 feet.
 - C. Post Setting: Set posts in concrete at indicated spacing into firm, undisturbed soil.
 1. Verify that posts are set plumb, aligned, and at correct height and spacing, and hold in position during setting with concrete or mechanical devices.
 2. Concrete Fill: Place concrete around posts and vibrate or tamp for consolidation. Protect aboveground portion of posts from concrete splatter.
 - a. Exposed Concrete: Extend 2 inches above grade. Finish and slope top surface to drain water away from post.
 - b. Concealed Concrete: Top [2 inches] [Insert dimension] below grade [as indicated on Drawings] to allow covering with surface material. Slope top surface of concrete to drain water away from post.
 3. Posts Set in Concrete: Extend post to within 6 inches of specified excavation depth, but not closer than 3 inches to bottom of concrete.
 4. Space posts uniformly at [6 feet] [8 feet] [Insert dimension] o.c.
- 3.4 GATE INSTALLATION
- A. Install gates according to manufacturer's written instructions, level, plumb, and secure for full opening without interference. Attach hardware using tamper-resistant or concealed means. Install ground-set items in concrete for anchorage. Adjust hardware for smooth operation and lubricate where necessary.
- 3.5 GATE OPERATOR INSTALLATION
- A. General: Install gate operators according to manufacturer's written instructions, aligned and true to fence line and grade.
 - B. Excavation for Concrete Bases: Hand-excavate holes for bases, in firm, undisturbed soil to dimensions and depths and at locations as required by gate operator component manufacturer's written instructions and as indicated.
 - C. Concrete Bases: Cast-in-place or precast concrete, [depth not less than 12 inches] [Insert depth] [6 to 12 inches] below frost line or detail on Drawings], dimensioned and reinforced according to gate operator component manufacturer's written instructions and as indicated on Drawings.
 - D. Vehicle Loop Detector System: [Cut grooves in pavement and] bury and seal wire loop according to manufacturer's written instructions. Connect to equipment operated by detector.
 - E. Comply with NFPA 70 and manufacturer's written instructions for grounding of electric-powered motors, controls, and other devices.
- 3.6 ADJUSTING
- A. Gates: Adjust gates to operate smoothly, easily, and quietly, free of binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.
 - B. Automatic Gate Operators: Energize circuits to electrical equipment and devices. Adjust operators, controls, safety devices, [alarms,] and limit switches.
 1. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 - C. Lubricate hardware, gate operators, and other moving parts.

END OF SECTION

SECTION 32 8000

IRRIGATION

PART 1 - GENERAL

1.1 COORDINATION

- A. Coordinate to ensure that irrigation sleeving and electrical power source is in place.

1.2 OPERATION AND MAINTENANCE DATA

- A. Provide instructions for operation and maintenance of system and controls, seasonal activation and shutdown, and manufacturer's parts catalog.

1.3 REGULATORY REQUIREMENTS

- A. Conform to applicable code for piping and component requirements.

PART 2 - PRODUCTS

2.1 MATERIALS - GENERAL

- A. The materials chosen for the design of the sprinkler system have been specifically referred to by manufacturer, enabling the Owner to establish the level of quality and performance required by the system design. After award of contract and prior to beginning work, the contractor shall submit for approval three copies of the complete list of materials to be installed. Landscape architect will review submittals, no substitutions will be allowed.
- B. Polyvinyl Chloride Pipe (PVC): PVC pipe manufactured in accordance with standards noted herein.
 - 1. Marking and Identification: Continuously and permanently marked with the following information:
 - a. Class 200 SDR 21 number.
 - b. ASTM D 2241 standard number.
 - c. NSF (National Sanitation Foundation) seal.
 - 2. PVC Pipe Fitting: ASTM D 2464 and D 2466, of the same materials as PVC pipe specified and compatible with PVC pipe provided.
- C. Solvent Cement: ASTM D 2564 for PVC pipe and fittings.
- D. Copper Tubing: Seamless, type 'M' hard drawn, ASTM B 88.
- E. Copper Piping: Hard, straight lengths of domestic manufacture only, ASTM B 88, Type 'L'. No copper tube of foreign extrusion, or so-called irrigation tubing (thin wall) allowed.
- F. Copper Pipe Fittings: Cast brass or wrought copper, sweat-solder type.
- G. Wire: 14 gage, single copper strand minimum. Type UF with 1/64 inches insulation. Underwriters Laboratory (UL) approved for direct underground burial when used in a National Electric Code Class II Circuit (30 volts AC or less).

