

PROJECT MANUAL

T OR C ANIMAL SHELTER ADDITION TRUTH OR CONSEQUENCES, NEW MEXICO ITB #2024-10-001 ANIMAL SHELTER ADDITION

SET NO.

September 2024



ARCHITECTS • PLANNERS • AIA

**SECTION 00-0020
PROJECT DIRECTORY**

OWNER:	City of Truth or Consequences 505 Sims Truth of Consequences, NM 87901 Phone: 575.894.6673 Contact: Traci Alvarez 575-952-0565
ARCHITECT:	NCA Architects, P.A. 1306 Rio Grande Blvd. NW Albuquerque, NM 87104 Phone: (505) 238-7814 Contact: Dave Puritz
STRUCTURAL ENGINEER:	Chavez – Grieves Consulting Engineers, Inc. 4700 Lincoln NE Suite 102 Albuquerque, NM 87109 Phone: 505.344.4080
MECHANICAL ENGINEER:	ArSed Engineering Group, LLC 4700 Lincoln NE Albuquerque, NM 87109 Phone: 505.761.3100
ELECTRICAL ENGINEER:	A C Engineering Enterprises, LLC 141 E. Palace Ave. Santa Fe, NM 87501 Contact: Bud Telck 505.681.5401

END OF SECTION 00-0020

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**SECTION 00-0200
INVITATION TO BID**

**City of T or C
Truth or Consequences, New Mexico
Animal Shelter Addition**

General Notice

City of T or C (Owner) is requesting Bids for the construction of the following Project:

TITLE

ITB #2024-10-001 Animal Shelter Addition

Bids for the construction of the Project will be received at the **Purchasing Department, located at 505 Sims, T or C, NM 87901 at 10/31/2024 2:00PM** local time. At that time the Bids received will be publicly opened and read.

The Project includes the following Work according to Drawings and Specifications prepared by NCA - Architects and described in general as:

The project consists of a metal building addition, housing, new kennels, office, breakroom, dog bathing, storage and associated site work.

Bids are requested for the following Contract: **ITB #2024-10-001 Animal Shelter Addition**

The Project has an expected duration of 120 calendar days.

Information and Bidding Documents for the Project can be found at the following designated website: <https://torcnm.org>

Bidding Documents may be downloaded from the designated website. Prospective Bidders are urged to register with the designated website as a plan holder, even if Bidding Documents are obtained from a plan room or source other than the designated website in either electronic or paper format. The designated website will be updated periodically with addenda, lists of registered plan holders, reports, and other information relevant to submitting a Bid for the Project. All official notifications, addenda, and other Bidding Documents will be offered only through the designated website. Neither Owner nor Engineer will be responsible for Bidding Documents, including addenda, if any, obtained from sources other than the designated website. The Issuing Office for the Bidding Documents is:

City of T or C- Purchasing Department

[Welcome to Truth & Consequences, NM \(torcnm.org\)](https://torcnm.org)

Prospective Bidders may obtain or examine the Bidding Documents at the Issuing Office on Monday through Friday between the hours of 8:00AM- 5:00PM and may obtain copies of the Bidding Documents from the Issuing Office as described below. Partial sets of Bidding Documents will not be available from the Issuing Office. Neither Owner nor NCA Architects will be responsible for full or partial sets of Bidding Documents, including addenda, if any, obtained from sources other than the Issuing Office. Full document's, addenda and other deviations shall be located at the T or C website under the Purchasing Department:

Pre-bid Conference

A pre-bid conference for the Project will be held on **October 17, 2024**, at 10:00 AM at The Truth or Consequences Animal Shelter 1101 Cedar St. Building C. **T or C, NM 87901.**

Attendance at the pre-bid conference is mandatory.

Instructions to Bidders.

For all further requirements regarding bid submittal, qualifications, procedures, and contract award, refer to the Instructions to Bidders that are included in the Bidding Documents.

This Advertisement is issued by:

Owner: **City of T or C**

By: **Leiandra Guerra**

Title: **Chief Procurement Officer**

Email: lguerra@torcnm.org

Date: October 3, 2024

INSTRUCTIONS TO BIDDERS

SECTION 00-1000

1.0 DEFINITIONS AND TERMS

- 1.1 Terms used in these Bidding Documents which are defined in the Instructions to Bidders and in the Conditions of the Contract for Construction (General, Supplementary, and Other Conditions) have the meanings assigned to them in those documents.
- A. **ADDENDUM:** A written or graphic instrument issued prior to the opening of Bids which clarifies, corrects, or changes the Bidding Documents or Contract Documents. Plural: addenda.
 - B. **ALTERNATE BID:** Amount stated in the Bid as the sum to be added from the amount of the Base Bid if the corresponding change in the project scope, materials, and/or methods of construction is awarded by the Owner.
 - C. **BASE BID:** Amount stated in the Bid as the sum for which the Bidder offers to perform the work, excluding alternate Bids.
 - D. **BID:** The offer of the bidder submitted on the prescribed form setting forth the prices for the work to be performed in conformance with the Bidding Documents. This amount includes gross receipts or local options taxes.
 - E. **BID LOT:** A major item of work for which a separate quotation or proposal is requested.
 - F. **BIDDER:** One who submits a Bid directly to the Owner, as distinct from a subcontractor who submits a bid to a contractor.
 - G. **BIDDING DOCUMENTS:** The Bidding Requirements and the Contract Documents.
 - H. **BID FORM:** A form which shall include space in which the bid price shall be inserted and which the Bidder shall sign and submit along with all other necessary submissions. A Bidder may submit a reasonable facsimile of the Bid Form. Oral, telephonic, and telegraphic bids are invalid and will not be considered.
 - I. **BIDDING REQUIREMENTS:** Notice of Invitation to Bid, Prebid Information, Instructions to Bidders, Information Available for Bidders, the Bid Form, Supplements to the Bid Form, and portions of Addenda relating to any of these.
 - J. **INVITATION FOR BID:** All documents including those attached or incorporated by reference or utilized for soliciting sealed bids.
 - K. **RESPONSIBLE BIDDER:** A Bidder who submits a Responsive Bid and who has furnished, when required, information and data to prove that his financial resources, production or service facilities, personnel, service reputation, and experience are adequate to make satisfactory delivery of the services, construction, or items of tangible personal property described in the Invitation for Bid.
 - L. **RESPONSIVE BID:** A bid which conforms in all material respects to the requirements set forth in the Invitation for Bid.

- M. **SUCCESSFUL BIDDER:** The lowest Responsible Bidder to whom the Owner, on the basis of the Owner's evaluation, makes an award. A Successful Bidder does not become the contractor until an agreement with the Owner is signed.

2.0 EXAMINATION OF BIDDING DOCUMENTS AND SITE

2.1 Before submitting a Bid, each Bidder must:

- A. Examine the bidding Documents thoroughly;
- B. Familiarize himself with Federal, State, and local laws, ordinances, rules, and regulations that may in any manner affect cost, progress, or performance of the Work; and
- C. Study and carefully correlate the Bidder's observations with the Bidding Documents.

2.2 On request, the Owner will provide each Bidder access to the site to conduct such investigations and tests as each Bidder deems necessary for submission of his Bid.

2.3 The lands upon which the Work is to be performed, rights-of-way for access thereto, and other lands designated for use by the Contractor in performing the work are identified in the Bidding Documents.

2.4 The submission of a Bid will constitute an incontrovertible representation by the Bidder that he has complied with every requirement of this Section and that the Bidding Documents are sufficient in scope and detail to indicate and convey understanding of all terms and conditions for performance of the Work.

3.0 BIDDING DOCUMENTS

3.1 COPIES OF BIDDING DOCUMENTS

3.11 Complete sets of Bidding Documents shall be used in preparing bids; neither the Owner nor the Architect/Engineer assumes responsibility for errors or misinterpretations resulting from the use of incomplete sets of Bidding Documents.

3.1.2 The Owner and the Architect/Engineer, in making copies of Bidding Documents available on the above terms, do so only for the purpose of obtaining Bids on the Work and do not confer a license or grant for any other use.

3.2 INTERPRETATIONS

3.2.1 All questions about the meaning or intent of the bidding Documents shall be submitted to the Architect/Engineer in writing. Replies will be issued by Addenda mailed or delivered to all parties recorded by the Architect/Engineer as having received the Bidding Documents. Questions received less than five days prior to the date for opening of Bids will not be answered. Only questions answered by formal written Addenda will be binding. Oral and other interpretations or clarifications will be without legal effect.

- 3.2.2 Bidders and Subcontractor shall promptly notify the Architect/engineer of any ambiguity, inconsistency, or error which they may discover upon examination of the Bidding Documents or of the site and local conditions.

3.3 SUBSTITUTE MATERIAL AND EQUIPMENT

- 3.3.1 The contract, if awarded, will be on the basis of material and equipment equal to products designated in the Drawings or described in the Specifications. For bidding purposes, product prior approval is not required unless specifically requested under the Section where specified. Products must meet or exceed that specified in specifications and construction documents. All substitutions must be submitted for shop drawing review by the Architect/Engineer prior to construction as required by Section 01631 - Substitutions.

3.4 ADDENDA

- 3.4.1 Addenda will be mailed or delivered to all who are known by the Architect/Engineer to have received a complete set of bidding Documents.
- 3.4.2 Copies of Addenda will be made available for inspection wherever Bidding Documents are on file for that purpose.
- 3.4.3 Addenda will be issued no later than four days prior to the date for receipt of Bids, except an addendum withdrawing the request for bids or one which includes postponement of the date for receipt of Bids.

4.0 BIDDING PROCEDURES

4.1 FORM AND STYLE OF BIDS

- 4.1.1 Bids shall be submitted on forms identical to the form included with the Bidding Documents.
- 4.1.2 All blanks on the Bid Form shall be filled in by typewriter or manually in ink.
- 4.1.3 Where so indicated by the makeup of the bid form, sums shall be expressed in both words and figures, and, in case of discrepancy between the two, the amount written in words shall govern.
- 4.1.4 Any interlineation, alteration, or erasure must be initiated by the signer of the bid.
- 4.1.5 Each copy of the bid shall include the complete name of the bidder and a statement that the bidder is a sole proprietor, a partnership, a corporation, or some other legal entity. Each copy shall be signed by the person or persons legally authorized to bind the bidder to contract. A Bid by a corporation shall further give the State of incorporation and have the applicable New Mexico Certificate of Incorporation number or Certificate of Authority number. The Bid shall include the current contractor's license number and type, and the current Contractor's preference number. A bid submitted by an agent shall have a current Power of Attorney attached certifying the agent's authority to bind the Bidder.
- 4.1.6 The Bid shall contain an acknowledgment of receipt of all Addenda (the numbers of which shall be filled in on the Bid Form).

4.1.7 The address to which communications regarding the Bid are to be directed must be shown.

4.1.8 The Project Name and Number, shall be clearly shown on the outside of the envelope in which the Bid is submitted.

4.2 BID SECURITY

(Bid Security submitted for 5 percent of the base bid)

4.3 PRE-BID CONFERENCE AND WALK-THROUGH

4.3.1 October 17, 2024 at 10:00 at The Truth or Consequences Animal Shelter located at 1101 Cedar St. Building C. T or C, NM 87901.

4.3.2 The pre-bid Conference shall be **“MANDATORY”** for General Contractors and their Principle Sub-Contractors in order to Qualify for Acceptance of their Bid by the Owner.

4.4 RESIDENT CONTRACTOR'S PREFERENCE

(Per State Statute)

4.5 SUBCONTRACTORS

4.5.1 The Bidder shall list the subcontractors he proposes to use for all trades or items on the Subcontractors Listing Form attached to the Bidding Documents. Pursuant to Chapter 18, Laws of 1988, 2nd session relating to Construction Industries; enacting the “Subcontractor Fair Practices Act”

4.6 CAMPAING CONTRIBUTION DISCLOSURE FORM

4.6.1 This form must be attached to the bidding documents.

4.6 SUBMISSION OF BIDS

4.6.1 Bids shall be submitted at the time and place indicated in the Invitation for Bid and shall be included in an opaque sealed envelope or facsimile cover letter marked with the Project title and name and address of the Bidder and other required documents listed in the Bidding Documents.

4.6.2 The envelope shall be addressed to:

Hand Carried

City of Truth or Consequences City Hall
Attn: Chief Procurement Officer
505 Sims Street
Truth or Consequences, NM 87901

Via Mail

City of Truth or Consequences City Hall
Attn: Chief Procurement Officer
505 Sims Street
Truth or Consequences, NM 87901

The sealed envelope shall have the notation SEALED BID on the face thereof.

- 4.6.3 Bids received after the date and time for receipt of Bids will be returned unopened.
- 4.6.4 The Bidder shall assume full responsibility for timely delivery of Bids at the office of the County Manager, including those Bids submitted by mail. Hand-delivered bids shall be submitted at the front desk of the County Manager and will be clocked in at the time received, which must be prior to the time specified. Bids will then be held for public opening.

4.7 CORRECTION OR WITHDRAWAL OF BIDS

- 4.7.1 A Bid containing a mistake discovered before Bid Opening may be modified or withdrawn by a Bidder prior to the time set for Bid Opening by delivering written or telegraphic notice to the location designated in the Invitation for Bid as the place where bids are to be received.
- 4.7.2 Bid security
 - A. Each bidder must submit with bid a certified check, cashier's check, or acceptable bid bond drawn in favor of the Owner in the amount of 5 percent of the base bid. Bid security shall guarantee that the bidder, if awarded the contract, will promptly execute the contract in accordance with the proposal and in the manner and form required by the Contract Documents and will furnish bond for the performance of the contract and for payment of all labor and materials. AIA Document A301 is an acceptable bid bond form. Bidder's bid security secures payment of any damages suffered by the Owner as a result of a bidder's failure to honor this guarantee.
 - B. The bid security of the five lowest bidders will be retained until the contract is awarded or other disposition is made thereof. The bid security of all bidders except the five lowest bidders will be returned promptly after the canvass of bids.
 - C. Bid bond sureties must be authorized to transact business in New Mexico and must be approved in the latest version of Federal Treasury Circular 570 as published by the U.S. Treasury Department. Bid bonds must be accompanied by an original certificate showing the authority to bind the surety of the person on behalf of the surety.
- 4.7.3 Withdrawn Bids may be resubmitted up to the time and date designated for the receipt of Bids, provided they are then fully in conformance with the Bidding Documents.
- 4.7.4 After Bid Opening, no modifications in Bid Prices or other provisions of Bids shall be permitted. A low Bidder alleging a material mistake of fact which makes his Bid non-responsive may be permitted to withdraw his Bid if:
 - A. The mistake is clearly evident on the fact of the Bid document; or
 - B. The Bidder submits evidence which clearly and convincingly demonstrates that a mistake was made.

Any decision by the Owner to permit or deny the withdrawal of a Bid on the basis of a mistake contained therein shall be supported by a determination setting forth the grounds for the decision. If withdrawal is permitted, Bid security will not be forfeited.

4.8 NOTICE OF CONTRACT REQUIREMENTS BINDING ON BIDDER

4.8.1 In submitting this bid, the Bidder represents that he has familiarized himself with the nature and extent of the following requirements of the Conditions of the Construction Contract (General, Supplementary, and Other Conditions regarding, but not limited to the following):

- A. Definitions - Sections 00-7000 and 00-8000;
- B. Bribes, Gratuities, and Kickbacks
- C. Contractor's Gross Receipts Tax Registration
- D. Assignment of Antitrust Claims
- E. Equal Employment Opportunity
- F. Others listed within the Contract Documents.

4.9 REJECTION OR CANCELLATION OF BIDS

4.9.1 An Invitation for Bid may be canceled, or any or all Bids may be rejected in whole or in part, when it is in the best interest of the Owner.

5.0 CONSIDERATION OF BIDS

5.1 RECEIPT, OPENING, AND RECORDING

Bids received on time will be opened publicly and will be read aloud, and an abstract of the amounts of the Base Bids and Alternates or Bid items, if any, will be made available to the Bidders.

5.2 BID EVALUATION AND AWARD

5.2.1 The Owner shall have the right to waive technical irregularities in the form of the Bid of the low Bidder which do not alter the price, quality, or quantity of the services, construction.

5.2.2 It is the intent of the Owner to award a contract to the lowest responsible Bidder, provided the Bid has been submitted in accordance with the requirements of the Bidding Documents. The unreasonable failure of a Bidder to promptly supply information in connection with an inquiry with respect to responsibility is grounds for a determination that the Bidder is not a responsible Bidder.

5.2.3 Discrepancies in the Bid form between words and figures will be resolved in favor of words. Discrepancies between the indicated sum of any column of figures and the correct sum thereof will be resolved in favor of the correct sum.

5.2.4 Conditional Bids or Bids with additional terms will not be accepted.

5.3 NOTICE OF AWARD

5.3.1 A written Notice of Award shall be issued by the Owner after review and approval of the bid and related documents by the Owner with reasonable promptness.

5.4 IDENTICAL BIDS

5.4.1 When two or more of the bids submitted are identical in price and are the low Bid, the Purchasing Agent or the Owner may:

A. Award by lottery to one of the identical low Bidders.

5.5 CANCELLATION OF AWARD

5.5.1 When in the best interest of the public, the Owner may cancel the award of any contract at any time before the execution of said contract by all parties without any liability against the Owner.

6.0 POST-BID INFORMATION

6.1 SUBMITTALS TO ARCHITECT/ENGINEER

Within five (5) days after Notice of Award, the following shall be submitted to the Architect/Engineer:

- A. The required bonds and certificate of insurance,
- B. The requirements under Subparagraph 4.5.5

6.3 EXECUTION AND APPROVAL OF CONTRACT

6.3.1 The Contract shall be signed by the Successful Bidder and returned, together with both the Contract Bonds and Certificate of Insurance, within five (5) calendar days after the date of the Notice of Award. If the Contract is not executed by the Owner within twenty one (21) days following receipt from the Bidder of the signed Contract with Bonds and Certificate, the Bidder shall have the right to withdraw his proposal without penalty. No Contract shall be effective until it has been fully executed by all of the parties thereto.

6.4 NOTICE TO PROCEED

6.4.1 The Owner will issue a written Notice to Proceed to the Contractor stipulating the date from which Contract Time will be charged and the date Contract Time is to expire, subject to valid modifications of the Contract authorized by Change Order.

6.5 FAILURE TO EXECUTE CONTRACT

6.5.1 Failure to return the signed Contract with acceptable Contract Bonds and Certificate of Insurance within five (5) calendar days after the date of the Notice of Award shall be just cause for the cancellation of the award and the forfeiture of the Bid Security, which shall become the property of the Owner, not as a penalty, but

in liquidation of damages sustained. Award may then be made to the next lowest responsible Bidder, or the Work may be re-advertised and constructed under contract or otherwise, as the Owner may decide.