- H. Sprinkler Riser: Sprinkler heads are to be connected to the laterals by poly flex-pipe and associated fittings by Toro or Irritrol.
 - 1. Toro or Irritrol
- I. Swing Joints: O-ring seal type
 - 1. Acceptable Product: Lasco.

2.2 ACCEPTABLE PRODUCTS

ITEM	MANUFAC.	MODEL NO.
4" Pop-up Spray Head	Toro	570Z-4P-COM
12" Pop-up Spray Head	Toro	570Z-12P-COM
Spray Head Nozzles with Pressure Compensation	Toro	Precision Series Nozzles
Rotor Sprinkler Head	Toro	T5PRS
Drip Line	Toro	DL2000
Controllers (Up to 16 Zones)	Toro	Evolution EVO-4OD EMOD-12
Weather Sensor	Toro	Evolution EVO-SC EVO-WS
Controllers (16 to 24 Zones)	Toro	TMC 424E
Weather Sensor (With TMC 424E)	Irritrol	CL-Wireless
Electric Valves	Toro	TPVF100
Gate Valves	NIBCO	
Quick Coupler Valve & Key	Toro	100-SLVLC 100 SLK
Swivel Hose E11	Toro	100 MHS
Backflow Preventer Valve	FEBCO	As Required
10" Round Valve Box	Amtec	181104
Surge Protection Kit	Irritrol	SPD-587

PART 3 - EXECUTION

3.1 INSPECTION

- A. Verify location of existing utilities and that they are ready for use.

3.2 PREPARATION

- A. Piping layout indicated is diagrammatic only. Layout and stake locations of system components. Route piping to avoid plants and structures. Verify full and complete coverage with a minimum 55% overlap of stated manufacturers diameter.
- B. Protect landscaping and other features remaining as final work.
- C. Coordinate work which is embedded in concrete or masonry and routed under paved areas according to underground irrigation sleeves.
- D. Provide timely delivery and installation at job site.

3.3 TRENCHING

- A. Keep trenches free of debris, material, or obstructions that may damage pipe.
- B. Leave trench bottoms smooth so pipe will lay flat.
- C. Make trenches wide enough to allow 6 inches between parallel lines.

3.4 INSTALLATION

A. General:

1. Perform work only in the presence of a licensed irrigator.
2. Do not install system as shown on the drawings when it is obvious in the field that obstructions, grade differences or discrepancies in equipment usage, area dimensions, or static water pressure exist that might not have been considered in the engineering. Bring obstructions or differences to the attention of the Owner's Representative. In the event this notifications is not performed, assume full responsibility for any revision necessary.
3. Staking: Prior to installation, place a stake where each sprinkler is to be located. Receive approval of Owner's Representative before proceeding.
4. Piping Layout: Piping layout is diagrammatic. Route piping around trees and shrubs in such a manner to avoid damage to plantings. Do not dig within balls of newly planted trees and shrubs. Hand excavate whenever possible to avoid cutting of roots greater than 1 inch diameter, during construction.
5. Install pipe, valves, controls, and outlets in accordance with manufacturer's instructions.

B. Pipe Installations:

1. Sprinkler Mains: Install in minimum 4 inch wide trenches with a minimum 12 inches cover.
2. Lateral Piping: Install in minimum 4 inch wide trenches deep enough to allow for installation of sprinkler heads and valves, but in no case with less than 12 inches cover.