6.6 CONSTRUCTION TIME AND LIQUIDATED DAMAGES

- A. The Agreement will include a stipulation that Substantial Completion is to be completed on or before:

300 days after receipt of Notice to Proceed

- B. The Agreement will include a stipulation that liquidated damages will be established in the amount of

\$250.00 (Two Hundred Fifty)

per calendar day for each calendar day after the agreed completion date that the Work is not fully certified by the Architect as being Substantially Complete as that stage of completion is defined in the Conditions of the Contract.

END OF SECTION 00-1000

**SECTION 00-3100
BID FORM**

TO: City of Truth or Consequences
hereinafter called "Owner"

1. The undersigned, having examined the proposed Contract Documents titled:

T or C Animal Shelter

and having visited the site and examined the conditions affecting the Work, hereby proposes and agrees to furnish all labor, materials, equipment, and appliances, and to perform operations necessary to complete the Work as required by said proposed Contract Documents, for that portion of the "Base Bid" excluding additive alternates.

_____ (\$) _____
Base Bid Proposal Amount (Before Taxes)

_____ (\$) _____
Gross Receipts Tax – Base Bid Proposal

_____ (\$) _____
Grand Base Bid Proposal (Including Taxes)

3. The undersigned understands and agrees to comply with and be bound by instructions to bidders issued for this Work.
4. The undersigned acknowledges receipt of Addenda numbers:

5. Enclosed with this bid is bid security in the amount of not less than 5% of the bidder's proposed Contract Sum.

BIDDER

(
(
(
(
(CORPORATE SEAL)
(
(
(
(
(

By: _____

Address: _____

License Number: _____

License Type: _____

Resident Contractor Preference No. _____

Type of business entity:

(corporation, co-partnership, individual, etc.)

Individual members of the firm:

President of corporation: _____

Secretary of corporation: _____

Corporation is organized under laws of the State of _____

Bid dated this _____ day of _____ 2016.

BID BOND

KNOW ALL MEN BY THESE PRESENT, that we, the undersigned, _____ as Principal, and _____ as Surety, are hereby held firmly bound unto _____ as owner in the penal sum of _____ for the payment of which, well and truly to be made, we hereby jointly and severally bind ourselves, our heirs, executors, administrators, successors and assigns.

Signed, this _____ day of _____ 2016.

The condition of the above obligation is such that whereas the Principal has submitted to _____ a certain Bid, attached hereto and hereby made a part hereof to enter into a contract in writing for _____.

NOW, THEREFORE,

- (a) If said Bid shall be rejected, or in the alternative,
- (b) If said Bid shall be accepted and the principal shall execute and deliver a contract in the Form of Contract attached hereto (properly completed in accordance with said Bid) and shall furnish a bond for his faithful performance of said contract and for the payment of all persons performing labor or furnishing materials in connection therewith, and shall in all other respects perform the agreement created by the acceptance of said Bid, then this obligation shall be void, otherwise the same shall remain in force and effect; it being expressly understood and agreed that the liability of the Surety for any and all claims hereunder shall, in no event, exceed the penal amount of this obligation as herein stated.

The Surety, for value received, hereby stipulates and agrees that the obligations of said Surety and its bond shall be in no way impaired or affected by any extension of the time within which the owner may accept such Bid; and said Surety does hereby waive notice of any such extension.

IN WITNESS WHEREOF, the Principal and the Surety have hereunto set their hands and seals, and such of them as are corporations have caused their corporate seals to be hereto affixed and these presents to be signed by their proper officers, the day and year first set forth above.

Principal (L.S.)

Surety

By: _____

SEAL

PAYMENT BOND

KNOW ALL MEN BY THESE PRESENTS: That we, the undersigned _____ hereinafter called "Principal" and _____ hereinafter called the "Surety", a corporation authorized under the laws of the State of _____ and authorized to transact business in the State of New Mexico, are held and firmly bound unto _____ hereinafter called "OWNER" in the penal sum of _____ dollars (\$ _____) in lawful money of the United States, for the payment of which sum well and truly to be made, we bind ourselves, our heirs, executors, administrators, and successors, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION is such that Whereas, the Principal entered into a written contract with the Owner, dated the _____ day of _____, 2016, a copy of which is hereto attached and made a part hereof for the construction of:

NOW, THEREFORE, if the Principal shall promptly make payment to all persons, firms, subcontractors, and corporations furnishing materials for or performing labor in the prosecution of the work provided for in such contract, and any authorized extension or modification thereof, including all amounts due for materials, lubricants, oil, gasoline, repairs on machinery, equipment and tools, consumed or used in connection with the construction of such work whether by subcontractor or otherwise, then this obligation shall be void; otherwise to remain in full force and effect.

PROVIDED FURTHER, that the said Surety, for value received, hereby stipulates and agrees that no change, extension of time, alteration or addition to the terms of the contract or to the work to be performed thereunder or the specifications accompanying the same shall in any wise affect its obligation or this bond, and it does hereby waive notice of any such change, extension of time, alteration or extension of time, alteration or addition to the terms of the contract or to the specifications.

PROVIDED FURTHER, that no final settlement between the Owner and the Contractor shall abridge the right of any beneficiary hereunder, whose claim may be unsatisfied.

IN WITNESS WHEREOF, this instrument is executed in four (4) counterparts, each one of which shall be deemed an original, this the _____ day of _____ 2016.

ATTEST:

(Principal) Secretary

Principal

By: _____

Address

(SEAL)

Witness as to Principal

Address

ATTEST:

(Surety) Secretary

Surety

By: _____
Attorney-in-Fact

Address

(SEAL)

Witness as to Surety

Address

PERFORMANCE BOND

KNOW ALL MEN BY THESE PRESENTS: That we, the undersigned _____ hereinafter called "Principal" and _____ hereinafter called the "surety" a corporation authorized under the laws of the State of _____ and authorized to transact business in the State of New Mexico, are held and firmly bound unto _____ hereinafter called "OWNER" in the penal sum of _____ dollars (\$_____) in lawful money of the United States, for the payment of which sum well and truly to be made, we bind ourselves, our heirs, executors, administrators, and successors, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION is such that Whereas, the Principal entered into a written contract with the Owner, dated the _____ day of _____, 2008, a copy of which is hereto attached and made a part hereof for the construction of:

NOW THEREFORE, if the Principal shall truly and faithfully perform its duties, all the undertakings, covenants, terms, conditions, and agreements of said contract during the original term thereof, and any extensions thereof which may be granted by the Owner with or without notice to the Surety, and if he shall satisfy all claims and demands incurred under such contract, and shall fully indemnify and save harmless the Owner from all costs and damages which it may suffer by reason of failure to do so, and shall reimburse and repay the Owner all outlay and expense which the Owner may incur in making good any default, and if the said principal shall for a period of one (1) year from the immediately following the completion of said contract and acceptance thereof by the Owner guarantee all work performed under the contract against faulty or defective materials and workmanship at his own expense and at no cost to the Owner, then this obligation shall be void; otherwise to remain in full force and effect.

PROVIDED FURTHER, that the said Surety, for value received, hereby stipulates and agrees that no change, extension of time, alteration or addition to the terms of the contract or to the work to be performed thereunder of the specifications accompanying the same shall in any wise affect its obligation or this bond, and it does hereby waive notice of any such change, extension of time, alteration or addition to the terms of the contract or to the specifications.

PROVIDED FURTHER, that no final settlement between the Owner and the Contractor shall abridge the right of any beneficiary hereunder, whose claim may be unsatisfied.

IN WITNESS WHEREOF, this instrument is executed in four (4) counterparts, each one of which shall be deemed an original, this the _____ day of _____ 2008.

ATTEST:

(Principal) Secretary

Principal

By: _____

Address

(SEAL)

Witness as to Principal

Address

ATTEST:

(Surety) Secretary

Surety

By: _____
Attorney-in-Fact

Address

(SEAL)

Witness as to Surety

Address

END OF SECTION 00-3100

**SECTION 00-4300
SUBCONTRACTORS LISTING**

TO: City of Truth or Consequences, New Mexico
hereinafter called "Owner"

1. Pursuant to bidding requirements for the Work titled:

Truth or Consequences Animal Shelter Addition

"Sub-contractors to be used on the project must be listed on the bid form in accordance with the requirements of the New Mexico Statute 13-4-34 Sub-contracting Fair Practice Act. Listed sub-contractors must be used to complete the project unless written approval is given for good and sufficient reason by the designated Owner's representative, whose decision is final. The listing threshold equals the greater of: one-half of one percent of Base Bid or \$5000.00. The Architect's estimate is \$1,060,000. Failure to conform to this requirement shall disqualify the bidder.

2. Portion of the Work:

Subcontractor name and address:

USE ADDITIONAL SHEETS IF REQUIRED

PROVIDE SIGNATURE IDENTICAL TO THAT SHOWN ON THE BID FORM

Bidder

by: _____

END OF SECTION 00-4300

**SECTION 00-5000
OWNER/CONTRACTOR AGREEMENT**

The form of Owner/Contractor Agreement to be executed is AIA Document A101, 1997 Edition.

END OF SECTION 00-5000

SECTION 00-6600

MINIMUM WAGE RATE INFORMATION

NEW MEXICO STATE MINIMUM WAGE RATES

The New Mexico State Minimum Wage Rates applicable for this Contract, as evidenced by the attached determination by the New Mexico Labor and Industrial Commission, shall be paid to all workers employed in the performance of the Work.

END OF SECTION 00-6600 – MINIMUM WAGE RATE INFORMATION

**SECTION 00-7000
GENERAL CONDITIONS**

The General Conditions of this contract shall be A.I.A. Document A201, 1997 edition, "General Conditions of the Contract for Construction", and is hereby made a part of the contract documents by reference.

A copy of the document may be viewed at the office of the Architect: NCA ARCHITECTS, P.A.
1306 Rio Grande Blvd. NW, Albuquerque, NM 87104.

END OF SECTION 00-7000

**SECTION 00-8000
SUPPLEMENTAL GENERAL CONDITIONS**

The following supplements modify the "General Conditions of the Contract for Construction," AIA Document A201, Fifteenth Edition, 1997. Where a portion of the General Conditions is modified or deleted by these Supplementary Conditions, the unaltered portions of the General Conditions shall remain in effect.

- A. OWNER'S REPRESENTATIVE: Owner's Representative shall be designated by the Owner in writing, and shall be authorized to act on the Owner's behalf with respect to the Project, the Work and the Contract Documents. The Owner's Representative may further designate in writing an assistant(s) (assistant Owner's Representative) to act on behalf of the Owner's Representative, with the authority (and any limitations thereon) to be defined in such written designation.
- B. Amend Paragraph 1.1.1.: To include the Instructions to Bidders, sample forms, the proposal form and the Contractor's bid as part of the contract documents.
- C. Amend Paragraph 1.1.5: Add the words Contract Documents, wherever located and whenever issued.
- D. Amend Paragraph 1.6.1.: Add at the end of the paragraph: "A set of original drawings and specifications shall be furnished by the Architect to become the property of the Owner."
- E. Amend Paragraph 3.3.1: Omit the last sentence of this paragraph beginning with, "If the Contractor is then instructed to proceed . . ."
- F. Omit Paragraph 3.4.2 in its entirety.
- G. Add the following Subparagraphs 3.4.4 and 3.4.5 directly under Subparagraph 3.4.3:
 - 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 (Division 1 of the Specifications).
 - 3.4.5 By making requests for substitutions based on Subparagraph 3.4.4 above, the Contractor:
 - 1. Represents that the Contractor has personally investigated the proposed substitute product and determined that it is equal or superior in all respects to that specified;
 - 2. Represents that the Contractor will provide the same warranty for the substitution that the Contractor would for that specified;
 - 3. Certifies that the cost data presented is complete and includes all related costs under this Contract except the Architect's redesign costs, and waives all claims for additional costs related to the substitution which subsequently become apparent;

4. Will coordinate the installation of the accepted substitute, making such changes as may be required for the Work to be complete in all respects.
- H. Amend Paragraph 3.18.1: Omit the word negligent so that the amended sentence reads, "but only to the extent caused by the acts or omissions of the contractor, . . ."
- I. Add Subparagraph 4.1.4: Wherever the term "Architect" occurs in the contract documents, it shall be replaced by the term "Architect/Engineer."
- J. Amend Paragraph 4.3.8: Omit the verbiage that reads, . . . "not exceeding 21 days after discovery" and insert the following: "Notice to Owner should be in conformance with New Mexico Tort Claims Act."
- K. Amend 5.2.1: Delete the first sentence of this Subparagraph and add the following as the first sentence: "Award of Subcontractors and other contracts for portions of the work are subject to the New Mexico Subcontractor's Fair Practices Act" and add as the revised second sentence the following: The Contractor, in accordance with the Subcontractors Fair Practices Act, shall furnish in writing to the Owner the names of persons or entities (including those who are to furnish materials or equipment fabricated to a special design) proposed for each principal portion of the Work."
- L. Amend Paragraph 7.3.6: In the first sentence, delete the words "a reasonable allowance for overhead and profit" and substitute "an allowance for overhead and profit in accordance with Clause 7.3.10.1 through 7.3.10.6 below."
- M. Add Subparagraph 7.3.10 directly under Subparagraph 7.3.9:
- 7.3.10 The allowance in Subparagraph 7.3.6, for the combined overhead and profit included in the total cost to the Owner shall be based on the following schedule:
1. For the Contractor/Subcontractor, for Work performed by that Contractor's/Subcontractor's own forces, overhead at (10%) ten percent of the cost, and profit at (10%) ten percent of the cost.
 2. For the Contractor, for Work performed by the Contractor's Subcontractor, (10%) ten percent of the amount due the Subcontractor.
 3. For each Subcontractor, for Work performed by the Subcontractor's Sub-subcontractors, (10%) ten percent of the amount due the Sub-subcontractor.
 4. Costs to which overhead and profit is to be applied shall be determined in accordance with Subparagraph 7.3.6.
 5. In order to facilitate checking of quotations for extras or credits, all proposals, except those so minor that their propriety can be seen by inspection, shall be accompanied by a complete itemization of costs including labor, materials and Subcontracts. Labor and materials shall be itemized in the manner prescribed above. Where major cost items are Subcontracts, they shall be itemized also. In no case will a change be approved without such itemization.

N. Add the following Clause 9.3.1.3 directly under 9.3.1.2:

9.3.1.3 Retainage will not be withheld on all work in place and for properly stored materials. Contractor will be required to provide evidence of security and an accurate accounting of stored materials to accompany periodic applications for payment.

0. Amend Article 11 - Insurance and Bonds: Delete Paragraphs 11.1 through 11.1.8, and substitute the following:

11.1 Contractor's Insurance Requirements

11.1.1 General Requirements: Contractor shall not commence nor continue to perform any Work unless he, at his own expense, has in full force and effect all required insurance. The Contractor shall not permit any Subcontractor to perform Work on the Project unless the Worker's Compensation Insurance requirements have been complied with by such Subcontractor. The types of insurance the Contractor shall obtain and maintain are set forth herein.

11.1.1.2 Worker's Compensation Insurance and Liability Insurance shall be maintained in full force and effect for the full warranty period provided for in the Contract Documents. [See Paragraph 12.2.2 of the General Conditions].

11.1.1.3 Insurers must be authorized to do business (and have an agent for service of process) in New Mexico and either (1) have an "A" policyholder's rating and a financial rating of at least Class XI in accordance with the most current Best's Rating; or (2) be acceptable to Owner as evidenced by Owner's written approval of such Insurer. If by the terms of any insurance to be provided herein, any mandatory deductibles are required, or if Contractor should so elect, with the written concurrence of Owner, to increase the mandatory deductible amounts or purchase insurance with voluntary deductible amounts, the Contractor shall be responsible (without entitlement to any reimbursement from Owner) for payment of the amount of the deductible in the event of a paid claim.

11.1.1.4 Certificates of insurance (and endorsements) must be on forms acceptable to Owner delivered to Owner prior to commencement of the Work. The Contractor shall furnish a Certificate of Insurance under either Accord 25/8/84 or Accord 25-S (11/85) form. The Certificate shall include a 30 day cancellation clause. The Certificate must include the provision the insurance company will mail 30 day written notice to THE QWNER. The wording will endeavor is not acceptable. Contractor surety shall provide Owner with a transmittal letter stating that all insurance documents have been reviewed and have met or exceeded the contract document requirements.

11.1.1.5 In addition, Contractor, if requested by Owner, shall deliver to Owner (within 10 days of Owner's request) a certified copy of any policies

called for herein. Contractor shall also immediately furnish Owner with copies of any endorsements, addenda, or amendments to such policies. If Owner is damaged by Contractor's failure to obtain and maintain the insurance called for herein, then Contractor shall be liable to Owner for all costs, expenses, and damages resulting therefrom. All insurance policies to be furnished by Contractor under this Agreement shall be subject to approval by Owner. All policies shall be on an occurrence (as opposed to claims made) basis.

P. Amend Paragraph 11.1.2: Delete Paragraphs 11.1.2 and substitute the following:

11.1.2 Workers Compensation and Employer's Liability Insurance. Contractor shall comply with all applicable provisions of the New Mexico Workers Compensation Act, the New Mexico Subsequent Injury Act, and the New Mexico Occupational Disease Disablement Law. Contractor shall procure and maintain during the life of the Agreement complete Worker's and Employer's Liability Insurance in accordance with New Mexico laws and regulations. Such insurance shall include coverage permitted under Section 59-10-7, N.M.S.A. 1978 for safety devices.

11.1.2.1 Contractor shall require each Subcontractor similarly to provide such coverage (or qualify as a self-insured) for all the latter's employees to be engaged in such Work. The Owner, the Architect, any consultants of Owner or Architect and its consultants, and each of their directors, officers, board members, representatives, agents, and employees, will not be responsible for any claims or actions occasioned by the failure of the Contractor to comply with this obligation of Contractor. Worker's Compensation coverage shall be carried in the amounts of the statutory limits. Contractor shall provide and shall cause each Subcontractor to provide Employer's Liability coverage of not less than \$100,000 - each person.

11.1.2.2 At the time of Contractor's execution of the Agreement, Contractor shall deliver to Owner a certificate(s) of insurance certifying that he has obtained full Worker's Compensation and Employer's Liability Insurance coverage for all persons whom he employs or may employ in carrying out the Work under the Agreement. Contractor shall maintain such coverage for the period of the Agreement (and the warranty period). At the same time, the Contractor shall deliver to Owner any required insurance endorsement(s) on forms approved by Owner. This insurance shall be in strict accordance with the requirements of the most current and applicable Worker's Compensation Insurance laws and regulations in the State where the Project is located.