3. Provide firm, uniform bearing in trenches for entire length of each pipe to prevent uneven settlement. Wedging or blocking of pipe is not permitted. Remove foreign matter and dirt from inside of pipes before welding, and keep inside of piping clear during and after layout of pipes.
 4. Provide for thermal movement.
 5. Backfill: Hand-tamp and water-jet to prevent settling. Hand rake trenches and adjoining areas to leave grade in a good or better condition than before installation. Backfill trench and compact as specified in Section 02300. Protect piping from displacement.
- C. PVC Pipe and Fittings Assembly:
1. Solvent: Use solvent and procedures recommended by manufacturer to make solvent-welded joints. Thoroughly clean pipe and fittings of dirt, dust and moisture before applying solvent.
 2. PVC to Metal Connections: Work metal connections first. Use a non-hardening pipe dope on threaded PVC to metal joints. Use only light wrench pressure.
 - a. Acceptable Product: Permatex No. 2.
 3. Threaded PVC Connections: Where required, use threaded PVC adapters into which pipe may be welded.
- D. Copper Pipe and Fittings Assembly:
1. Clean pipe and fittings thoroughly and buff connections with sand paper to remove residue from pipe.
 2. Flux pipe and fitting and solder connection.
- E. Electrical Valves:
1. Provide valves in accordance with materials list and size according to Drawings.
 2. Provide valves in a level position in accordance with manufacturer's specifications.
 3. Provide 10" round plastic or concrete valve box as noted on the Drawings, centered over valve, flush with finish grade, one valve per enclosure. Provide valve box extensions as required.
- F. Sprinklers:
1. General: Provide in accordance with materials list, with nozzling in accordance with Drawings. Revise nozzle degree and trajectory if wind conditions affect coverage. Set pop-up heads flush with finish grade.
 2. Shrub Heads: High pop sprinklers attached to lateral piping with flexible flex pipe, sufficiently high to water over shrubs and plants when they have reached their ultimate growth, or as otherwise directed by Owner's Representative.
- G. Wiring:
1. Provide wire from automatic sprinkler controls to valves. No conduit required for U.L. wire, except under pavement, unless otherwise noted on Drawings.
 2. Make wire connections with waterproof connectors according to manufacturer's recommendations, and only in approved value boxes.
 3. Provide wire from controller to each electric valve. Provide a common neutral wire from controller to valves served by a particular controller.

4. Install control wiring. Provide 10 inch expansion coil at each valve to which controls are connected, and at 100 foot intervals. Bury wire beside pipe. Mark valves with neoprene valve markers.

H. Automatic Sprinkler Controllers:

1. Provide and install per manufacturer's recommendations.
2. Locate as shown on Drawings with approval of Owner's Representative.
3. Complete controller connection to power supply in PVC conduit in accordance with local electrical codes with watertight fittings.
4. Provide lightning protection (ground rod and wire) to nearest available ground location.

3.5 TESTING

- A. Prior to backfilling, test mains for a period of 4 hours. If leaks or pressure drops occur, correct defect and repeat test.

3.6 FINAL ADJUSTMENT

- A. After installation is complete, make final adjustment of sprinkler system preparatory to Owner's Representative's final inspection.
- B. Completely flush system to remove debris from lines by removing nozzles from heads on ends of lines and operating system.
- C. Adjust sprinklers for proper operation and proper alignment for direction of throw.
NOTE: Under no circumstances shall the direction of throw come into contact with any portion of the building and/or exterior cooler/freezer box.
- D. Adjust each section of spray heads for operating pressure and balance to other sections by use of flow adjustment on top of each valve.
- E. Adjust nozzling for proper coverage. Prevailing wind conditions or slopes may indicate that arc of angle or trajectory of spray should be other than as shown on Drawings. Change nozzles to provide correct coverage.

3.7 CLEANUP

- A. Keep premises clean and neat.
- B. Replace and/or repair plant material, structures, and installations by others, damaged by work of this section.

3.8 SYSTEM DEMONSTRATION

- A. Instruct Owner's personnel in operation and maintenance of system including adjusting of sprinkler heads. Use operation and maintenance material as basis for demonstration.

END OF SECTION

SECTION 32 9000

PLANTING

PART 1 - GENERAL

1.1 QUALITY ASSURANCE

- A. Source Quality Control: Furnish certificates of inspection of landscape materials, to accompany shipments, as required by governmental authorities. Comply with applicable Federal, state, county and local regulations governing landscape materials.