Q. Amend Paragraph 11.1.3: Delete Paragraphs 11.1.3 and substitute the following:

11.1.3 Liability Insurance: The Contractor shall procure and maintain, during the life of the Agreement, an Owner's Protective Liability Insurance Policy. The policy will be written with the Owner, its officers, agents and employees as named insured. The policy shall provide limits as follows:

- 11.1.3.1 \$1,000,000 Bodily Injury and Property Damage per occurrence.
- 11.1.3.2 1,000,000 Bodily Injury and Property Damage Aggregate.
- 11.1.3.3 The Contractor shall procure and maintain, during the life of the Agreement, Commercial General Liability Insurance. The policy shall provide limits as follows, if under the ISO 11/85 policy.
 - 1. \$1,000,000 General Aggregate
 - 2. 1,000,000 Products/Completed Operations Aggregate
 - 3. 1,000,000 Personal Injury & Advertising Injury
 - 4. 1,000,000 Each Occurrence
 - 5. 50,000 Fire Damage (any one fire)
 - 6. 5,000 Medical Expense (any one person)
- 11.1.3.4 If coverage is provided under Comprehensive General Liability (prior to 11/85 I.S.O. policy) limits shall be:
 - 1. \$1,000,000 Bodily Injury and Property Damage combined per occurrence
 - 2. 1,000,000 Bodily Injury and Property Damage combined Aggregate
- 11.1.3.5 The policy must include:
 - 1. Premises/Operations, Independent Contractors, Products and Completed Operations, Contractual Liability Covering the Agreement, Broad Form Property Damage including Completed Operations, Personal Injury, and Underground coverage.
- 11.1.3.6 The Contractor shall procure and maintain, during the life of the Agreement Automobile Liability Insurance. The limits shall be:
 - 1. \$1,000,000 Combined Single Limit Bodily Injury or Property Damage per occurrence.
 - 2. Coverage must be on an "Any Auto" basis or include Owned, Hired and non-Owned Automobile Coverage.
- 11.1.3.7 Excess Insurance or Umbrella Liability Insurance will be acceptable in attaining above limits.

R. The following new Subparagraph 11.1.4 shall be inserted directly under Subparagraph 11.3.7:

- 11.1.4 Builder's Risk Insurance: Contractor shall obtain and maintain Builder's Risk "All Risk" insurance coverage (for full insurable value to replace or repair up to the Contract Sum, with provision for endorsements to increase coverage if the Contract Sum is increased). Such insurance coverage shall include the interests of Owner, Contractor, Subcontractor, and Sub-subcontractors in the

Work and shall insure (without limitation) against the perils of fire with extended coverage and shall include "all risk" insurance for physical loss or damage including, without duplication of coverage, theft, vandalism, and malicious mischief. Such coverage shall include completed Work in progress. If not covered by the "all risk" insurance, Contractor shall also obtain similar property insurance coverage on portions of the Work stored off the site or in transit when such portions of the Work are to be included in an Application for Payment. Such insurance shall include as additional insured: the Owner, the Owner's Representative, and each of their respective directors, officers, board members, employees, representatives, and agents. The form of coverage and policy called for herein must be accepted and approved by Owner.

11.1.4.1 Such insurance may have a deductible clause but not to exceed \$5,000. Contractor shall be liable for the deductible on any loss to which the deductible is applicable.

11.1.5 Any loss insured under this Subparagraph shall be adjusted with the Owner and made payable to Owner. Owner shall reimburse Contractor (or his Subcontractors) for insured losses incurred (for which they hadn't received payment) upon receipt of the insurance proceeds (less any deductible charged to the Owner).

11.1.6 Contractor shall deliver to Owner such endorsements to the coverage provided herein to insure coverage of the entire Work even if Owner should take partial occupancy of part of the Work before Substantial Completion is reached on all the Work. The policy shall contain a "Permission to Occupy" endorsement acceptable to Owner.

11.1.7 To the extent Contractor (or any Subcontractor) is reimbursed by Owner for any loss covered by the insurance provided in this Paragraph, then Contractor/Subcontractor shall waive any claim they have for such losses to the extent covered by the insurance called for in this Subparagraph.

11.1.8 Contractor's Liability Not Limited By Insurance: Nothing contained in these insurance requirements is to be construed as limiting the liability of the Contractor or the Contractor's Surety.

S. Amend Paragraph 13.2.2: Delete entire paragraph.

T. Amend Paragraph 14.4.3: Delete the following, ...“along with reasonable overhead and profit on the work not executed.”

END OF SECTION 00-8000

**SECTION 00-8200
GEOTECHNICAL CONDITIONS**

A Geo-technical Report has not been performed for this project.

END OF SECTION 00-8200

**SECTION 00-8510
DRAWINGS INDEX****TRUTH OF CONSEQUENCES ANIMAL SHELTER ADDITION**

G-001 COVER SHEET

GENERAL INFORMATION

G-101 GENERAL INFORMATION
G-200 CODE INFORMATION
G-201 CODE PLAN
G-211 ADA DETAILS

ARCHITECTURAL SITE

AS-101 SITE PLANS
AS-501 SITE DETAILS

STRUCTURAL

S-001 ABBREVIATIONS AND LEGEND
S-002 GENERAL STRUCTURAL NOTES
S-003 SPECIAL INSPECTION TABLES
S-101 FOUNDATION PLAN
S-311 FOUNDATION SECTIONS
S-601 SCHEDULES
S-721 TYPICAL MASONRY DETAILS

ARCHITECTURAL

AD-101 DEMOLITION FLOOR PLAN AND EXTERIOR ELEVATIONS
AD-311 DEMOLITION WALL SECTION
A-101 FLOOR PLAN
A-111 ROOF PLAN
A-121 REFLECTED CEILING PLAN
A-201 EXTERIOR ELEVATIONS
A-301 BUILDING SECTIONS
A-311 WALL SECTIONS
A-312 WALL SECTIONS
A-313 WALL SECTIONS
A-401 ENLARGED FLOOR PLAN AND INTERIOR ELEVATIONS
A-501 PLAN DETAILS
A-511 ROOF DETAILS
A-521 CEILING DETAILS
A-531 CASEWORK DETAILS
A-551 DOOR AND WINDOW DETAILS
A-601 PARTITION TYPES
A-602 PARTITION TYPES
A-611 ROOM FINISH SCHEDULE
A-621 DOOR SCHEDULE AND DOOR AND FRAME TYPES

PLUMBING

P-001 PLUMBING INFORMATION AND CALCULATIONS
P-002 PLUMBING SCHEDULES
P-101 PLUMBING FLOOR PLAN WASTE AND VENT

P-102 PLUMBING FLOOR PLAN WATER AND GAS
P-301 PLUMBING DETAILS

MECHANICAL

M-001 MECHANICAL SPECIFICATIONS
M-002 MECHANICAL SCHEDULES
M-003 MECHANICAL ENERGY CALCULATIONS
M-101 MECHANICAL FLOOR PLAN
M-201 MECHANICAL DETAILS

ELECTRICAL

E-001 FIXTURE SCHEDULE, GENERAL NOTES, SYMBOL LEGEND
ES-101 ELECTRICAL SITE PLAN
EL-101 ELECTRICAL LIGHTING PLAN
EP-101 ELECTRICAL POWER PLAN

END OF SECTION 00-8510

SECTION 01-1000 SUMMARY

PART 1 - GENERAL

1.1 PROJECT MANUAL

- 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 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.

1.3 SUMMARY

- A. Section includes:

1. Project information.
2. Work covered by Contract Documents.
3. Work by Owner.
4. Owner-furnished products.
5. Contractor-furnished, Owner-installed products.
6. Access to site.
7. Coordination with occupants.
8. Work restrictions.
9. Specification and drawing conventions.

- B. Related Section:

1. Division 01 Section "Temporary Facilities and Controls" for limitations and procedures governing temporary use of Owner's facilities.

1.4 PROJECT INFORMATION

- A. Project Identification: Truth or Consequences Animal Shelter Addition

1. Project Location: 1101 Cedar Street, Building C, T or C, New Mexico 87901

- B. Owner: City of Truth or Consequences NM

1. Owner's Representative: Traci Alvarez, 505 Sims, Truth or Consequences, New Mexico 87901 Phone: 575.952.0565. talvarez@torcnm.org

- C. Architect: NCA Architects,

1. Project Manager: Dave Puritz - 1306 Rio Grande Blvd. NW. Albuquerque, New Mexico. 87104. Phone: 505.238.7814. dpuritz@nca-architects.com

1.5 WORK COVERED BY CONTRACT DOCUMENTS

- A. This project consists of a new 1,766 sf metal building addition to the existing T or C Animal Shelter facility including new kennels, office, break room, dog bathing room, storage room and all associated Mechanical and Electrical work. Some minor sitework is also included in this project.

1.6 WORK BY OWNER

- A. General: Cooperate fully with Owner so work may be carried out smoothly, without interfering with or delaying work under this Contract or work by Owner. Coordinate the Work of this Contract with work performed by Owner.

1.7 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/ Contractor installed products: The Work includes receiving the products from the Owner's location and installing the product in the specified area and making building service connections.
 - 1. Refrigerator, freezer
 - 2. Furniture
 - 3. Office and veterinarian equipment
 - 4. Other items as indicated in the Drawings.

1.8 ACCESS TO SITE

- A. 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.
- B. Use of Site: Limit use of Project site to areas within the Contract limits indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated.
 - 1. Limits: Confine construction operations to that indicated in the construction drawings.
 - 2. Driveways, Walkways and Entrances: Keep driveways and entrances serving premises clear and available to Owner, Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or storage of materials.
 - a. Schedule deliveries to minimize use of driveways and entrances by construction operations.
 - b. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.

1.9 COORDINATION WITH OCCUPANTS

- A. The building and site are not currently occupied.

1.10 WORK RESTRICTIONS

- A. Work Restrictions, General: Comply with restrictions on construction operations.
 - 1. Comply with limitations on use of public streets and other requirements of authorities having jurisdiction.
- B. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after providing temporary utility services according to requirements indicated:
 - 1. Notify Owner not less than five days in advance of proposed utility interruptions.
 - 2. Obtain Owner's written permission before proceeding with utility interruptions.
- C. Noise, Vibration, and Odors: Coordinate operations that may result in high levels of noise and vibration, odors, or other disruption to Owner occupancy with Owner.
 - 1. Notify Owner not less than five days in advance of proposed disruptive operations.
 - 2. Obtain Owner's written permission before proceeding with disruptive operations.
- D. Controlled Substances: Use of tobacco products and other controlled substances on the Project site is not permitted.

1.11 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.

1.12 MISCELLANEOUS PROVISIONS

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01-1000

SECTION 01-2500 SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for substitutions.
- B. Related Sections:
 - 1. Division 01 Section "Allowances" for products selected under an allowance.
 - 2. Division 01 Section "Alternates" for products selected under an alternate.
 - 3. Division 01 Section "Product Requirements" for requirements for submitting comparable product submittals for products by listed manufacturers.
 - 4. Divisions 02 through 49 Sections for specific requirements and limitations for substitutions.

1.3 DEFINITIONS

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

1.4 SUBMITTALS

- A. Substitution Requests: Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
 - 1. Substitution Request Form: Use 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 cannot 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.
 - 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 10 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.

PART 3 - EXECUTION (Not Used)

END OF SECTION 01-2500

SECTION 01-2600 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."

1.4 PROPOSAL REQUESTS

- A. Owner-Initiated Proposal Requests: Architect will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.
 - 1. Proposal Requests issued by Architect are not instructions either to stop work in progress or to execute the proposed change.
 - 2. Within time specified in Proposal Request or 10 days, when not otherwise specified, after receipt of Proposal Request, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.
 - a. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
 - b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
 - c. Include costs of labor and supervision directly attributable to the change.
 - d. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
 - e. Quotation Form: Use CSI Form 13.6B "Proposal Worksheet Summary" and 13.6C "Proposal Worksheet Detail".

- B. Contractor-Initiated Proposals: If latent or changed conditions require modifications to the Contract, Contractor may initiate a claim by submitting a request for a change to Architect.
1. Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.
 2. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
 3. Indicate 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 CSI Form 13.6A "Change Order Request (Proposal)" with attachments CSI Form 13.6B "Proposal Worksheet Summary" and 13.6C "Proposal Worksheet Detail".

1.5 CHANGE ORDER PROCEDURES

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

1.6 CONSTRUCTION CHANGE DIRECTIVE

- A. Construction Change Directive: Architect may issue a Construction Change Directive on AIA Document G714 Change Directive instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.
1. Construction Change Directive contains a complete description of change in the Work. It also designates method to be followed to determine change in the Contract Sum or the Contract Time.
- B. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.
1. 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 01-2600

SECTION 01-2900 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.
- B. Related Sections:
 - 1. Division 01 Section "Allowances" for procedural requirements governing the handling and processing of allowances.
 - 2. Division 01 Section "Contract Modification Procedures" for administrative procedures for handling changes to the Contract.
 - 3. Division 01 Section "Construction Progress Documentation" for administrative requirements governing the preparation and submittal of the Contractor's construction schedule.
 - 4. Division 01 Section "Submittal Procedures" for administrative requirements governing the preparation and submittal of the submittal schedule.
 - 5. Division 01 Section "Sustainable Design Requirements" for administrative requirements governing submittal of cost breakdown information required for LEED documentation.

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. Submit the schedule of values to Architect at earliest possible date but no later than 15 days before the date scheduled for submittal of initial Applications for Payment.

3. Subschedules for Separate Elements of Work: Where the Contractor's construction schedule defines separate elements of the Work, provide subschedules showing values correlated with each element.
- 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 two 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. If required, include evidence of insurance.
 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. Payment Application Times: Progress payments shall be submitted to Architect by the 20th day of the month. The period covered by each Application for Payment is one month, ending on the last day of the month.
 1. Submit draft copy of Application for Payment seven days prior to due date for review by Architect.
- D. Application for Payment Forms: Use AIA Document G702 and AIA Document G703 as form for Applications for Payment.
- 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 Five signed and notarized original copies of each Application for Payment to Architect by a method ensuring receipt. 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.
 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. 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.
- K. 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 01-2900

SECTION 01-3100 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 meetings.
- B. Each contractor shall participate in coordination requirements. Certain areas of responsibility are assigned to a specific contractor.
- C. Related Sections:
 - 1. Division 01 Section "Construction Progress Documentation" for preparing and submitting Contractor's construction schedule.
 - 2. Division 01 Section "Execution" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.
 - 3. Division 01 Section "Closeout Procedures" for coordinating closeout of the Contract.

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. Preinstallation conferences.
 - 7. Project closeout activities.
 - 8. Startup and adjustment of systems.
 - 9. Project closeout activities.
- D. Conservation: Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials. Coordinate use of temporary utilities to minimize waste.
 - 1. Salvage materials and equipment involved in performance of, but not actually incorporated into, the Work. Refer to other Sections for disposition of salvaged materials that are designated as Owner's property.

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.

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 in the form specified.
 - 1. Architect will return RFIs submitted to Architect by other entities controlled by Contractor with no response.
 - 2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.
- B. 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 and Construction Manager.
 - 6. RFI number, numbered sequentially.
 - 7. RFI subject.
 - 8. Specification Section number and title and related paragraphs, as appropriate.
 - 9. Drawing number and detail references, as appropriate.
 - 10. Field dimensions and conditions, as appropriate.
 - 11. Contractor's suggested resolution. If Contractor's solution(s) impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
 - 12. Contractor's signature.
 - 13. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.
 - a. Include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments on attached sketches.

- C. RFI Forms: AIA Document G716.
- D. Architect's Action: Architect will review each RFI, determine action required, and respond. Allow seven working 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 and Construction Manager'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. Software log with not less than the following:
 - 1. Project name.
 - 2. Name and address of Contractor.
 - 3. Name and address of Architect.
 - 4. RFI number including RFIs that were dropped and not submitted.
 - 5. RFI description.
 - 6. Date the RFI was submitted.
 - 7. Date Architect's response was received.
 - 8. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.
 - 9. Identification of related Field Order, Work Change Directive, and Proposal Request, as appropriate.

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 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, 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, and Owner's Commissioning Authority, 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 a Project closeout conference, at a time convenient to Owner and Architect, but no later than 30 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, Owner's Commissioning Authority, 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 weekly intervals.
 - 1. Coordinate dates of meetings with preparation of payment requests.
 - 2. Attendees: In addition to representatives of Owner, Owner's Commissioning Authority and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
 - 3. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
 - a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
 - 1) Review schedule for next period.
 - b. Review present and future needs of each entity present, including the following:
 - 1) 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 weekly intervals. Project coordination meetings are in addition to specific meetings held for other purposes, such as progress meetings and preinstallation conferences.
 1. **Attendees:** In addition to representatives of Owner, Owner's Commissioning Authority 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 01-3100

SECTION 01-3200 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. Start-up construction schedule.
 - 2. Contractor's construction schedule.
 - 3. Daily construction reports.
 - 4. Material location reports.
 - 5. Field condition reports.
 - 6. Special reports.
- B. Related Sections:
 - 1. Division 01 Section "Submittal Procedures" for submitting schedules and reports.
 - 2. Division 01 Section "Quality Requirements" for submitting a schedule of tests and inspections.

1.3 DEFINITIONS

- A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction project. Activities included in a construction schedule consume time and resources.
 - 1. Critical Activity: An activity on the critical path that must start and finish on the planned early start and finish times.
 - 2. Predecessor Activity: An activity that precedes another activity in the network.
 - 3. Successor Activity: An activity that follows another activity in the network.
- B. Cost Loading: The allocation of the schedule of values for the completion of an activity as scheduled. The sum of costs for all activities must equal the total Contract Sum, unless otherwise approved by Architect.
- C. CPM: Critical path method, which is a method of planning and scheduling a construction project where activities are arranged based on activity relationships. Network calculations determine when activities can be performed and the critical path of the Project.
- D. Critical Path: The longest connected chain of interdependent activities through the network schedule that establishes the minimum overall Project duration and contains no float.
- E. Event: The starting or ending point of an activity.

- F. Float: The measure of leeway in starting and completing an activity.
 - 1. Float time is not for the exclusive use or benefit of either Owner or Contractor, but is a jointly owned, expiring Project resource available to both parties as needed to meet schedule milestones and Contract completion date.
 - 2. Free float is the amount of time an activity can be delayed without adversely affecting the early start of the successor activity.
 - 3. Total float is the measure of leeway in starting or completing an activity without adversely affecting the planned Project completion date.
- G. Resource Loading: The allocation of manpower and equipment necessary for the completion of an activity as scheduled.

1.4 INFORMATIONAL SUBMITTALS

- A. Format for Submittals: Submit required submittals in the following format:
 - 1. PDF electronic file.
 - 2. Two paper copies.
- B. Start-up construction schedule.
 - 1. Approval of cost-loaded start-up construction schedule will not constitute approval of schedule of values for cost-loaded activities.
- C. Start-up Network Diagram: Of size required to display entire network for entire construction period. Show logic ties for activities.
- D. Contractor's Construction Schedule: Initial schedule, of size required to display entire schedule for entire construction period.
 - 1. Submit a working electronic copy of schedule, using software indicated, and labeled to comply with requirements for submittals. Include type of schedule (initial or updated) and date on label.
- E. CPM Reports: Concurrent with CPM schedule, submit each of the following reports. Format for each activity in reports shall contain activity number, activity description, cost and resource loading, original duration, remaining duration, early start date, early finish date, late start date, late finish date, and total float in calendar days.
 - 1. Activity Report: List of all activities sorted by activity number and then early start date, or actual start date if known.
 - 2. Logic Report: List of preceding and succeeding activities for all activities, sorted in ascending order by activity number and then early start date, or actual start date if known.
 - 3. Total Float Report: List of all activities sorted in ascending order of total float.
 - 4. Earnings Report: Compilation of Contractor's total earnings from commencement of the Work until most recent Application for Payment.
- F. Daily Construction Reports: Submit at monthly intervals.
- G. Material Location Reports: Submit at monthly intervals.
- H. Field Condition Reports: Submit at time of discovery of differing conditions.

- I. Special Reports: Submit at time of unusual event.
- J. Qualification Data: For scheduling consultant.

1.5 QUALITY ASSURANCE

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

1.6 COORDINATION

- A. Coordinate preparation and processing of schedules and reports with performance of construction activities and with scheduling and reporting of separate contractors.
- B. Coordinate Contractor's construction schedule with the schedule of values, submittal schedule, progress reports, payment requests, and other required schedules and reports.
 - 1. Secure time commitments for performing critical elements of the Work from entities involved.
 - 2. Coordinate each construction activity in the network with other activities and schedule them in proper sequence.

PART 2 - PRODUCTS

2.1 CONTRACTOR'S CONSTRUCTION SCHEDULE, GENERAL

- A. Time Frame: Extend schedule from date established for the Notice to Proceed to date of 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. Activity Duration: Define activities so no activity is longer than 20 days, unless specifically allowed by Architect.
 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 15 days for punch list and final completion.
- C. Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule, and show how the sequence of the Work is affected.
1. Phasing: Arrange list of activities on schedule by phase.
 2. Work by Owner: Include a separate activity for each portion of the Work performed by Owner.
 3. Products Ordered in Advance: Include a separate activity for each product. Include delivery date indicated in Division 01 Section "Summary." Delivery dates indicated stipulate the earliest possible delivery date.
 4. Owner-Furnished Products: Include a separate activity for each product. Include delivery date indicated in Division 01 Section "Summary." Delivery dates indicated stipulate the earliest possible delivery date.
 5. 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.
 6. Work Stages: Indicate important stages of construction for each major portion of the Work, including, but not limited to, the following:
 - a. Subcontract awards.
 - b. Submittals.
 - c. Purchases.
 - d. Mockups.
 - e. Fabrication.
 - f. Sample testing.
 - g. Deliveries.
 - h. Installation.
 - i. Tests and inspections.
 - j. Adjusting.
 - k. Curing.
 - l. Startup and placement into final use and operation.
 7. 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. 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.
- F. Recovery Schedule: When periodic update indicates the Work is 14 or more calendar days behind the current approved schedule, submit a separate recovery schedule indicating means by which Contractor intends to regain compliance with the schedule. Indicate changes to working hours, working days, crew sizes, and equipment required to achieve compliance, and date by which recovery will be accomplished.

2.2 START-UP CONSTRUCTION SCHEDULE

- A. Bar-Chart Schedule: Submit start-up horizontal bar-chart-type construction schedule within seven days of date established for the Notice to Proceed.
- B. Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line. Outline significant construction activities for first 90 days of construction. Include skeleton diagram for the remainder of the Work and a cash requirement prediction based on indicated activities.

2.3 CONTRACTOR'S CONSTRUCTION SCHEDULE (GANTT CHART)

- A. Gantt-Chart Schedule: Submit a comprehensive, fully developed, horizontal Gantt-chart-type, Contractor's construction schedule within 30 days of date established for the Notice of Award. Base schedule on the start-up construction schedule and additional information received since the start of Project.
- B. Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line.
 - 1. For construction activities that require three months or longer to complete, indicate an estimated completion percentage in 10 percent increments within time bar.

2.4 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: At monthly intervals, prepare and submit a comprehensive list of materials delivered to and stored at Project site. List shall be cumulative, showing materials previously reported plus items recently delivered. Include with list a statement of progress on and delivery dates for materials or items of equipment fabricated or stored away from Project site.
- 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.

2.5 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. 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.
- B. Distribution: Distribute copies of approved schedule to Architect, Owner, separate contractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.
1. Post copies in Project meeting rooms and temporary field offices.
 2. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.

END OF SECTION 01-3200

SECTION 01-3300 SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes requirements for the submittal schedule and administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.
- B. Related Sections:
 - 1. Division 01 Section "Payment Procedures" for submitting Applications for Payment and the schedule of values.
 - 2. Division 01 Section "Construction Progress Documentation" for submitting schedules and reports, including Contractor's construction schedule.
 - 3. Division 01 Section "Operation and Maintenance Data" for submitting operation and maintenance manuals.
 - 4. Division 01 Section "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.

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.
 - a. Submit revised submittal schedule to reflect changes in current status and timing for submittals.
4. Format: Arrange the following information in a tabular format:
 - a. Scheduled date for first submittal.
 - b. Specification Section number and title.
 - c. Submittal category: Action, informational.
 - d. Name of subcontractor.
 - e. Description of the Work covered.
 - f. Scheduled date for Architect's final release or approval.
 - g. Scheduled dates for 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 of the Contract Drawings will be provided by Architect for Contractor's use in preparing submittals upon written request by the Contractor. Signed waiver forms and fees may be required and are indicated in the specifications. Architect makes no representations as to the accuracy or completeness of digital data files as they relate to the Contract Documents.
- B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.
 1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
 2. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.
 3. Submit action submittals and informational submittals required by the same Specification Section as separate packages under separate transmittals.
 4. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.
 - a. Architect 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.

1. Initial Review: Allow 15 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect advise Contractor when a submittal being processed must be delayed for coordination.
 2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
 3. Resubmittal Review: Allow 15 days for review of each resubmittal.
 4. Sequential Review: Where sequential review of submittals by Architect's consultants, Owner, or other parties is indicated, allow 21 days for initial review of each submittal.
- D. Identification and Information: Place a permanent label or title block on each paper copy submittal item for identification.
1. Indicate name of firm or entity that prepared each submittal on label or title block.
 2. Provide a space approximately 6 by 8 inches on label or beside title block to record Contractor's review and approval markings and action taken by Architect.
 3. Include the following information for processing and recording action taken:
 - a. Project name.
 - b. Date.
 - c. Name of Architect.
 - d. Name of Contractor.
 - e. Name of subcontractor.
 - f. Name of supplier.
 - g. Name of manufacturer.
 - h. Submittal number 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. Options: Identify options requiring selection by the Architect.
- F. Deviations: Identify deviations from the Contract Documents on submittals.
- G. 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.
1. Submit one copy of submittal to concurrent reviewer in addition to specified number of copies to Architect.
- H. Transmittal: Assemble each submittal individually and appropriately for transmittal and handling. Transmit each submittal using a transmittal form. Architect will discard submittals received from sources other than Contractor.
1. Transmittal Form: Use AIA Document G810.

2. Transmittal Form: Provide locations on form for the following information:

- a. Project name.
- b. Date.
- c. Destination (To:).
- d. Source (From:).
- e. Names of subcontractor, manufacturer, and supplier.
- f. Category and type of submittal.
- g. Submittal purpose and description.
- h. Specification Section number and title.
- i. Indication of full or partial submittal.
- j. Drawing number and detail references, as appropriate.
- k. Transmittal number.
- l. Submittal and transmittal distribution record.
- m. Remarks.
- n. Signature of transmitter.

3. 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.

I. Re-submittals: Make re-submittals in same form and number of copies as initial submittal.

1. Note date and content of previous submittal.
2. Note date and content of revision in label or title block and clearly indicate extent of revision.
3. Resubmit submittals until they are marked with approval notation from Architect's stamp.

J. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.

K. Use for Construction: Use only final submittals that are marked with approval notation from Architect's action stamp.

L. Submittals must be grouped together based on materials/equipment type. As an example, please make every effort to include all of the projects lights in the lighting submittal and all the plumbing fixtures in the plumbing submittal. Contact the architect if unique time constraints prohibit this.

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. Action Submittals: Submit five paper copies of each submittal, unless otherwise indicated. Architect will return two copies.

2. Informational Submittals: Submit five paper copies of each submittal, unless otherwise indicated. Architect will not return copies.
 3. Closeout Submittals and Maintenance Material Submittals: Comply with requirements specified in Division 01 Section "Closeout Procedures."
 4. 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 notarized statement on original paper copy certificates and certifications where indicated.
 5. 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. Five paper copies of Product Data, unless otherwise indicated. Architect will return two copies.
- C. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data, unless submittal based upon Architect's digital data drawing files is otherwise permitted.
1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
 - a. Identification of products.
 - b. Schedules.

- c. Compliance with specified standards.
 - d. Notation of coordination requirements.
 - e. Notation of dimensions established by field measurement.
 - f. Relationship and attachment to adjoining construction clearly indicated.
 - g. Seal and signature of professional engineer if specified.
 2. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches but no larger than 30 by 42 inches.
 3. Submit Shop Drawings in the following format:
 - a. Five opaque copies of each submittal. Architect will retain two copies; remainder will be returned.
- 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 two 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 three sets of Samples. Architect will retain two Sample sets; remainder will be returned.

- 1) Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
 - 2) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least three sets of paired units that show approximate limits of variations.
- E. Product Schedule: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:
1. Type of product. Include unique identifier for each product.
 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. Five paper copies of product schedule or list, unless otherwise indicated. Architect will return two copies.
- 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. Number of Copies: Five paper copies of subcontractor list, unless otherwise indicated. Architect will return two copies.
- 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.

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.
- 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 discarded.
- F. Submittals not required by the Contract Documents may not be reviewed and may be discarded.

END OF SECTION 01-3300

SECTION 01-4000 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. Division 01 Section "Allowances" for testing and inspecting allowances.
 - 2. Division 01 Section "Construction Progress Documentation" for developing a schedule of required tests and inspections.
 - 3. 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. 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.
- 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 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. Contractor's Statement of Responsibility: When required by authorities having jurisdiction, submit copy of written statement of responsibility sent to authorities having jurisdiction before starting work on the following systems.
 - 1. Seismic-force resisting system, designated seismic system, or component listed in the designated seismic system quality assurance plan prepared by the Architect.
 - 2. Main wind-force resisting system or a wind-resisting component listed in the wind-force-resisting system quality assurance plan prepared by the Architect.
- D. Testing Agency Qualifications: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.
- E. Schedule of Tests and Inspections: Prepare in tabular form and include the following:
 - 1. Specification Section number and title.
 - 2. Entity responsible for performing tests and inspections.
 - 3. Description of test and inspection.
 - 4. Identification of applicable standards.
 - 5. Identification of test and inspection methods.
 - 6. Number of tests and inspections required.
 - 7. Time schedule or time span for tests and inspections.
 - 8. Requirements for obtaining samples.
 - 9. Unique characteristics of each quality-control service.

1.6 CONTRACTOR'S QUALITY-CONTROL PLAN

- A. Quality-Control Plan, General: Submit quality-control plan within 10 days of Notice of Award 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.

1.7 REPORTS AND DOCUMENTS

- A. Test and Inspection Reports: Prepare and submit certified written reports specified in other Sections. Include the following:
1. Date of issue.
 2. Project title and number.
 3. Name, address, and telephone number of testing agency.
 4. Dates and locations of samples and tests or inspections.
 5. Names of individuals making tests and inspections.
 6. Description of the Work and test and inspection method.
 7. Identification of product and Specification Section.
 8. Complete test or inspection data.
 9. Test and inspection results and an interpretation of test results.
 10. Record of temperature and weather conditions at time of sample taking and testing and inspecting.
 11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
 12. Name and signature of laboratory inspector.
 13. Recommendations on retesting and 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.

1.8 QUALITY ASSURANCE

- A. **General:** Qualifications paragraphs in this article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.
- B. **Manufacturer Qualifications:** A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- C. **Fabricator Qualifications:** A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- D. **Installer Qualifications:** A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.
- E. **Professional Engineer Qualifications:** A professional engineer who is legally qualified to practice in 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. Mockups: Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:
1. Build mockups in location and of size indicated or, if not indicated, as directed by Architect.
 2. Notify Architect seven 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.

1.9 QUALITY CONTROL

- A. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.
1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspecting they are engaged to perform.
 2. Payment for these services will be made from testing and inspecting allowances, as authorized by Change Orders.
 3. Costs for retesting and re-inspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to Contractor, and the Contract Sum will be adjusted by Change Order.
- B. Contractor Responsibilities: Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Perform additional quality-control activities required to verify that the Work complies with requirements, whether specified or not.
1. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.

2. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform these quality-control services.
 - a. Contractor shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.
 3. Notify testing agencies at least 48 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 preinstallation conferences, examination of substrates and conditions, verification of materials, observation of Installer activities, inspection of completed portions of the Work, and submittal of written reports.
- E. **Retesting/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.
- I. Schedule of Tests and Inspections: Prepare a schedule of tests, inspections, and similar quality-control services required by the Contract Documents as a component of the Contractor's quality-control plan. Coordinate and submit concurrently with Contractor's construction schedule. Update as the Work progresses. .
1. Distribution: Distribute schedule to Owner, Architect, testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.

1.10 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 in Special Inspection Tables indicated on sheet S-003 of the Construction Drawings 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 reinspecting 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 01-4000

SECTION 01-4200 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 Thomson Gale's "Encyclopedia of Associations" or in Columbia Books' "National Trade & Professional Associations of the U.S."
- B. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

AA	Aluminum Association, Inc. (The) www.aluminum.org	(703) 358-2960
AAADM	American Association of Automatic Door Manufacturers www.aaadm.com	(216) 241-7333
AABC	Associated Air Balance Council www.aabchq.com	(202) 737-0202
AAMA	American Architectural Manufacturers Association www.aamanet.org	(847) 303-5664
AASHTO	American Association of State Highway and Transportation Officials www.transportation.org	(202) 624-5800
AATCC	American Association of Textile Chemists and Colorists www.aatcc.org	(919) 549-8141
ABAA	Air Barrier Association of America www.airbarrier.org	(866) 956-5888
ABMA	American Bearing Manufacturers Association www.abma-dc.org	(202) 367-1155
ACI	American Concrete Institute www.concrete.org	(248) 848-3700
ACPA	American Concrete Pipe Association www.concrete-pipe.org	(972) 506-7216
AEIC	Association of Edison Illuminating Companies, Inc. (The) www.aeic.org	(205) 257-2530
AF&PA	American Forest & Paper Association www.afandpa.org	(800) 878-8878 (202) 463-2700

AGA	American Gas Association www.aga.org	(202) 824-7000
AGC	Associated General Contractors of America (The) www.agc.org	(703) 548-3118
AHA	American Hardboard Association (Now part of CPA)	
AHAM	Association of Home Appliance Manufacturers www.aham.org	(202) 872-5955
AI	Asphalt Institute www.asphaltinstitute.org	(859) 288-4960
AIA	American Institute of Architects (The) www.aia.org	(800) 242-3837 (202) 626-7300
AISC	American Institute of Steel Construction www.aisc.org	(800) 644-2400 (312) 670-2400
AISI	American Iron and Steel Institute www.steel.org	(202) 452-7100
AITC	American Institute of Timber Construction www.aitc-glulam.org	(303) 792-9559
ALCA	Associated Landscape Contractors of America (Now PLANET - Professional Landcare Network)	
ALSC	American Lumber Standard Committee, Incorporated www.alsc.org	(301) 972-1700
AMCA	Air Movement and Control Association International, Inc. www.amca.org	(847) 394-0150
ANSI	American National Standards Institute www.ansi.org	(202) 293-8020
AOSA	Association of Official Seed Analysts, Inc. www.aosaseed.com	(405) 780-7372
APA	Architectural Precast Association www.archprecast.org	(239) 454-6989
APA	APA - The Engineered Wood Association www.apawood.org	(253) 565-6600
APA EWS	APA - The Engineered Wood Association; Engineered Wood Systems (See APA - The Engineered Wood Association)	
API	American Petroleum Institute www.api.org	(202) 682-8000

ARI	Air-Conditioning & Refrigeration Institute www.ari.org	(703) 524-8800
ARMA	Asphalt Roofing Manufacturers Association www.asphaltroofing.org	(202) 207-0917
ASCE	American Society of Civil Engineers www.asce.org	(800) 548-2723 (703) 295-6300
ASCE/SEI	American Society of Civil Engineers/Structural Engineering Institute (See ASCE)	
ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers www.ashrae.org	(800) 527-4723 (404) 636-8400
ASME	ASME International (American Society of Mechanical Engineers International) www.asme.org	(800) 843-2763 (973) 882-1170
ASSE	American Society of Sanitary Engineering www.asse-plumbing.org	(440) 835-3040
ASTM	ASTM International (American Society for Testing and Materials International) www.astm.org	(610) 832-9500
AWCI	Association of the Wall and Ceiling Industry www.awci.org	(703) 534-8300
AWCMA	American Window Covering Manufacturers Association (Now WCMA)	
AWI	Architectural Woodwork Institute www.awinet.org	(571) 323-3636
AWPA	American Wood Protection Association (Formerly: American Wood Preservers' Association) www.awpa.com	(205) 733-4077
AWS	American Welding Society www.aws.org	(800) 443-9353 (305) 443-9353
AWWA	American Water Works Association www.awwa.org	(800) 926-7337 (303) 794-7711
BHMA	Builders Hardware Manufacturers Association www.buildershardware.com	(212) 297-2122
BIA	Brick Industry Association (The) www.bia.org	(703) 620-0010
BICSI	BICSI, Inc. www.bicsi.org	(800) 242-7405 (813) 979-1991

BIFMA	BIFMA International (Business and Institutional Furniture Manufacturer's Association International) www.bifma.com	(616) 285-3963
BISSC	Baking Industry Sanitation Standards Committee www.bissc.org	(866) 342-4772
BWF	Badminton World Federation (Formerly: IBF - International Badminton Federation) www.internationalbadminton.org	6-03-9283 7155
CCC	Carpet Cushion Council www.carpetcushion.org	(610) 527-3880
CDA	Copper Development Association www.copper.org	(800) 232-3282 (212) 251-7200
CEA	Canadian Electricity Association www.canelect.ca	(613) 230-9263
CEA	Consumer Electronics Association www.ce.org	(866) 858-1555 (703) 907-7600
CFFA	Chemical Fabrics & Film Association, Inc. www.chemicalfabricsandfilm.com	(216) 241-7333
CGA	Compressed Gas Association www.cganet.com	(703) 788-2700
CIMA	Cellulose Insulation Manufacturers Association www.cellulose.org	(888) 881-2462 (937) 222-2462
CISCA	Ceilings & Interior Systems Construction Association www.cisca.org	(630) 584-1919
CISPI	Cast Iron Soil Pipe Institute www.cispi.org	(423) 892-0137
CLFMI	Chain Link Fence Manufacturers Institute www.chainlinkinfo.org	(301) 596-2583
CRRC	Cool Roof Rating Council www.coolroofs.org	(866) 465-2523 (510) 485-7175
CPA	Composite Panel Association www.pbmdf.com	(301) 670-0604
CPPA	Corrugated Polyethylene Pipe Association www.cppa-info.org	(800) 510-2772 (202) 462-9607
CRI	Carpet and Rug Institute (The) www.carpet-rug.com	(800) 882-8846 (706) 278-3176
CRSI	Concrete Reinforcing Steel Institute www.crsi.org	(847) 517-1200