1.2 JOB CONDITIONS

- A. Proceed with and complete the landscape work as rapidly as portions of the site become available, working within the seasonal limitations for each kind of landscape work required.
- B. Cooperate with other contractors and trades working in and adjacent to the landscape work areas. Examine drawings which show the development of the entire site and become familiar with the scope of other work required.
- C. Excavation: When conditions detrimental to plant growth are encountered, such as rubble fill, adverse drainage conditions, or obstructions, notify Owner's Representative before planting.
- D. Scheduling: Plant or install materials only during normal planting seasons for each type of landscape work required. Correlate planting with specified maintenance periods to provide maintenance until occupancy by the Owner.
- E. Site Utilities
 - 1. Determine locations of underground utilities, especially site lighting, and perform work in a manner which will avoid possible damage. Do not permit heavy equipment such as trucks to damage utilities. Hand excavate, as required to minimize possibility of damage to underground utilities. Maintain grade stakes set by others until removal is mutually agreed upon by all parties concerned.
 - 2. Coordinate work with the irrigation, electrical, and other trades to prevent damage to underground piping or conduit and similar obstruction work located in landscape areas.
- F. Protections: Do not move any equipment over existing or newly placed concrete without approval of Owner's Representative. Provide necessary protections such as board-roading as required.
- G. Provide water, hoses, other watering equipment and labor necessary for the work.
- H. Do not install plant materials when ground is frozen.

1.3 MAINTENANCE

- A. Until final acceptance or in accordance with the Warranty Program (refer to contract), maintain plantings and trees by watering, cultivating, weeding, controlling pests and diseases, cleaning and replacing as necessary to keep landscape in a vigorous, healthy condition. Rake bed areas as required.

- B. In general, provide maintenance as follows:
1. Watering: As necessary to promote growth. Water will be available on site. Provide necessary hoses and other watering equipment required to complete work.
 2. Watering Trees: Keep tree balls moistened to depth of tree ball.
 3. Weeding: Remove weeds and foreign grass over plant areas at least once every 2 weeks. Herbicides may be used only when approved by Owner's Representative.
 4. Mowing and Edging: Mow and edge newly planted turf when growth reaches minimum required height for specified turf type. Maintain at this height.
 5. Apply pesticides in accordance with manufacturer's instructions. Remedy damage from use of pesticides.
 6. Trimming and pruning: including the removal of clippings and dead or broken branches and treatment of pruned areas and other wounds.
 7. Provide disease control if needed.
 8. Maintain wrapping, guys, turnbuckles, and stakes. Adjust turnbuckles to keep guy wires tight. Repair or replace accessories when required.

PART 2 - PRODUCTS

2.1 PLANTS

- A. General:
1. Well-formed No. 1 grade or better nursery stock, in accordance with ANSI Z-60 and as noted hereafter, subject to Owner's Representative's approval.
 2. Listed Plant Heights: From top of root ball to nominal top of plant.
 3. Provide only healthy, vigorous stock, grown under climatic conditions similar to conditions in the locality of the project and free of disease, insects, eggs, larvae, and defects such as knots, sun-scald, injuries, abrasions, or disfigurement.
- B. Shrub Size: As shown on scheduled. Trees and shrubs of larger size may be used if acceptable to Owner's Representative, in which case, increase size of roots or balls proportionately. Larger-than-specified plant materials shall not exceed original budget intent.
- C. Tree Size: Unless otherwise stated, caliper size will refer to trunk diameter as determined in accordance with ANSI Z-60.1.
- D. Ornamental and Shade Trees:
1. Healthy, vigorous, full-branched, well-shaped, with trunk diameter and height requirements as specified.
 2. Balls: Firm, neat, slightly tapered and well burlapped. Trees with loose or broken balls at time of planting will be rejected.
 3. Trees will be individually approved by the Owner's Representative.
 4. Ball Diameter: Minimum 10 inches for each 1 inch caliper measured 6 to 12 inches above root ball.
 5. Containers: Heavy gage plastic, metal and wooden boxes only.
 6. Provide trees with full rounded crowns, meeting height and spread standards after pruning. No flat sided trees or trees with open areas on any side will be acceptable, consistently superior in form and branching, and typical of the growth habit of their species unless otherwise specified.
- E. Multi-trunk Trees: Measure multi-trunk tree caliper as follows. Add the caliper of the largest trunk to one-half the caliper of the remaining trunks.