CSA	Canadian Standards Association	(800) 463-6727 (416) 747-4000
CSA	CSA International (Formerly: IAS - International Approval Services) www.csa-international.org	(866) 797-4272 (416) 747-4000
CSI	Cast Stone Institute www.caststone.org	(717) 272-3744
CSI	Construction Specifications Institute (The) www.csinet.org	(800) 689-2900 (703) 684-0300
CSSB	Cedar Shake & Shingle Bureau www.cedarbureau.org	(604) 820-7700
CTI	Cooling Technology Institute (Formerly: Cooling Tower Institute) www.cti.org	(281) 583-4087
DHI	Door and Hardware Institute www.dhi.org	(703) 222-2010
EIA	Electronic Industries Alliance www.eia.org	(703) 907-7500
EIMA	EIFS Industry Members Association www.eima.com	(800) 294-3462 (770) 968-7945
EJCDC	Engineers Joint Contract Documents Committee www.ejdc.org	(703) 295-5000
EJMA	Expansion Joint Manufacturers Association, Inc. www.ejma.org	(914) 332-0040
ESD	ESD Association (Electrostatic Discharge Association) www.esda.org	(315) 339-6937
ETL SEMCO	Intertek ETL SEMCO (Formerly: ITS - Intertek Testing Service NA) www.intertek.com	(800) 967-5352
FIBA	Federation Internationale de Basketball (The International Basketball Federation) www.fiba.com	41 22 545 00 00
FIVB	Federation Internationale de Volleyball (The International Volleyball Federation) www.fivb.ch	41 21 345 35 35
FM Approvals	FM Approvals LLC www.fmglobal.com	(781) 762-4300
FM Global	FM Global	(401) 275-3000

	(Formerly: FMG - FM Global) www.fmgglobal.com	
FMRC	Factory Mutual Research (Now FM Global)	
FRSA	Florida Roofing, Sheet Metal & Air Conditioning Contractors Association, Inc. www.floridarroof.com	(407) 671-3772
FSA	Fluid Sealing Association www.fluidsealing.com	(610) 971-4850
FSC	Forest Stewardship Council www.fsc.org	49 228 367 66 0
GA	Gypsum Association www.gypsum.org	(202) 289-5440
GANA	Glass Association of North America www.glasswebsite.com	(785) 271-0208
GRI	(Part of GSI)	
GS	Green Seal www.greenseal.org	(202) 872-6400
GSI	Geosynthetic Institute www.geosynthetic-institute.org	(610) 522-8440
HI	Hydraulic Institute www.pumps.org	(973) 267-9700
HI	Hydronics Institute www.gamanet.org	(908) 464-8200
HMMA	Hollow Metal Manufacturers Association (Part of NAAMM)	
HPVA	Hardwood Plywood & Veneer Association www.hpva.org	(703) 435-2900
HPW	H. P. White Laboratory, Inc. www.hpwhite.com	(410) 838-6550
IAS	International Approval Services (Now CSA International)	
IBF	International Badminton Federation (Now BWF)	
ICEA	Insulated Cable Engineers Association, Inc. www.icea.net	(770) 830-0369
ICRI	International Concrete Repair Institute, Inc. www.icri.org	(847) 827-0830

IEC	International Electrotechnical Commission www.iec.ch	41 22 919 02 11
IEEE	Institute of Electrical and Electronics Engineers, Inc. (The) www.ieee.org	(212) 419-7900
IESNA	Illuminating Engineering Society of North America www.iesna.org	(212) 248-5000
IEST	Institute of Environmental Sciences and Technology www.iest.org	(847) 255-1561
IGCC	Insulating Glass Certification Council www.igcc.org	(315) 646-2234
IGMA	Insulating Glass Manufacturers Alliance www.igmaonline.org	(613) 233-1510
ILI	Indiana Limestone Institute of America, Inc. www.iliai.com	(812) 275-4426
ISO	International Organization for Standardization www.iso.ch	41 22 749 01 11
	Available from ANSI www.ansi.org	(202) 293-8020
ISSFA	International Solid Surface Fabricators Association www.issfa.net	(877) 464-7732 (702) 567-8150
ITS	Intertek Testing Service NA (Now ETL SEMCO)	
ITU	International Telecommunication Union www.itu.int/home	41 22 730 51 11
KCMA	Kitchen Cabinet Manufacturers Association www.kcma.org	(703) 264-1690
LMA	Laminating Materials Association (Now part of CPA)	
LPI	Lightning Protection Institute www.lightning.org	(800) 488-6864
MBMA	Metal Building Manufacturers Association www.mbma.com	(216) 241-7333
MFMA	Maple Flooring Manufacturers Association, Inc. www.maplefloor.org	(888) 480-9138
MFMA	Metal Framing Manufacturers Association, Inc. www.metalframingmfg.org	(312) 644-6610
MH	Material Handling	

	(Now MHIA)	
MHIA	Material Handling Industry of America www.mhia.org	(800) 345-1815 (704) 676-1190
MIA	Marble Institute of America www.marble-institute.com	(440) 250-9222
MPI	Master Painters Institute www.paintinfo.com	(888) 674-8937 (604) 298-7578
MSS	Manufacturers Standardization Society of The Valve and Fittings Industry Inc. www.mss-hq.com	(703) 281-6613
NAAMM	National Association of Architectural Metal Manufacturers www.naamm.org	(630) 942-6591
NACE	NACE International (National Association of Corrosion Engineers International) www.nace.org	(800) 797-6623 (281) 228-6200
NADCA	National Air Duct Cleaners Association www.nadca.com	(202) 737-2926
NAGWS	National Association for Girls and Women in Sport www.aahperd.org/nagws/	(800) 213-7193, ext. 453
NAIMA	North American Insulation Manufacturers Association www.naima.org	(703) 684-0084
NBGQA	National Building Granite Quarries Association, Inc. www.nbgqa.com	(800) 557-2848
NCAA	National Collegiate Athletic Association (The) www.ncaa.org	(317) 917-6222
NCMA	National Concrete Masonry Association www.ncma.org	(703) 713-1900
NCPI	National Clay Pipe Institute www.ncpi.org	(262) 248-9094
NCTA	National Cable & Telecommunications Association www.ncta.com	(202) 775-2300
NEBB	National Environmental Balancing Bureau www.nebb.org	(301) 977-3698
NECA	National Electrical Contractors Association www.necanet.org	(301) 657-3110
NeLMA	Northeastern Lumber Manufacturers' Association www.nelma.org	(207) 829-6901

NEMA	National Electrical Manufacturers Association www.nema.org	(703) 841-3200
NETA	InterNational Electrical Testing Association www.netaworld.org	(888) 300-6382 (269) 488-6382
NFHS	National Federation of State High School Associations www.nfhs.org	(317) 972-6900
NFPA	NFPA (National Fire Protection Association) www.nfpa.org	(800) 344-3555 (617) 770-3000
NFRC	National Fenestration Rating Council www.nfrc.org	(301) 589-1776
NGA	National Glass Association www.glass.org	(866) 342-5642 (703) 442-4890
NHLA	National Hardwood Lumber Association www.natlhardwood.org	(800) 933-0318 (901) 377-1818
NLGA	National Lumber Grades Authority www.nlga.org	(604) 524-2393
NOFMA	NOFMA: The Wood Flooring Manufacturers Association (Formerly: National Oak Flooring Manufacturers Association) www.nofma.com	(901) 526-5016
NOMMA	National Ornamental & Miscellaneous Metals Association www.nomma.org	(888) 516-8585
NRCA	National Roofing Contractors Association www.nrca.net	(800) 323-9545 (847) 299-9070
NRMCA	National Ready Mixed Concrete Association www.nrmca.org	(888) 846-7622 (301) 587-1400
NSF	NSF International (National Sanitation Foundation International) www.nsf.org	(800) 673-6275 (734) 769-8010
NSSGA	National Stone, Sand & Gravel Association www.nssga.org	(800) 342-1415 (703) 525-8788
NTMA	National Terrazzo & Mosaic Association, Inc. (The) www.ntma.com	(800) 323-9736 (540) 751-0930
NTRMA	National Tile Roofing Manufacturers Association (Now TRI)	
NWWDA	National Wood Window and Door Association (Now WDMA)	
OPL	Omega Point Laboratories, Inc. (Now ITS)	

PCI	Precast/Prestressed Concrete Institute www.pci.org	(312) 786-0300
PDCA	Painting & Decorating Contractors of America www.pdca.com	(800) 332-7322 (314) 514-7322
PDI	Plumbing & Drainage Institute www.pdionline.org	(800) 589-8956 (978) 557-0720
PGI	PVC Geomembrane Institute http://pgi-tp.ce.uiuc.edu	(217) 333-3929
PLANET	Professional Landcare Network (Formerly: ACLA - Associated Landscape Contractors of America) www.landcarenetwork.org	(800) 395-2522 (703) 736-9666
PTI	Post-Tensioning Institute www.post-tensioning.org	(602) 870-7540
RCSC	Research Council on Structural Connections www.boltcouncil.org	
RFCI	Resilient Floor Covering Institute www.rfci.com	(301) 340-8580
RIS	Redwood Inspection Service www.redwoodinspection.com	(888) 225-7339 (415) 382-0662
SAE	SAE International www.sae.org	(877) 606-7323 (724) 776-4841
SDI	Steel Deck Institute www.sdi.org	(847) 458-4647
SDI	Steel Door Institute www.steeldoor.org	(440) 899-0010
SEFA	Scientific Equipment and Furniture Association www.sefalabs.com	(877) 294-5424 (516) 294-5424
SEI/ASCE	Structural Engineering Institute/American Society of Civil Engineers (See ASCE)	
SGCC	Safety Glazing Certification Council www.sgcc.org	(315) 646-2234
SIA	Security Industry Association www.siaonline.org	(866) 817-8888 (703) 683-2075
SIGMA	Sealed Insulating Glass Manufacturers Association (Now IGMA)	
SJI	Steel Joist Institute	(843) 626-1995

	www.steeljoist.org	
SMA	Screen Manufacturers Association www.smacentral.org	(561) 533-0991
SMACNA	Sheet Metal and Air Conditioning Contractors' National Association www.smacna.org	(703) 803-2980
SMPTE	Society of Motion Picture and Television Engineers www.smpte.org	(914) 761-1100
SPFA	Spray Polyurethane Foam Alliance (Formerly: SPI/SPFD - The Society of the Plastics Industry, Inc.; Spray Polyurethane Foam Division) www.sprayfoam.org	(800) 523-6154
SPIB	Southern Pine Inspection Bureau (The) www.spib.org	(850) 434-2611
SPRI	Single Ply Roofing Industry www.spri.org	(781) 647-7026
SSINA	Specialty Steel Industry of North America www.ssina.com	(800) 982-0355 (202) 342-8630
SSPC	SSPC: The Society for Protective Coatings www.sspc.org	(877) 281-7772 (412) 281-2331
STI	Steel Tank Institute www.steeltank.com	(847) 438-8265
SWI	Steel Window Institute www.steelwindows.com	(216) 241-7333
SWRI	Sealant, Waterproofing, & Restoration Institute www.swrionline.org	(816) 472-7974
TCA	Tile Council of America, Inc. (Now TCNA)	
TCNA	Tile Council of North America, Inc. www.tileusa.com	(864) 646-8453
TIA/EIA	Telecommunications Industry Association/Electronic Industries Alliance www.tiaonline.org	(703) 907-7700
TMS	The Masonry Society www.masonrysociety.org	(303) 939-9700
TPI	Truss Plate Institute, Inc. www.tpinst.org	(703) 683-1010
TPI	Turfgrass Producers International www.turfgrasssod.org	(800) 405-8873 (847) 649-5555

TRI	Tile Roofing Institute www.tilerroofing.org	(312) 670-4177
UL	Underwriters Laboratories Inc. www.ul.com	(877) 854-3577 (847) 272-8800
UNI	Uni-Bell PVC Pipe Association www.uni-bell.org	(972) 243-3902
USAV	USA Volleyball www.usavolleyball.org	(888) 786-5539 (719) 228-6800
USGBC	U.S. Green Building Council www.usgbc.org	(800) 795-1747
USITT	United States Institute for Theatre Technology, Inc. www.usitt.org	(800) 938-7488 (315) 463-6463
WASTEC	Waste Equipment Technology Association www.wastec.org	(800) 424-2869 (202) 244-4700
WCLIB	West Coast Lumber Inspection Bureau www.wclib.org	(800) 283-1486 (503) 639-0651
WCMA	Window Covering Manufacturers Association www.wcmanet.org	(212) 297-2122
WCSC	Window Covering Safety Council (Formerly: WCMA - Window Covering Manufacturers Association) www.windowcoverings.org	(800) 506-4636 (212) 297-2109
WDMA	Window & Door Manufacturers Association (Formerly: NWWDA - National Wood Window and Door Association) www.wdma.com	(800) 223-2301 (847) 299-5200
WI	Woodwork Institute (Formerly: WIC - Woodwork Institute of California) www.wicnet.org	(916) 372-9943
WIC	Woodwork Institute of California (Now WI)	
WMMPA	Wood Moulding & Millwork Producers Association www.wmmpa.com	(800) 550-7889 (530) 661-9591
WSRCA	Western States Roofing Contractors Association www.wsrca.com	(800) 725-0333 (650) 570-5441
WWPA	Western Wood Products Association www.wwpa.org	(503) 224-3930

- C. Code Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list.

Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

IAPMO	International Association of Plumbing and Mechanical Officials www.iapmo.org	(909) 472-4100
ICC	International Code Council www.iccsafe.org	(888) 422-7233
ICC-ES	ICC Evaluation Service, Inc. www.icc-es.org	(800) 423-6587 (562) 699-0543
UBC	Uniform Building Code (See ICC)	

- D. Federal Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

CE	Army Corps of Engineers www.usace.army.mil	(202) 761-0011
CPSC	Consumer Product Safety Commission www.cpsc.gov	(800) 638-2772 (301) 504-7923
DOC	Department of Commerce www.commerce.gov	(202) 482-2000
DOD	Department of Defense http://.dodssp.daps.dla.mil	(215) 697-6257
DOE	Department of Energy www.energy.gov	(202) 586-9220
EPA	Environmental Protection Agency www.epa.gov	(202) 272-0167
FAA	Federal Aviation Administration www.faa.gov	(866) 835-5322
FCC	Federal Communications Commission www.fcc.gov	(888) 225-5322
FDA	Food and Drug Administration www.fda.gov	(888) 463-6332
GSA	General Services Administration www.gsa.gov	(800) 488-3111
HUD	Department of Housing and Urban Development www.hud.gov	(202) 708-1112
LBL	Lawrence Berkeley National Laboratory www.lbl.gov	(510) 486-4000

NCHRP	National Cooperative Highway Research Program (See TRB)	
NIST	National Institute of Standards and Technology www.nist.gov	(301) 975-6478
OSHA	Occupational Safety & Health Administration www.osha.gov	(800) 321-6742 (202) 693-1999
PBS	Public Buildings Service (See GSA)	
PHS	Office of Public Health and Science www.osophs.dhhs.gov/ophs	(202) 690-7694
RUS	Rural Utilities Service (See USDA)	(202) 720-9540
SD	State Department www.state.gov	(202) 647-4000
TRB	Transportation Research Board http://gulliver.trb.org	(202) 334-2934
USDA	Department of Agriculture www.usda.gov	(202) 720-2791
USPS	Postal Service www.usps.com	(202) 268-2000

- E. Standards and Regulations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the standards and regulations in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

ADAAG	Americans with Disabilities Act (ADA) Architectural Barriers Act (ABA) Accessibility Guidelines for Buildings and Facilities Available from U.S. Access Board www.access-board.gov	(800) 872-2253 (202) 272-0080
CFR	Code of Federal Regulations Available from Government Printing Office www.gpoaccess.gov/cfr/index.html	(866) 512-1800 (202) 512-1800
DOD	Department of Defense Military Specifications and Standards Available from Department of Defense Single Stock Point http://dodssp.daps.dla.mil	(215) 697-2664
DSCC	Defense Supply Center Columbus (See FS)	
FED-STD	Federal Standard (See FS)	

FS	Federal Specification Available from Department of Defense Single Stock Point http://dodssp.daps.dla.mil Available from Defense Standardization Program www.dps.dla.mil Available from General Services Administration www.gsa.gov Available from National Institute of Building Sciences www.wbdg.org/ccb	(215) 697-2664 (202) 619-8925 (202) 289-7800
FTMS	Federal Test Method Standard (See FS)	
MIL	(See MILSPEC)	
MIL-STD	(See MILSPEC)	
MILSPEC	Military Specification and Standards Available from Department of Defense Single Stock Point http://dodssp.daps.dla.mil	(215) 697-2664
UFAS	Uniform Federal Accessibility Standards Available from Access Board www.access-board.gov	(800) 872-2253 (202) 272-0080

F. State Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

CBHF	State of California, Department of Consumer Affairs Bureau of Home Furnishings and Thermal Insulation www.dca.ca.gov/bhfti	(800) 952-5210 (916) 574-2041
CCR	California Code of Regulations www.calregs.com	(916) 323-6815
CPUC	California Public Utilities Commission www.cpuc.ca.gov	(415) 703-2782
TFS	Texas Forest Service Forest Resource Development http://txforestservation.tamu.edu	(979) 458-6650

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01-4200

**SECTION 01-5000
TEMPORARY FACILITIES AND CONTROLS**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes requirements for temporary utilities, support facilities, and security and protection facilities.
- B. Related Sections:
 - 1. Division 01 Section "Summary" for work restrictions and limitations on utility interruptions.
 - 2. Division 32 Section "Concrete Paving" for construction and maintenance of cement concrete pavement for temporary roads and paved areas.

1.3 USE CHARGES

- A. General: Installation and removal of and use charges for temporary facilities shall be included in the Contract Sum unless otherwise indicated. Allow other entities to use temporary services and facilities without cost, including, but not limited to, Owner's construction forces, Architect, occupants of Project, testing agencies, and authorities having jurisdiction.
- B. Sewer Service: Owner will pay sewer service use charges for sewer usage by all entities for construction operations.
- C. Water Service: Owner will pay water service use charges for water used by all entities for construction operations.
- D. Electric Power Service: Owner will pay electric power service use charges for electricity used by all entities for construction operations.
- E. Water and Sewer Service from Existing System: Water from Owner's existing water system is available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations.
- F. Electric Power Service from Existing System: Electric power from Owner's existing system is available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations.

1.4 INFORMATIONAL SUBMITTALS

- A. Site Plan: Show temporary facilities, utility hookups, staging areas, and parking areas for construction personnel.

- B. Erosion- and Sedimentation-Control Plan: Show compliance with requirements of EPA Construction General Permit or authorities having jurisdiction, whichever is more stringent.
- C. Moisture-Protection Plan: Describe procedures and controls for protecting materials and construction from water absorption and damage, including delivery, handling, and storage provisions for materials subject to water absorption or water damage, discarding water-damaged materials, protocols for mitigating water intrusion into completed Work, and replacing water damaged Work.
 - 1. Indicate sequencing of work that requires water, such as sprayed fire-resistive materials, plastering, and terrazzo grinding, and describe plans for dealing with water from these operations. Show procedures for verifying that wet construction has dried sufficiently to permit installation of finish materials.
- D. Dust-Control and HVAC-Control Plan: Submit coordination drawing and narrative that indicates the dust-control and HVAC-control measures proposed for use, proposed locations, and proposed time frame for their operation. Identify further options if proposed measures are later determined to be inadequate. Include the following:
 - 1. Locations of dust-control partitions at each phase of the work.
 - 2. HVAC system isolation schematic drawing.
 - 3. Location of proposed air filtration system discharge.
 - 4. Other dust-control measures.
 - 5. Waste management plan.

1.5 QUALITY ASSURANCE

- A. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.
- B. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.
- C. Accessible Temporary Egress: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines.

1.6 PROJECT CONDITIONS

- A. Temporary Use of Permanent Facilities: Engage installer of each permanent service to assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before Owner's acceptance, regardless of previously assigned responsibilities.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Chain-Link Fencing: Minimum 2-inch, 0.148-inch-thick, galvanized steel, chain-link fabric fencing; minimum 6 feet high with galvanized steel pipe posts; minimum 2-3/8-inch- OD line posts and 2-7/8-inch- OD corner and pull posts, with 1-5/8-inch- OD top rails.

- B. Polyethylene Sheet: Reinforced, fire-resistive sheet, 10 mils minimum thickness, with flame-spread rating of 15 or less per ASTM E 84.
- C. Dust Control Adhesive-Surface Walk-off Mats: Provide mats minimum 36 by 60 inches.

2.2 TEMPORARY FACILITIES

- A. Field Offices, General: Prefabricated or mobile units with serviceable finishes, temperature controls, and foundations adequate for normal loading.
- B. Common-Use Field Office: Of sufficient size to accommodate needs of Owner, Architect and construction personnel office activities and to accommodate project meetings specified in other Division 01 Sections. Keep office clean and orderly.
- C. Storage and Fabrication Sheds: Provide sheds sized, furnished, and equipped to accommodate materials and equipment for construction operations.
 - 1. Store combustible materials apart from building.

2.3 EQUIPMENT

- A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.
- B. HVAC Equipment: Unless Owner authorizes use of permanent HVAC system, provide vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work.
 - 1. Locate facilities to limit site disturbance as specified in Division 01 Section "Summary."
- B. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

3.2 TEMPORARY UTILITY INSTALLATION

- A. General: Install temporary service or connect to existing service.
 - 1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.
- B. Water Service: Connect to Owner's existing water service facilities. Clean and maintain water service facilities in a condition acceptable to Owner. At Substantial Completion, restore these facilities to condition existing before initial use.

- C. Sanitary Facilities: Provide temporary toilets, wash facilities, and drinking water for use of construction personnel. Comply with requirements of authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.
 - 1. Toilets: Use of Owner's existing toilet facilities will not be permitted..
- D. Heating and Cooling: Provide temporary heating and cooling required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed.
- E. Electric Power Service: Connect to Owner's existing electric power service. Maintain equipment in a condition acceptable to Owner.
- F. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.
 - 1. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.
 - 2. Install lighting for Project identification sign.
- G. Telephone Service: Provide temporary telephone service in common-use facilities for use by all construction personnel. Install one telephone line(s) for each field office.
 - 1. Provide additional telephone lines for the following:
 - a. Provide a dedicated telephone line for each facsimile machine in each field office.
 - 2. At each telephone, post a list of important telephone numbers.
 - a. Police and fire departments.
 - b. Ambulance service.
 - c. Contractor's home office.
 - d. Architect's office.
 - e. Engineers' offices.
 - f. Owner's office.
 - g. Principal subcontractors' field and home offices.
 - 3. Provide superintendent with cellular telephone or portable two-way radio for use when away from field office.

3.3 SUPPORT FACILITIES INSTALLATION

- A. General: Comply with the following:
 - 1. Provide construction for temporary offices, shops, and sheds located within construction area or within 30 feet of building lines that is noncombustible according to ASTM E 136. Comply with NFPA 241.
 - 2. Maintain support facilities until Architect schedules Substantial Completion inspection. Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Owner.
- B. Traffic Controls: Comply with requirements of authorities having jurisdiction.

1. Protect existing site improvements to remain including curbs, pavement, and utilities.
 2. Maintain access for fire-fighting equipment and access to fire hydrants.
- C. Parking: Provide temporary parking areas for construction personnel.
- D. Project Signs: Provide Project signs as indicated. Unauthorized signs are not permitted.
1. Identification Signs: Provide Project identification signs as indicated on Drawings.
 2. Temporary Signs: Provide other signs as indicated and as required to inform public and individuals seeking entrance to Project.
 - a. Provide temporary, directional signs for construction personnel and visitors.
 - b. Install Owner and Architects sign. Signs will be provided by Owner and Architect.
 3. Maintain and touchup signs so they are legible at all times.
- E. Waste Disposal Facilities: Comply with requirements specified in Division 01 Section "Construction Waste Management and Disposal."
- F. Lifts and Hoists: Provide facilities necessary for hoisting materials and personnel.
1. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.

3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION

- A. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction as required to comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.
1. Comply with work restrictions specified in Division 01 Section "Summary."
- B. Temporary Erosion and Sedimentation Control: Comply with requirements of 2003 EPA Construction General Permit or authorities having jurisdiction, whichever is more stringent and requirements specified in Division 31 Section "Site Clearing."
- C. Stormwater Control: Comply with requirements of authorities having jurisdiction. Provide barriers in and around excavations and subgrade construction to prevent flooding by runoff of stormwater from heavy rains.
- D. Tree and Plant Protection: Install temporary fencing located as indicated or outside the drip line of trees to protect vegetation from damage from construction operations. Protect tree root systems from damage, flooding, and erosion.
- E. Pest Control: Engage pest-control service to recommend practices to minimize attraction and harboring of rodents, roaches, and other pests and to perform extermination and control procedures at regular intervals so Project will be free of pests and their residues at Substantial Completion. Obtain extended warranty for Owner. Perform control operations lawfully, using environmentally safe materials.
- F. Site Enclosure Fence: Before construction operations begin furnish and install site enclosure fence in a manner that will prevent people and animals from easily entering site except by entrance gates.

1. Extent of Fence: As indicated on Drawings.
 2. Maintain security by limiting number of keys and restricting distribution to authorized personnel. Furnish one set of keys to Owner.
- G. Security Enclosure and Lockup: Install temporary enclosure around partially completed areas of construction. Provide lockable entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security. Lock entrances at end of each work day.
- H. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.
- I. Temporary Egress: Maintain temporary egress from existing occupied facilities as indicated and as required by authorities having jurisdiction.

3.5 MOISTURE AND MOLD CONTROL

- A. Contractor's Moisture-Protection Plan: Avoid trapping water in finished work. Document visible signs of mold that may appear during construction.
- B. Exposed Construction Phase: Before installation of weather barriers, when materials are subject to wetting and exposure and to airborne mold spores, protect as follows:
1. Protect porous materials from water damage.
 2. Protect stored and installed material from flowing or standing water.
 3. Keep porous and organic materials from coming into prolonged contact with concrete.
 4. Remove standing water from decks.
 5. Keep deck openings covered or dammed.
- C. Partially Enclosed Construction Phase: After installation of weather barriers but before full enclosure and conditioning of building, when installed materials are still subject to infiltration of moisture and ambient mold spores, protect as follows:
1. Do not load or install drywall or other porous materials or components, or items with high organic content, into partially enclosed building.
 2. Keep interior spaces reasonably clean and protected from water damage.
 3. Periodically collect and remove waste containing cellulose or other organic matter.
 4. Discard or replace water-damaged material.
 5. Do not install material that is wet.
 6. Discard, replace or clean stored or installed material that begins to grow mold.
 7. Perform work in a sequence that allows any wet materials adequate time to dry before enclosing the material in drywall or other interior finishes.
- D. Controlled Construction Phase of Construction: After completing and sealing of the building enclosure but prior to the full operation of permanent HVAC systems, maintain as follows:
1. Control moisture and humidity inside building by maintaining effective dry-in conditions.
 2. Use permanent HVAC system to control humidity.
 3. Comply with manufacturer's written instructions for temperature, relative humidity, and exposure to water limits.

3.6 OPERATION, TERMINATION, AND REMOVAL

- A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.
- B. Maintenance: Maintain facilities in good operating condition until removal.
 - 1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.
- C. Operate Project-identification-sign lighting daily from dusk until 12:00 midnight.
- D. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.
- E. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.
 - 1. Materials and facilities that constitute temporary facilities are property of Contractor. Owner reserves right to take possession of Project identification signs.
 - 2. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances that might impair growth of plant materials or lawns. Repair or replace street paving, curbs, and sidewalks at temporary entrances, as required by authorities having jurisdiction.
 - 3. At Substantial Completion, repair, renovate, and clean permanent facilities used during construction period. Comply with final cleaning requirements specified in Division 01 Section "Closeout Procedures."

END OF SECTION 01-5000

SECTION 01-6000 PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; and comparable products.
- B. Related Sections:
 - 1. Division 01 Section "Alternates" for products selected under an alternate.
 - 2. Division 01 Section "Substitution Procedures" for requests for substitutions.
 - 3. Division 01 Section "References" for applicable industry standards for products specified.

1.3 DEFINITIONS

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

1.4 ACTION SUBMITTALS

- A. Comparable Product Requests: Submit request for consideration of each comparable product. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.

1. Include data to indicate compliance with the requirements specified in "Comparable Products" Article.
 2. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within 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. Each contractor is responsible for providing products and construction methods compatible with products and construction methods of other contractors.
 2. If a dispute arises between contractors over concurrently selectable but incompatible products, Architect will determine which products shall be used.

1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft and vandalism. Comply with manufacturer's written instructions.
- B. Delivery and Handling:
1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
 2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
 3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
 4. Inspect products on delivery to determine compliance with the Contract Documents and to determine that products are undamaged and properly protected.
- C. Storage:
1. Store products to allow for inspection and measurement of quantity or counting of units.
 2. Store materials in a manner that will not endanger Project structure.
 3. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
 4. Store 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.

B. Product Selection Procedures:

1. Product: Where Specifications name a single manufacturer and product, provide the named product that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
2. Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
3. Products:
 - a. Restricted List: Where Specifications include a list of names of both manufacturers and products, provide one of the products listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
 - b. Nonrestricted List: Where Specifications include a list of names of both available manufacturers and products, provide one of the products listed, or an unnamed product, that complies with requirements. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product.
4. Manufacturers:
 - a. Restricted List: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
 - b. Nonrestricted List: Where Specifications include a list of available manufacturers, provide a product by one of the manufacturers listed, or a product by an unnamed manufacturer, that complies with requirements. Comply with requirements in "Comparable Products" Article for consideration of an unnamed manufacturer's product.
5. Basis-of-Design Product: Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product by one of the other named manufacturers.

C. Visual Matching Specification: Where Specifications require "match Architect's sample", provide a product that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches.

1. If no product available within specified category matches and complies with other specified requirements, comply with requirements in 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, 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 01-6000

SECTION 01-7300 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.
- B. Related Sections:
 - 1. Division 01 Section "Submittal Procedures" for submitting surveys.
 - 2. Division 01 Section "Closeout Procedures" for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, and final cleaning.
 - 3. Division 07 Section "Penetration Firestopping" for patching penetrations in fire-rated construction.

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. Cutting and Patching Plan: Submit plan describing procedures at least 10 days prior to the time cutting and patching will be performed. Include the following information:
 - 1. Extent: Describe reason for and extent of each occurrence of cutting and patching.

2. Changes to In-Place Construction: Describe anticipated results. Include changes to structural elements and operating components as well as changes in building appearance and other significant visual elements.
 3. Products: List products to be used for patching and firms or entities that will perform patching work.
 4. Dates: Indicate when cutting and patching will be performed.
 5. Utilities and Mechanical and Electrical Systems: List services and systems that cutting and patching procedures will disturb or affect. List services and systems that will be relocated and those that will be temporarily out of service. Indicate how long services and systems will be disrupted.
- B. Landfill Receipts: Submit copy of receipts issued by a landfill facility, licensed to accept hazardous materials, for hazardous waste disposal.

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
 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.
 3. 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 and 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 INSTALLATION

- A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.
1. Make vertical work plumb and make horizontal work level.
 2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
 3. Conceal pipes, ducts, and wiring in finished areas, unless otherwise indicated.
 4. Maintain minimum headroom clearance of 96 inches in occupied spaces and in unoccupied spaces.
- B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.
- C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.
- D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.
- E. 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.

3.5 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 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 rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
 5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition.
- H. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

3.6 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.

3.7 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." and 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.
- 3.8 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."

3.9 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.

3.10 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 01-7300

SECTION 01-7329 CUTTING AND PATCHING

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 includes procedural requirements for cutting and patching.
- B. Related Sections include the following:
 - 1. Divisions 02 through 49 Sections for specific requirements and limitations applicable to cutting and patching individual parts 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 surfaces to original conditions after installation of other Work.

1.4 SUBMITTALS

- A. Cutting and Patching Proposal: Submit a proposal describing procedures at least 10 days before the time cutting and patching will be performed, requesting approval to proceed. Include the following information:
 - 1. Extent: Describe cutting and patching, show how they will be performed, and indicate why they cannot be avoided.
 - 2. Changes to In-Place Construction: Describe anticipated results. Include changes to structural elements and operating components as well as changes in building's appearance and other significant visual elements.
 - 3. Products: List products to be used and firms or entities that will perform the Work.
 - 4. Dates: Indicate when cutting and patching will be performed.
 - 5. Utility Services and Mechanical/Electrical Systems: List services/systems that cutting and patching procedures will disturb or affect. List services/systems that will be relocated and those that will be temporarily out of service. Indicate how long services/systems will be disrupted.
 - 6. Structural Elements: Where cutting and patching involve adding reinforcement to structural elements, submit details and engineering calculations showing integration of reinforcement with original structure.
 - 7. Architect's Approval: Obtain approval of cutting and patching proposal before cutting and patching. Approval does not waive right to later require removal and replacement of unsatisfactory work.

1.5 QUALITY ASSURANCE

- A. Structural Elements: Do not cut and patch structural elements in a manner that could change their load-carrying capacity or load-deflection ratio.
- B. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety. Operating elements include the following:
 - 1. Primary operational systems and equipment.
 - 2. Air or smoke barriers.
 - 3. Fire-suppression systems.
 - 4. Mechanical systems piping and ducts.
 - 5. Control systems.
 - 6. Communication systems.
 - 7. Conveying systems.
 - 8. Electrical wiring systems.
 - 9. Operating systems of special construction in Division 13 Sections.
- C. Miscellaneous Elements: Do not cut and patch miscellaneous elements or related components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety. Miscellaneous elements include the following:
 - 1. Water, moisture, or vapor barriers.
 - 2. Membranes and flashings.
 - 3. Exterior curtain-wall construction.
 - 4. Equipment supports.
 - 5. Piping, ductwork, vessels, and equipment.
 - 6. Noise- and vibration-control elements and systems.
- D. Visual Requirements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch construction exposed on the exterior or in occupied spaces in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.
- E. 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.

1.6 WARRANTY

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

PART 2 - PRODUCTS

2.1 MATERIALS

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

PART 3 - EXECUTION

3.1 EXAMINATION

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

3.2 PREPARATION

- A. Temporary Support: Provide temporary support of Work to be cut.
- B. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.
- C. Adjoining Areas: Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.
- D. 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 interruption to occupied areas.

3.3 PERFORMANCE

- A. General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.
 - 1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.
- B. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or

adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.

1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots as small as possible, neatly to size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
 2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
 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.
- C. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other Work. Patch with durable seams that are as invisible as possible. Provide materials and comply with installation requirements specified in other Sections.
1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate integrity of installation.
 2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.
 - a. Clean piping, conduit, and similar features before applying paint or other finishing materials.
 - 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, apply primer and intermediate paint coats over the patch and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.
 4. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
 5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition.
- D. Cleaning: Clean areas and spaces where cutting and patching are performed. Completely remove paint, mortar, oils, putty, and similar materials.

END OF SECTION 01-7329

SECTION 01-7419
CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes administrative and procedural requirements for the following:
 - 1. Salvaging nonhazardous demolition and construction waste.
 - 2. Recycling nonhazardous demolition and construction waste.
 - 3. Disposing of nonhazardous demolition and construction waste.
- B. Related Sections include the following:
 - 1. Division 01 Section "Temporary Facilities and Controls" for environmental-protection measures during construction, and location of waste containers at Project site.
 - 2. Division 02 Section "Selective Structure Demolition" for disposition of waste resulting from partial demolition of buildings, structures, and site improvements.
 - 3. Division 31 Section "Site Clearing" for disposition of waste resulting from site clearing and removal of above- and below-grade improvements.

1.3 DEFINITIONS

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

1.4 PERFORMANCE REQUIREMENTS

- A. General: Develop waste management plan that results in end-of-Project rates for salvage/recycling of 75 percent by weight of total waste generated by the Work.
- B. Salvage/Recycle Requirements: Owner's goal is to salvage and recycle as much nonhazardous demolition and construction waste as possible. Owner has established minimum goals for the following materials:
 - 1. Demolition Waste:
 - a. Asphaltic concrete paving.
 - b. Concrete.
 - c. Concrete reinforcing steel.
 - d. Structural and miscellaneous steel.
 - e. Piping.
 - f. Valves.
 - g. Mechanical equipment.
 - h. Electrical conduit.
 - i. Copper wiring.
 - j. Electrical devices.
 - k. Transformers.
 - 2. Construction Waste:
 - a. Site-clearing waste.
 - b. Lumber.
 - c. Wood sheet materials.
 - d. Wood trim.
 - e. Metals.
 - f. Roofing.
 - g. Insulation.
 - h. Carpet and pad.
 - i. Gypsum board.
 - j. Piping.
 - k. Electrical conduit.
 - l. Packaging: Regardless of salvage/recycle goal indicated above, salvage or recycle 100 percent of the following uncontaminated packaging materials:
 - 1) Paper.
 - 2) Cardboard.
 - 3) Boxes.
 - 4) Plastic sheet and film.
 - 5) Polystyrene packaging.
 - 6) Wood crates.
 - 7) Plastic pails.