1. Example: An 8 inch caliper, multi-trunk could be 3 trunks of 5 inch/4 inch/2 inch or 5 inch/3 inch/3 inch).
- F. Shrubs, Groundcovers, Perennials and (Annuals with Owner's approval only): Nursery grown, healthy, vigorous, and of normal habit of growth for the species.
- G. Turf Grass Sod:
1. Green, actively growing, with strong fibrous root system, free of weeds, stones, and foreign grasses of type indicated in Plant Schedule or on Drawings. Sod which is dormant, heat or drought stressed will not be accepted.
 2. Cut sod with a minimum of 3/4 inch of soil covering the roots.
 3. Deliver to the site in no larger than 24 inch wide rolls or pallets.
 4. Do not stack more than 24 hours between time of cutting and time of delivery.
- H. Turf Grass Seed:
1. Provide pure grass seed common to location with minimum weed content. Seed needs to be no older than 1 year.
- I. Plants:
1. Conform to sizes and quality notes in plant list and as indicated, with the exception of that larger plants than those specified may be used if approved by the Owner's Representative. Use of larger plants shall not increase the contract price.
 2. Specified sizes are after pruning.
 3. Measure plants with their branches in normal position.
 4. Normal, well-developed branches and vigorous, fibrous root systems, conforming to specifications of the last edition of ANSI Z60.1, Standards for Nursery Stock published by the American Association of Nurserymen, Inc. (A.A.N.).
 5. Healthy, vigorous and free from defects, decay, girdling roots, sun-scald injuries, abrasions of the bark, plant diseases, and insect pests, their eggs and larvae.
 6. Hardy grown under soil type conditions similar to those in the locality of the project.
- NOTE: YUM Standard Site Landscaping Design prohibits the installation of planting beds directly adjacent (i.e., with 18") to the building perimeter. If planting beds are required (only by the Jurisdiction Having Authority) directly adjacent to the building perimeter, only those plant varieties that are VASE-SHAPED (i.e., pear-shaped) and open at the base shall be permitted.
- J. Upon becoming aware of any condition that will adversely affect the long-term survival of any plant, notify the Owner's Representative before installation of the plant(s).

2.2 SOIL PREPARATION MATERIALS

- A. Bedding Soil:
1. Acceptable Manufacturer for location
- B. Commercial Fertilizer (if used): Uniform in composition, dry and free-flowing. Deliver fertilizer to site in original unopened containers, each bearing manufacturer's guaranteed statement of analysis.
1. Fertilizer per the landscape architect / landscape designer's recommendation - do not over-stimulate plantings with nitrogen.

- C. Coarse grade Sphagnum Moss, no Peat Moss permitted.
- D. Bark Mulch: if wood mulch used (see note 3.6-B below), it must be sterilized and contain no harmful active residues: pesticides, disease organisms and foreign chemicals. Screen to particle size of 1 inch or smaller. Shredded mulch preferred.
- E. Refer to Drawings for specific soil preparation materials which may be proprietary in nature. If such materials are indicated, provide only these proprietary materials unless specific approval of substitutions has been granted in accordance with Section 01600.

2.3 TOPSOIL

- A. Fertile, agricultural soil typical for locality.

2.4 TREE STAKING AND GUYING MATERIALS

- A. Hose: New 3/4 inch rubber hose.
- B. Hardware
 - 1. Wire: #10 gage, galvanized.
- C. Stakes: Steel "T" posts, minimum 5 feet in height.
- D. Warning Flags: Plastic surveyor's ribbon, international orange, 1 inch wide and 24 inches long, minimum
- E. Tree Wrap: Heavy crepe paper, impregnated with insect repellent chemicals.
- F. Install staking and guying as indicated on the Drawings.
- G. Turnbuckles: Cadmium plated steel with 3 inch minimum lengthwise adjustment.

2.5 MISCELLANEOUS PRODUCTS

- A. Steel Edging: 4 inches deep, 1/8 inch thick, painted dark green with rust-resistant paint and stake loops welded or formed onto backside.
- B. Spikes: Similar material as steel edging, 18 inches long.
- C. Erosion Fabric: Jute matting, 4 inch open weave.
- D. Root Wrapping Materials: Quality burlap.
- E. Tree Wound Dressing: Black asphaltic based antiseptic paint.
- F. Herbicides – Acceptable Products:
 - 1. Pre-Emergent per landscape architect/landscape designer: local or regional use.
 - 2. Post-Emergent per landscape architect/landscape designer: local or regional use.
- G. Tree, Shrub, and Plant Bed Mulch: Shredded decomposed pine bark, having a pH between 6.0 and 7.0, sterilized, and containing no harmful active residues, that is, pesticides, disease organisms and foreign chemicals, uniform in size with a medium particle size of 1-1/2 inch, free of sticks, stones, leaves and other debris.

- H. Turf Mulches: Hydroseed base, no dry hay or straw permitted.
- I. Weed Barrier: spun-bond or woven, polypropylene, needle-punched fabric. 10-year warranty preferred.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine subgrade, verify elevations noted on the Drawings, observe the conditions under which work is to be performed, and notify Owner's Representative of unsatisfactory conditions. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to the Contractor and Owner's Representative.
- B. Beginning of installation means acceptance of existing site.
- C. Verify location of underground irrigation lines and other utilities.

3.2 SOIL PREPARATION

- A. Trees:
 - 1. General: Refer to the Drawings for tree locations.
 - 2. Backfill Soil: Unless noted on drawings, backfill tree planting pits with native topsoil.
 - a. Topsoil: Free from rocks, construction debris and other foreign materials. Do not use soil amendments.
- B. Shrubs and Ground Covers:
 - 1. General: Refer to the Drawings for shrub area locations.
 - a. Shrub areas with ground cover: Rough grade in bed areas will be left 4 inches low prior to work of this Section.
 - b. Shrub areas without ground cover: The rough grade will be left 3 inches low prior to work of this Section.
 - 2. Soil Mix: General Planting
 - a. 1 part bedding mix
 - b. 1 part native soil
 - c. Add 4 pounds fertilizer per 100 square feet of bed area and cultivate 6 inches deep.
 - 3. Shrub Beds without Ground Cover: Pocket planted with soil mix described above. Fertilize as above.
 - 4. Specimen or Individual Shrubs: Plant in pits twice the diameter and no deeper than the root ball, and backfill with soil mix described above.
 - 5. Refer to the Drawings for other soil preparation details, notes, and requirements.

3.3 TREE PLANTING

- A. Location: Refer to Drawings for location of trees. Stake and label position of trees before pits are dug. Receive approval from Owner's Representative before proceeding.

B. General:

1. Excavate pit: During pit excavation, if pit walls are glazed, roughen sides to allow for good root bond with backfill.
2. Center trees with root flare at or above finish grade and with trunk plumb: once tree is positioned, remove any wire/rope at tree trunk base (critical).
3. Remove top 1/3 of ball burlap immediately prior to backfilling pit, 2 hour maximum, and gently roughen exposed soil around ball, being careful not to damage feeder roots.

C. Size of Tree Pits: Plant tree balls in pits slightly larger than tree root ball unless otherwise dictated by the landscape architect/landscape designer and no deeper than height of ball. In some locations coniferous trees may need to be planted higher than level ground (verify with landscape architect/landscape designer). Rest root ball on undisturbed soil. During backfilling do not allow air pockets.

D. Maintain trees in vertical position while backfilling.

3.4 SPACING AND PLANTING SHRUBS AND GROUND COVERS

- A. Place plants in position on bed areas or in individual pits before cans or burlap have been removed.
- B. Remove top 1/3 burlap from balled and burlapped plants. Plant where located and approved, setting plants with root flares at or slightly above finish grade, and compact soil carefully around each plant ball.
- C. Water each plant thoroughly with hoses to eliminate air pockets. Carefully prune plants to remove dead or broken branches and hand-rake bed areas to smooth, even surfaces.
- D. Owner's Representative reserves the right to interchange or shift locations of plants prior to planting.

3.5 STAKING

- A. Refer to Drawing details for placement of stakes.
- B. No staking required for trees smaller than 1 ½ in. caliber.
- C. Use 3 or more wires, attached to tree by loops of wire covered by 3/4 inch rubber hose, and secured around the lowest crotch. Anchor wire to "T" posts, driven into the ground to a depth of 20 inches.
- D. Inspect hose and wire attachments regularly to evidence of girdling or other damage, and adjusted before such damage occurs.
- E. Warning Flags: Flag guy wires or cable with plastic surveyor's ribbon to warn pedestrians - do not place guy wires and cable across paths or sidewalks
- F. At direction of Owner's Representative, leave some trees unstaked for reasons of sheltered location or large relative size of root ball.
- G. At the direction of Owner's Representative, stake certain large shrubs for reasons of exposure to prevailing winds or small size of root ball in relation to top growth.

3.6 MULCHING

- A. After work of planting has been completed and approved by Owner's Representative, mulch soil in and around tree pit and bed areas with 3 inch thickness of mulch, lightly cultivated into area. Do not disturb watering saucer, and do not cover root flare. Delay this operation until just prior to final inspection.
- B. Mulching Material: Mulching material shall be prevalent in location, and free of germination-inhibiting ingredients. Combustible, wood based mulches shall not be used directly adjacent to the building. If the mulch is required adjacent to the building, mulching materials shall consist of pea gravel or crushed stone for a distance of 18" from the face of the building. Gravel shall be separated from organic mulches with a metal or commercial grade nylon spike edging. No black or white pumice rock will be permitted

3.7 FINE GRADING

- A. Loosen lawn areas and fine rake to break up lumps and produce a smooth, even grade free from unsightly variations, ridges or depressions.
- B. Remove and legally dispose off site stones 1/2 inch or larger, sticks, root or other debris that is exposed during this operation.
- C. Fine Grading: Subject to approval by Owner's Representative.
- D. Ensure positive drainage away from building at planting areas adjacent to the building.

3.8 LAWN SEEDING

- A. Grading and Rolling: Carefully smooth surfaces to be seeded. Roll area to expose soil depressions or surface irregularities.
- B. Fertilizing: Spread Turf Starter Fertilizer onto the soil evenly at the rate of 10 pounds per 1,000 square feet of lawn area. Rake in lightly. Be sure soil is level and smooth before seeding. Avoid seeding on dry soil. Apply fertilizer no more than 48 hours prior to seeding.
- C. Broadcast Seeding Method With a Hydromulch Cap
 - 1. Mechanically or chemically eliminate weeds from areas to be seeded.
 - 2. Spread grass seed over entire area to be grassed per landscape architect/landscape designer's specification.
 - 3. Rake seed into soil to a depth of 1/4 inch to 1/2 inch.
 - 4. Apply a Hydromulch cap over seeded area using 50 pounds of wood cellulose fiber per 1,000 square feet.
 - 5. Water seeded areas in a fashion that will keep the seeds moist 24 hours a day, for a period of 15 to 25 days. Do not allow areas to become dry, or water to the extent that seed will be lost by erosion.
- D. For Bermuda grass seed (stolen), utilize Hydromulching.
 - 1. Mechanically or chemically eliminate weeds from areas to be seeded.
 - 2. Hydromulch Bermuda grass seed over entire area to be grassed using 2 pounds PLS per 1,000 square feet.
 - 3. Water seeded areas in a fashion that will keep the seeds moist 24 hours a day, for a period of 15 to 25 days. Do not allow areas to become dry, or water to the extent that seed will be lost by erosion.

- E. Do not sow immediately following rain, when ground is too dry, or during windy periods.
- F. Seed Protection:
 - 1. Identify seeded areas with stakes and string around area periphery. Set string height to 12 inches. Space stakes at maximum 20'-0" on center
 - 2. Cover seeded slopes where grade is 4 inches per foot or greater with erosion fabric. Roll fabric onto slopes without stretching or pulling.
 - 3. Lay fabric smoothly on surface, bury top end of each section in 6 inch deep excavated topsoil trench. Provide 12 inch overlap of adjacent rolls. Backfill trench and rake smooth, level with adjacent soil
 - 4. Secure outside edges and overlaps at 36 inch intervals with stakes.
 - 5. Lightly dress slopes with topsoil to ensure close contact between fabric and soil.
 - 6. At sides of ditches, lay fabric laps in direction of water flow. Lap ends and edges minimum 6 inches.
- G. Replacement: Replace any areas of grass not showing sufficient growth at the end of 3 weeks after the original application at no additional cost to Owner.

3.9 TURF PLANTING/SPRIGGING

- A. Grading and Rolling: Carefully smooth surfaces to be sprigged. Roll area to expose soil depressions or surface irregularities.
- B. Fertilizing: Spread Turf Fertilizer onto soil evenly at rate of 1 pound per 100 square feet of lawn area. Rake in lightly. Be sure soil is level and smooth before sprigging. Avoid laying sprigs on dry soil. Apply fertilizer no more than 48 hours prior to planting.
- C. Preparation of Sprigs: By manual or mechanical means, shred live, green sod into sprigs.
 - 1. Sprigs: 4 to 6 inches long, and have minimum of 3 nodes.
- D. Sprigging Rate: Shred 31 square feet of sod to provide sprigs for 1000 square feet of lawn.
- E. Watering: Do not sprig whole lawn before watering. When a conveniently large area has been sprigged, water lightly preventing drying; continue to lay sprigs, and water until installation is complete.
- F. Rolling Sprigs: After laying all sprigs, roll lightly to eliminate irregularities and to form good contact between sprigs and soil. Avoid a very heavy roller or excessive initial watering which may cause roller marks. Hydromulch cap may be substituted for rolling.
- G. Replacement: Replace any areas of grass not showing sufficient growth at the end of 4 weeks.
 - 1. Replace per original method application at no additional cost to Owner.

3.10 SOD PLANTING

- A. Grading and Rolling: Carefully smooth surfaces to be sodded. Roll area to expose soil depressions or surface irregularities.
- B. Fertilizing: Spread turf fertilizer onto soil evenly at rate of 10 pounds per 1,000 square feet of lawn area. Rake in lightly. Be sure soil is level and smooth before laying sod. Avoid laying sod on dry soil. Apply fertilizer no more than 48 hours prior to laying sod.

- C. Laying Sod:
1. Moisten prepared surface immediately prior to laying sod.
 2. Lay sod within 24 hours after harvesting.
 3. Lay first strip of sod slabs along a straight line, using a string in irregular areas.
 4. Butt joints tightly, but do not overlap edges.
 5. On second strip stagger end joints.
 6. Use a sharp knife to cut sod to fit curves, edges, sprinkler heads.
 7. Lay smooth. Align with adjoining grass areas. Place top elevation of sod 1/2 inch below adjoining edging, paving, and curbs.
 8. On slopes 6 inches per foot and steeper, lay sod perpendicular to slope and secure every row with wooden pegs at maximum 2 feet on center. Drive pegs flush with soil portion of sod.
 9. Prior to placing sod on slopes exceeding 8 inches per foot (or where indicated) - place wire mesh over topsoil. Securely anchor in place with wood pegs sunk firmly into ground.
- D. Watering: Do not lay whole lawn before watering. When a conveniently large area has been sodded, water lightly to prevent drying. Continue to lay sod and water until installation is complete.
- E. Rolling Sod: After laying sod, roll lightly to eliminate irregularities and to form good contact between sod and soil. Avoid a very heavy roller or excessive initial watering which may cause roller marks.
- F. Replacement: Replace any areas of grass not showing sufficient growth at the end of 3 weeks per original method of application at no additional cost to Owner.
- G. Watering: Continue irrigation regularly to keep soil evenly moist until active growth resumes.

3.11 CLEAN UP

- A. During work, keep premises neat and orderly including organization of storage areas. Remove trash, including debris resulting from removing weeds or rocks from planting areas, preparing beds, or planting plants, from site daily as work progresses. Keep walkway and driveway areas clean by sweeping or hosing.

END OF SECTION