1.5 SUBMITTALS

- A. Landfill and Incinerator Disposal Records: Indicate receipt and acceptance of waste by landfills and incinerator facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.
- B. Qualification Data: For Waste Management Coordinator.

- C. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that all refrigerant that was present was recovered and that recovery was performed according to EPA regulations. Include name and address of technician and date refrigerant was recovered.

1.6 QUALITY ASSURANCE

- A. Refrigerant Recovery Technician Qualifications: Certified by EPA-approved certification program.
- B. Regulatory Requirements: Comply with hauling and disposal regulations of authorities having jurisdiction.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 PLAN IMPLEMENTATION

- A. General: Implement waste management plan as approved by Architect and Owner. Provide handling, containers, storage, signage, transportation, and other items as required to implement waste management plan during the entire duration of the Contract.
 - 1. Comply with Division 01 Section "Temporary Facilities and Controls" for operation, termination, and removal requirements.
- B. Waste Management Coordinator: Engage a waste management coordinator to be responsible for implementing, monitoring, and reporting status of waste management work plan. Coordinator shall be present at Project site full time for duration of Project.
- C. Training: Train workers, subcontractors, and suppliers on proper waste management procedures, as appropriate for the Work occurring at Project site.
 - 1. Distribute waste management plan to everyone concerned within three days of submittal return.
 - 2. Distribute waste management plan to entities when they first begin work on-site. Review plan procedures and locations established for salvage, recycling, and disposal.
- D. Site Access and Temporary Controls: Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
 - 1. Designate and label specific areas on Project site necessary for separating materials that are to be salvaged, recycled, reused, donated, and sold.
 - 2. Comply with Division 01 Section "Temporary Facilities and Controls" for controlling dust and dirt, environmental protection, and noise control.

3.2 SALVAGING DEMOLITION WASTE

- A. Salvaged Items for Sale and Donation: Not permitted on Project site.

B. Salvaged Items for Owner's Use:

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

3.3 RECYCLING DEMOLITION AND CONSTRUCTION WASTE, GENERAL

- A. General: Recycle paper and beverage containers used by on-site workers.
- B. Recycling Incentives: Revenues, savings, rebates, tax credits, and other incentives received for recycling waste materials shall accrue to Contractor.
- C. Procedures: Separate recyclable waste from other waste materials, trash, and debris. Separate recyclable waste by type at Project site to the maximum extent practical.
1. Provide appropriately marked containers or bins for controlling recyclable waste until they are removed from Project site. Include list of acceptable and unacceptable materials at each container and bin.
 - a. Inspect containers and bins for contamination and remove contaminated materials if found.
 2. Stockpile processed materials on-site without intermixing with other materials. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
 3. Stockpile materials away from construction area. Do not store within drip line of remaining trees.
 4. Store components off the ground and protect from the weather.
 5. Remove recyclable waste off Owner's property and transport to recycling receiver or processor.

3.4 DISPOSAL OF WASTE

- A. General: Except for items or materials to be salvaged, recycled, or otherwise reused, remove waste materials from Project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.
1. Except as otherwise specified, do not allow waste materials that are to be disposed of accumulate on-site.
 2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
- B. Burning: Do not burn waste materials.
- C. Disposal: Transport waste materials off Owner's property and legally dispose of them unless otherwise agreed upon.

END OF SECTION 01-7419

SECTION 01-7700 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.
- B. Related Sections:
 - 1. Division 01 Section "Execution" for progress cleaning of Project site.
 - 2. Division 01 Section "Operation and Maintenance Data" for operation and maintenance manual requirements.
 - 3. Division 01 Section "Project Record Documents" for submitting Record Drawings, Record Specifications, and Record Product Data.
 - 4. Division 01 Section "Demonstration and Training" for requirements for instructing Owner's personnel.
 - 5. Divisions 02 through 49 Sections for specific closeout and special cleaning requirements for the Work in those Sections.

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.

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.

1. Organize list of spaces in sequential order, starting with exterior areas first and proceeding from lowest floor to highest floor.
2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
3. Include the following information at the top of each page:
 - a. Project name.
 - b. Date.
 - c. Name of Architect.
 - d. Name of Contractor.
 - e. Page number.
4. Submit list of incomplete items in the following format:
 - a. Five 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.

- I. 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 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 "Temporary Facilities and Controls." and Division 01 Section "Construction Waste Management and Disposal."

END OF SECTION 01-7700

SECTION 01-7823 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. This 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. Maintenance manuals for the care and maintenance of products, materials, and finishes and systems and equipment.
- B. Related Sections include the following:
 - 1. Division 01 Section "Submittal Procedures" for submitting copies of submittals for operation and maintenance manuals.
 - 2. Division 01 Section "Closeout Procedures" for submitting operation and maintenance manuals.
 - 3. Division 01 Section "Project Record Documents" for preparing Record Drawings for operation and maintenance manuals.
 - 4. Divisions 02 through 49 Sections for specific operation and maintenance manual requirements for the Work in those Sections.

1.3 DEFINITIONS

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

1.4 SUBMITTALS

- A. Initial Submittal: Submit 2 draft copies of each manual at least 15 days before requesting inspection for Substantial Completion. Include a complete operation and maintenance directory. Architect will return one copy of draft and mark whether general scope and content of manual are acceptable.
- B. Final Submittal: Submit one copy of each manual in final form at least 15 days before final inspection. Architect will return copy with comments within 15 days after final inspection.

1. Correct or modify each manual to comply with Architect's comments. Submit 3 copies of each corrected manual within 15 days of receipt of Architect's comments.

1.5 COORDINATION

- A. Where operation and maintenance documentation includes information on installations by more than one factory-authorized service representative, assemble and coordinate information furnished by representatives and prepare manuals.

PART 2 - PRODUCTS

2.1 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY

- A. 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 MANUALS, GENERAL

- A. Organization: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:
 1. Title page.
 2. Table of contents.
 3. Manual contents.
- B. Title Page: Enclose title page in transparent plastic sleeve. 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, address, and telephone number of Contractor.
 6. Name and address of Architect.
 7. 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.
1. Binders: Heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.
 - a. If two or more binders are necessary to accommodate data of a system, organize data in each binder into groupings by subsystem and related components. Cross-reference other binders if necessary to provide essential information for proper operation or maintenance of equipment or system.
 - b. Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, and subject matter of contents. Indicate volume number for multiple-volume sets.
 2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section. 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 diskettes 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.
 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.
 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 MANUAL

- 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.
- 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 MANUAL

- 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.
- C. Manufacturers' Maintenance Documentation: Manufacturers' maintenance documentation including the following information for each component part or piece of equipment:
 - 1. Standard printed 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 videotape, if available.
- E. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.
 - 1. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.
 - 2. Maintenance and Service Record: Include manufacturers' forms for recording maintenance.
- F. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.
- G. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.
- H. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
 - 1. Include procedures to follow and required notifications for warranty claims.

PART 3 - EXECUTION

3.1 MANUAL PREPARATION

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

END OF SECTION 01-7823

**SECTION 01-7839
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. This Section includes administrative and procedural requirements for Project Record Documents, including the following:
 - 1. Record Drawings.
 - 2. Record Specifications.
 - 3. Record Product Data.
- B. Related Sections include the following:
 - 1. Division 01 Section "Closeout Procedures" for general closeout procedures.
 - 2. Division 01 Section "Operation and Maintenance Data" for operation and maintenance manual requirements.
 - 3. Divisions 02 through 49 Sections for specific requirements for Project Record Documents of the Work in those Sections.

1.3 SUBMITTALS

- A. Record Drawings: Comply with the following:
 - 1. Number of Copies: Submit one set(s) of marked-up Record Prints.
- B. Record Specifications: Submit one copy of Project's Specifications, including addenda and contract modifications.
- C. Record Product Data: Submit one copy of each Product Data submittal.
 - 1. Where Record Product Data is required as part of operation and maintenance manuals, submit marked-up Product Data as an insert in manual instead of submittal as Record Product Data.

PART 2 - PRODUCTS

2.1 RECORD DRAWINGS

- A. Record Prints: Maintain one set of blue- or black-line white prints 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 prepare the 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 understandable drawing technique.
 - c. Record data as soon as possible after obtaining it. Record and check the markup before enclosing concealed installations.
 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 or Shop Drawings, whichever is most capable of showing actual physical conditions, completely and accurately. If Shop Drawings are marked, show cross-reference on the Contract Drawings.
 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 Transparencies: Immediately before inspection for Certificate of Substantial Completion, review marked-up Record Prints with Architect. When authorized, prepare a full set of corrected transparencies of the Contract Drawings and Shop Drawings.
1. Incorporate changes and additional information previously marked on Record Prints. Erase, redraw, and add details and notations where applicable.
 2. Refer instances of uncertainty to Architect for resolution.
 3. Owner will furnish Contractor one set of transparencies of the Contract Drawings for use in recording information.
 4. Print the Contract Drawings and Shop Drawings for use as Record Transparencies. Architect will make the Contract Drawings available to Contractor's print shop.
- 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. Record Transparencies: Organize into unbound sets matching Record Prints. Place transparencies in durable tube-type drawing containers with end caps. Mark end cap of each container with identification. If container does not include a complete set, identify Drawings included.
 3. Record CAD Drawings: Organize CAD 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 CAD file.
 4. Identification: As follows:
 - a. Project name.
 - b. Date.
 - c. Designation "PROJECT RECORD DRAWINGS."
 - d. Name of Architect.
 - e. Name of Contractor.

2.2 RECORD SPECIFICATIONS

- A. Preparation: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.
1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
 2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
 3. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.
 4. 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 and Record Drawings where applicable.

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, and Record Drawings where applicable.

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.

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 reference during normal working hours.

END OF SECTION 01-7839

SECTION 01-7900 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. This Section includes administrative and procedural requirements for instructing Owner's personnel, including the following:
 - 1. Demonstration of operation of systems, subsystems, and equipment.
 - 2. Training in operation and maintenance of systems, subsystems, and equipment.
 - 3. Demonstration and training videotapes.
- B. Related Sections include the following:
 - 1. Division 01 Section "Project Management and Coordination" for requirements for preinstruction conferences.
 - 2. Divisions 02 through 49 Sections for specific requirements for demonstration and training for products in those Sections.

1.3 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.

1.4 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 equipment not part of a system, as required by individual Specification Sections, and as follows:

1. Motorized doors.
2. Equipment.
3. Fire-protection systems.
4. Intrusion detection systems.
5. Laboratory equipment, including laboratory air and vacuum equipment and piping.
6. Heat generation systems.
7. Refrigeration systems.
8. HVAC systems.
9. HVAC instrumentation and controls.
10. Electrical service and distribution.
11. Lighting equipment and controls.
12. Communication systems.

- 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:

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 combined training manual.

- 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.
 - 1. Architect will furnish an instructor to describe basis of system design, operational requirements, criteria, and regulatory requirements.
 - 2. Owner will furnish an instructor to describe Owner's operational philosophy.
 - 3. Owner will furnish Contractor with names and positions of participants.
- C. Scheduling: Provide instruction at mutually agreed on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.
 - 1. Schedule training with Owner, through Architect, with at least seven days' advance notice.
- D. Cleanup: Collect used and leftover educational materials and remove from Project site. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

END OF SECTION 01-7900

SECTION 02-4119 SELECTIVE STRUCTURE DEMOLITION

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 includes the following:
 - 1. Demolition and removal of selected portions of building or structure.
 - 2. Demolition and removal of selected site elements.
 - 3. Salvage of existing items to be reused or recycled.
- B. Related Sections include the following:
 - 1. Division 01 Section "Summary" for use of premises and Owner-occupancy requirements.
 - 2. Division 01 Section "Temporary Facilities and Controls" for temporary construction and environmental-protection measures for selective demolition operations.
 - 3. Division 01 Section "Cutting and Patching" for cutting and patching procedures.
 - 4. Division 01 Section "Construction Waste Management and Disposal" for disposal of demolished materials.

1.3 DEFINITIONS

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

1.4 MATERIALS OWNERSHIP

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

1.5 SUBMITTALS

- A. Schedule of Selective Demolition Activities: Indicate the following:
 - 1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity. Ensure Owner's on-site operations are uninterrupted.
 - 2. Interruption of utility services. Indicate how long utility services will be interrupted.
 - 3. Coordination for shutoff, capping, and continuation of utility services.
 - 4. Means of protection for items to remain and items in path of waste removal from building.
- B. Inventory: After selective demolition is complete, submit a list of items that have been removed and salvaged.
- C. Landfill Records: Indicate receipt and acceptance of hazardous wastes by a landfill facility licensed to accept hazardous wastes.
 - 1. Comply with submittal requirements in Division 01 Section "Construction Waste Management and Disposal."

1.6 QUALITY ASSURANCE

- A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.
- B. Standards: Comply with ANSI A10.6 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 including, but not limited to, the following:
 - 1. Inspect and discuss condition of construction to be selectively demolished.
 - 2. Review structural load limitations of existing structure.
 - 3. Review and finalize selective demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.
 - 4. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.
 - 5. Review areas where existing construction is to remain and requires protection.

1.7 PROJECT CONDITIONS

- A. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.
 - 1. Before selective demolition, Owner will remove the following items:
 - a. Interior walls comprised of chainlink fencing, posts, and gates.
- B. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.

- C. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.
- D. Storage or sale of removed items or materials on-site is not permitted.
- E. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.
 - 1. Maintain fire-protection facilities in service during selective demolition operations.

1.8 WARRANTY

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

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 pre-construction photographs.
- F. Perform surveys as the Work progresses to detect hazards resulting from selective demolition activities.

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."
- 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. Arrange to shut off indicated utilities with utility companies.
3. 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.
4. 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.
 - a. Where entire wall is to be removed, existing services/systems may be removed with removal of the wall.

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.
- C. Temporary Shoring: Provide and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.
 1. Strengthen or add new supports when required during progress of selective demolition.

3.4 SELECTIVE DEMOLITION, GENERAL

- A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:
 1. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping, to minimize disturbance of adjacent surfaces. Temporarily cover openings to remain.
 2. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
 3. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain portable fire-suppression devices during flame-cutting operations.
 4. Maintain adequate ventilation when using cutting torches.
 5. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.

6. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
7. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
8. Dispose of demolished items and materials promptly. Comply with requirements in Division 01 Section "Construction Waste Management and Disposal."

B. Removed and Salvaged Items:

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

C. Removed and Reinstalled Items:

1. Clean and repair items to functional condition adequate for intended reuse. Paint equipment to match new equipment.
2. Pack or crate items after cleaning and repairing. Identify contents of containers.
3. Protect items from damage during transport and storage.
4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.

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

3.5 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

- A. Concrete: Demolish in small sections. Cut concrete to a depth of at least 3/4 inch at junctures with construction to remain, using power-driven saw. Dislodge concrete from reinforcement at perimeter of areas being demolished, cut reinforcement, and then remove remainder of concrete indicated for selective demolition. Neatly trim openings to dimensions indicated.
- B. Concrete: Demolish in sections. Cut concrete full depth at junctures with construction to remain and at regular intervals, using power-driven saw, then remove concrete between saw cuts.
- C. Concrete Slabs-on-Grade: Saw-cut perimeter of area to be demolished, then break up and remove.

3.6 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.

3. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.
4. Comply with requirements specified in Division 01 Section "Construction Waste Management and Disposal."

B. Burning: Do not burn demolished materials.

C. Disposal: Transport demolished materials off Owner's property and legally dispose of them.

3.7 CLEANING

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

3.8 SELECTIVE DEMOLITION SCHEDULE

- A. Reference Drawings.

END OF SECTION 02-4119

**SECTION 06-1053
MISCELLANEOUS ROUGH CARPENTRY**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Wood blocking, cants, and nailers.
 - 2. Wood furring and grounds.
 - 3. Wood sleepers.
 - 4. Interior wood trim.
- B. Related Sections include the following:
 - 1. Division 06 Section "Rough Carpentry."

1.3 DEFINITIONS

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

1.4 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 specified to be High-Temperature (HT) type 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.
- B. Research/Evaluation Reports: For the following, showing compliance with building code in effect for Project:
1. Preservative-treated wood.
 2. Fire-retardant-treated wood.
 3. Power-driven fasteners.
 4. Powder-actuated fasteners.
 5. Expansion anchors.
 6. Metal framing anchors.

1.5 QUALITY ASSURANCE

- A. Forest Certification: For the following wood products, provide materials produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship":
1. Dimension lumber framing.
 2. Miscellaneous lumber.
 3. Interior wood trim.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Stack lumber flat with spacers between each bundle to provide air circulation. Provide for air circulation around stacks and under coverings.
- B. Deliver interior wood materials that are to be exposed to view only after building is enclosed and weatherproof, wet work other than painting is dry, and HVAC system is operating and maintaining temperature and humidity at occupancy levels.

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. For exposed lumber indicated to receive a stained or natural finish, mark grade stamp on end or back of each piece.

3. 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.
4. Provide dressed lumber, S4S, unless otherwise indicated.

2.2 WOOD-PRESERVATIVE-TREATED MATERIALS

- A. Preservative Treatment by Pressure Process: AWPAC2, except that lumber that is not in contact with the ground and is continuously protected from liquid water may be treated according to AWPAC31 with inorganic boron (SBX).
 1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
 2. For exposed items indicated to receive a stained or natural finish, use chemical formulations that do not require incising, contain colorants, bleed through, or otherwise adversely affect finishes.
- B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or does not comply with requirements for untreated material.
- C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.
 1. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece.
- D. Application: Treat all miscellaneous carpentry, unless otherwise indicated:
 1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
 2. Wood sills, sleepers, blocking, furring, stripping, and similar concealed members in contact with masonry or concrete.
 3. Wood framing and furring attached directly to the interior of below-grade exterior masonry or concrete walls.
 4. Wood framing members that are less than 18 inches above the ground in crawl spaces or unexcavated areas.
 5. Wood floor plates that are installed over concrete slabs-on-grade.

2.3 FIRE-RETARDANT-TREATED MATERIALS

- A. General: Comply with performance requirements in AWPAC20 (lumber) and AWPAC27 (plywood).
 1. Use treatment that does not promote corrosion of metal fasteners.
 2. Use Exterior type for exterior locations and where indicated.
 3. Use Interior Type A, High Temperature (HT) for enclosed roof framing, framing in attic spaces, and where indicated.
 4. Use Interior Type A, unless otherwise indicated.
 5. All Wood installed on the building, either visible or hidden (interior or exterior) shall be fire-treated.
- B. Identify fire-retardant-treated wood with appropriate classification marking of testing and inspecting agency acceptable to authorities having jurisdiction.

1. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece.
- C. For exposed items indicated to receive a stained or natural finish, use chemical formulations that do not bleed through, contain colorants, or otherwise adversely affect finishes.
- D. Application: Treat all miscellaneous carpentry, unless otherwise indicated:
 1. Framing for raised platforms.
 2. Concealed blocking.
 3. Roof construction.

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.
 4. Cants.
 5. Furring.
 6. Grounds.
- B. For items of dimension lumber size, provide Construction or No. 2 grade lumber with 19 percent maximum moisture content of any species.
- C. For concealed boards, provide lumber with 19 percent maximum moisture content and any of the following species and grades:
 1. Mixed southern pine, grade; SPIB.
 2. Hem-fir or hem-fir (north), Construction or 2 Common grade; NLGA, WCLIB, or WWPA.
 3. Spruce-pine-fir (south) or spruce-pine-fir, Construction or 2 Common grade; NeLMA, NLGA, WCLIB, or WWPA.
 4. Eastern softwoods, Common grade; NELMA.
 5. Northern species, Common grade; NLGA.
 6. Western woods, Construction or No. 2 Common grade; WCLIB or WWPA.
- D. For blocking not used for attachment of other construction Utility, Stud, or No. 3 grade lumber of any species may be used provided that it is cut and selected to eliminate defects that will interfere with its attachment and purpose.
- E. 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.
- F. For furring strips for installing plywood or hardboard paneling, select boards with no knots capable of producing bent-over nails and damage to paneling.

2.5 INTERIOR WOOD TRIM

- A. General: Provide kiln-dried finished (surfaced) material without finger-jointing, unless otherwise indicated.

- B. Hardwood Lumber Trim for Transparent (Stain or Clear) Finish: Clear red oak.
- C. Moldings: Made to patterns included in WMMPA WM 7 and graded according to WMMPA WM 4.
 - 1. Moldings for Transparent (Stain or Clear) Finish: N-grade red oak selected for compatible grain and color.

2.6 PLYWOOD BACKING PANELS

- A. Telephone and Electrical Equipment Backing Panels: DOC PS 1, Exposure 1, C-D Plugged, fire-retardant treated, in thickness indicated or, if not indicated, not less than 3/4-inch nominal thickness.

2.7 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and manufacture.
 - 1. Where carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.
- B. Nails, Brads, and Staples: ASTM F 1667.
- C. Power-Driven Fasteners: NES NER-272.
- D. Wood Screws: ASME B18.6.1.
- E. Screws for Fastening to Cold-Formed Metal Framing: ASTM C 954, except with wafer heads and reamer wings, length as recommended by screw manufacturer for material being fastened.
- F. Lag Bolts: ASME B18.2.1.
- G. Bolts: Steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers.
- H. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to 6 times the load imposed when installed in unit masonry assemblies and equal to 4 times the load imposed when installed in concrete as determined by testing per ASTM E 488 conducted by a qualified independent testing and inspecting agency.
 - 1. Material: Carbon-steel components, zinc plated to comply with ASTM B 633, Class Fe/Zn 5.

2.8 MISCELLANEOUS MATERIALS

- A. Adhesives for Gluing Furring and Sleepers to Concrete or Masonry: Formulation complying with ASTM D 3498 that is approved for use indicated by adhesive manufacturer.

1. Use adhesives that have a VOC content of 70 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Set carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit carpentry to other construction; scribe and cope as needed for accurate fit. Locate furring, nailers, blocking, grounds, and similar supports to comply with requirements for attaching other construction.
- B. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.
- C. Framing Standard: Comply with AF&PA's "Details for Conventional Wood Frame Construction," unless otherwise indicated.
- D. Metal Framing Anchors: Install metal framing to comply with manufacturer's written instructions.
- E. Do not splice structural members between supports, unless otherwise indicated.
- F. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.
 1. Provide metal clips for fastening gypsum board or lath at corners and intersections where framing or blocking does not provide a surface for fastening edges of panels. Space clips not more than 16 inches o.c.
- G. 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.
- H. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.
 1. Use inorganic boron for items that are continuously protected from liquid water.
 2. Use copper naphthenate for items not continuously protected from liquid water.
- I. Securely attach carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
 1. NES NER-272 for power-driven fasteners.
 2. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code.
 3. Table 23-II-B-1, "Nailing Schedule," and Table 23-II-B-2, "Wood Structural Panel Roof Sheathing Nailing Schedule," in ICBO's Uniform Building Code.
 4. Table 2305.2, "Fastening Schedule," in BOCA's BOCA National Building Code.
 5. Table 2306.1, "Fastening Schedule," in SBCCI's Standard Building Code.
 6. 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.

7. Table 602.3(1), "Fastener Schedule for Structural Members," and Table 602.3(2), "Alternate Attachments," in ICC's International One- and Two-Family Dwelling Code.

- J. Use common wire nails, unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood; do not countersink nail heads, unless otherwise indicated.

3.2 WOOD GROUND, SLEEPER, 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. Provide permanent grounds of dressed, pressure-preservative-treated, key-beveled lumber not less than 1-1/2 inches wide and of thickness required to bring face of ground to exact thickness of finish material. Remove temporary grounds when no longer required.

3.3 WOOD FURRING INSTALLATION

- A. Install level and plumb with closure strips at edges and openings. Shim with wood as required for tolerance of finish work.
- B. Furring to Receive Plywood or Hardboard Paneling: Install 1-by-3-inch nominal- size furring horizontally and vertically at 24 inches o.c.
- C. Furring to Receive Gypsum Board: Install 1-by-2-inch nominal- size furring vertically at 16 inches o.c.

3.4 WOOD TRIM INSTALLATION

- A. Install with minimum number of joints practical, using full-length pieces from maximum lengths of lumber available. Do not use pieces less than 24 inches long except where necessary. Stagger joints in adjacent and related standing and running trim. Cope at returns and miter at corners to produce tight-fitting joints with full-surface contact throughout length of joint. Use scarf joints for end-to-end joints.
1. Match color and grain pattern across joints.
 2. Install trim after gypsum board joint-finishing operations are completed.
 3. Drill pilot holes in hardwood before fastening to prevent splitting. Fasten to prevent movement or warping. Countersink fastener heads and fill holes.
 4. Install to tolerance of 1/8 inch in 96 inches for level and plumb. Install adjoining finish carpentry with 1/32-inch maximum offset for flush installation and 1/16-inch maximum offset for reveal installation.

3.5 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 06-1053

SECTION 06-1600 SHEATHING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Building wrap.
 - 2. Sheathing joint-and-penetration treatment.
- B. Related Sections include the following:
 - 1. Division 06 Section "Miscellaneous Rough Carpentry" for plywood backing panels.
 - 2. Division Section 07-5423 TPO Fully Adhered Roof System for roof sheathing.

1.3 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 plywood complies 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 plywood complies with requirements. Include physical properties of treated materials.
 - 3. For fire-retardant treatments specified to be High-Temperature (HT) type, include physical properties of treated plywood both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D 5516.
 - 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 building wrap, include data on air-/moisture-infiltration protection based on testing according to referenced standards.
- B. Research/Evaluation Reports: For the following, showing compliance with building code in effect for Project:
 - 1. Preservative-treated plywood.
 - 2. Fire-retardant-treated plywood.
 - 3. Building wrap.

1.4 QUALITY ASSURANCE

- A. Fire-Test-Response Characteristics: For assemblies with fire-resistance ratings, provide materials and construction identical to those of assemblies tested for fire resistance per ASTM E 119 by a testing and inspecting agency acceptable to authorities having jurisdiction.
 - 1. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory."
- B. Forest Certification: For the following wood products, provide materials produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship":
 - 1. Plywood.
 - 2. Oriented strand board.
 - 3. Fiberboard wall sheathing.
 - 4. Particleboard underlayment.
 - 5. Hardboard underlayment.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Stack plywood and other panels flat with spacers between each bundle to provide air circulation. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 WOOD PANEL PRODUCTS, GENERAL

- A. Plywood: Either DOC PS 1 or DOC PS 2, unless otherwise indicated.

2.2 FIRE-RETARDANT-TREATED PLYWOOD

- A. General: Comply with performance requirements in AWPA C27.
 - 1. Use treatment that does not promote corrosion of metal fasteners.
 - 2. Use Exterior type for exterior locations and where indicated.
- B. Kiln-dry material after treatment to a maximum moisture content of 15 percent. Do not use material that is warped or does not comply with requirements for untreated material.
- C. Identify fire-retardant-treated plywood with appropriate classification marking of UL, U.S. Testing, Timber Products Inspection, or another testing and inspecting agency acceptable to authorities having jurisdiction.
- D. Application: Treat plywood unless otherwise indicated.

2.3 WALL SHEATHING

- A. Paper-Surfaced Gypsum Wall Sheathing: ASTM C 79/C 79M or ASTM C 1396/C 1396M, gypsum sheathing; with water-resistant-treated core and with water-repellent paper bonded to core's face, back, and long edges.
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. American Gypsum.
 - b. LaFarge North America Inc.
 - c. G-P Gypsum Corporation.
 - d. National Gypsum Company.
 - e. United States Gypsum Co.
 - f. Products manufactured within 500 miles of the project site
 - 2. Type and Thickness: Type X, 5/8 inch thick.

2.4 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and manufacture.
- B. Nails, Brads, and Staples: ASTM F 1667.
- C. Power-Driven Fasteners: NES NER-272.
- D. Wood Screws: ASME B18.6.1.
- E. Screws for Fastening Gypsum Sheathing to Cold-Formed Metal Framing: Steel drill screws, in length recommended by sheathing manufacturer for thickness of sheathing board to be attached, with organic-polymer or other corrosion-protective coating having a salt-spray resistance of more than 800 hours according to ASTM B 117.
 - 1. For steel framing less than 0.0329 inch thick, attach sheathing to comply with ASTM C 1002.
 - 2. For steel framing from 0.033 to 0.112 inch thick, attach sheathing to comply with ASTM C 954.

2.5 WEATHER-RESISTANT SHEATHING PAPER

- A. Building Paper: 1-layer of No.15 (ASTM D226-97a) Grade D kraft building paper over all new sheathing substrates; 2-layers are required over all wood sheathings or as required by current and local codes.

2.6 SHEATHING JOINT-AND-PENETRATION TREATMENT MATERIALS

- A. Sealant for Paper-Surfaced Gypsum Sheathing Board: Elastomeric, medium-modulus, neutral-curing silicone joint sealant compatible with joint substrates formed by gypsum sheathing and other materials, recommended by sheathing manufacturer for application indicated, and

complying with requirements for elastomeric sealants specified in Division 07 Section "Joint Sealants."

- B. Sealant for Paper-Surfaced Gypsum Sheathing Board: Silicone emulsion sealant complying with ASTM C 834, compatible with sheathing tape and sheathing, and recommended by tape and sheathing manufacturers for use with glass-fiber sheathing tape and for covering exposed fasteners.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement.
- B. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction, unless otherwise indicated.
- C. Securely attach to substrate by fastening as indicated in structural specifications.
- D. Coordinate wall and roof sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.
- E. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.
- F. Coordinate sheathing installation with installation of materials installed over sheathing so sheathing is not exposed to precipitation or left exposed at end of the workday when rain is forecast.

3.2 PLYWOOD SHEATHING INSTALLATION

- A. Comply with GA-253 and with manufacturer's written instructions.
 - 1. Fasten gypsum sheathing to cold-formed metal framing with screws.
 - 2. Install boards with a 3/8-inch gap where non-load-bearing construction abuts structural elements.
 - 3. Install boards with a 1/4-inch gap where they abut masonry or similar materials that might retain moisture, to prevent wicking.
- B. Apply fasteners so heads bear tightly against face of sheathing boards but do not cut into facing.
- C. Horizontal Installation: Install sheathing with V-grooved edge down and tongue edge up. Interlock tongue with groove to bring long edges in contact with edges of adjacent boards without forcing. Abut ends of boards over centers of studs, and stagger end joints of adjacent boards not less than one stud spacing. Attach boards at perimeter and within field of board to each steel stud.

1. Space fasteners approximately 8 inches o.c. and set back a minimum of 3/8 inch from edges and ends of boards.
- D. Vertical Installation: Install board vertical edges centered over studs. Abut ends and edges of each board with those of adjacent boards. Attach boards at perimeter and within field of board to each stud.
1. Space fasteners approximately 8 inches o.c. and set back a minimum of 3/8 inch from edges and ends of boards.

3.3 WEATHER-RESISTANT SHEATHING-PAPER INSTALLATION

- A. General: Cover sheathing with weather-resistant sheathing paper 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.
- B. Building Paper: Apply horizontally with a 2-inch overlap and a 6-inch end lap; fasten to sheathing with galvanized staples or roofing nails.

3.4 SHEATHING JOINT-AND-PENETRATION TREATMENT

- A. Seal sheathing joints according to sheathing manufacturer's written instructions.
1. Apply elastomeric sealant to joints and fasteners and trowel flat. Apply sufficient quantity of sealant to completely cover joints and fasteners after troweling. Seal other penetrations and openings.
 2. Apply glass-fiber sheathing tape to glass-mat gypsum sheathing board joints, and apply and trowel silicone emulsion sealant to embed entire face of tape in sealant. Apply sealant to exposed fasteners with a trowel so fasteners are completely covered. Seal other penetrations and openings.
 3. Apply sheathing tape to joints between foam-plastic sheathing panels and at items penetrating sheathing. Apply at upstanding flashing to overlap both flashing and sheathing.

3.5 FLEXIBLE FLASHING INSTALLATION

- A. Apply flexible flashing where indicated to comply with manufacturers 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 weather-resistant building paper at bottom and sides of openings.

4. Lap weather-resistant building paper 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.

3.6 PROTECTION

- A. Protect sheathing by covering exposed exterior surface of sheathing with weather-resistant sheathing paper securely fastened to framing. Apply covering immediately after sheathing is installed.

END OF SECTION 06-1600

SECTION 06-4023 INTERIOR ARCHITECTURAL WOODWORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Plastic-laminate cabinets.
 - 2. Plastic-laminate countertops.
 - 3. Chemical-resistant plastic-laminate countertops.
 - 4. Quartz Countertops.
 - 5. Shop finishing of interior woodwork.
- B. Related Sections include the following:
 - 1. Division 06 Section "Rough Carpentry" for wood furring, blocking, shims, and hanging strips required for installing woodwork and concealed within other construction before woodwork installation.

1.3 DEFINITIONS

- A. Interior architectural woodwork includes wood furring, blocking, shims, and hanging strips for installing woodwork items unless concealed within other construction before woodwork installation.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated, including cabinet hardware and accessories and finishing materials and processes.
- B. Product Data: For panel products, high-pressure decorative laminate, adhesive for bonding plastic laminate, solid-surfacing material, cabinet hardware and accessories, finishing materials and processes.
 - 1. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements.
- C. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.
 - 1. Show details full size.
 - 2. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.

3. Show locations and sizes of cutouts and holes for plumbing fixtures, faucets, soap dispensers, and other items installed in architectural woodwork.
4. Show veneer leaves with dimensions, grain direction, exposed face, and identification numbers indicating the flitch and sequence within the flitch for each leaf.
5. Apply WI-certified compliance label to first page of Shop Drawings.

D. Samples for Initial Selection:

1. Shop-applied transparent finishes.
2. Plastic laminates.
3. PVC edge material.

E. Product Certificates: For each type of product, signed by product manufacturer.

F. Woodwork Quality Standard Compliance Certificates: AWI Quality Certification Program certificates.

G. Qualification Data: For Installer and fabricator.

1.5 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate products similar to those required for this Project and whose products have a record of successful in-service performance. Shop is a certified participant in AWI's Quality Certification Program.

B. Installer Qualifications: Certified participant in AWI's Quality Certification Program.

C. Source Limitations: Engage a qualified woodworking firm to assume undivided responsibility for production of interior architectural woodwork with sequence-matched wood veneers and transparent-finished wood doors that are required to be of same species as woodwork.

D. Quality Standard: Unless otherwise indicated, comply with AWI's "Architectural Woodwork Quality Standards" for grades of interior architectural woodwork indicated for construction, finishes, installation, and other requirements.

1. Provide AWI Quality Certification Program labels and certificates indicating that woodwork, including installation, complies with requirements of grades specified.

E. Fire-Test-Response Characteristics: Where fire-retardant materials or products are indicated, provide materials and products with specified fire-test-response characteristics as determined by testing identical products per test method indicated by UL, ITS, or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify with appropriate markings of applicable testing and inspecting agency in the form of separable paper label or, where required by authorities having jurisdiction, imprint on surfaces of materials that will be concealed from view after installation.

F. Forest Certification: Provide interior architectural woodwork produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship."

G. Pre-installation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver woodwork until painting and similar operations that could damage woodwork have been completed in installation areas. If woodwork must be stored in other than installation areas, store only in areas where environmental conditions comply with requirements specified in "Project Conditions" Article.

1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install woodwork until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.
- B. Environmental Limitations: Do not deliver or install woodwork until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature between 60 and 90 deg F and relative humidity between 17 and 50 percent during the remainder of the construction period.
- C. Field Measurements: Where woodwork is indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
 - 1. Locate concealed framing, blocking, and reinforcements that support woodwork by field measurements before being enclosed, and indicate measurements on Shop Drawings.
 - 2. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating woodwork without field measurements. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

1.8 COORDINATION

- A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that interior architectural woodwork can be supported and installed as indicated.
- B. Hardware Coordination: Distribute copies of approved hardware schedule specified in Division 08 Section "Door Hardware (Scheduled by Describing Products)" to fabricator of architectural woodwork; coordinate Shop Drawings and fabrication with hardware requirements.

PART 2 - PRODUCTS

2.1 WOODWORK FABRICATORS

- A. Fabricators: Subject to compliance with requirements.

2.2 MATERIALS

- A. General: Provide materials that comply with requirements of AWI's quality standard for each type of woodwork and quality grade specified, unless otherwise indicated.

- B. Wood Species and Cut for Transparent Finish: Red oak, plain sawn or sliced.
- C. Wood Products: Comply with the following:
 - 1. Recycled Content of Medium-Density Fiberboard and Particleboard: Provide products with an average recycled content so postconsumer recycled content plus one-half of preconsumer recycled content is not less than 100 percent.
 - 2. Softwood Plywood: DOC PS 1.
- D. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated or, if not indicated, as required by woodwork quality standard.
 - 1. Manufacturer: Subject to compliance with requirements, provide high-pressure decorative laminates by:
 - a. Pionite.
- E. Chemical-resistant Plastic-laminate: 'Chemtop2' chemical resistant laminate sheets by Formica Corporation, Cincinnati, Ohio.
- F. Quartz Surface Counter: 'One Quartz Surfaces' by Daltile, slab with polished finish.

2.3 FIRE-RETARDANT-TREATED MATERIALS

- A. General: Where fire-retardant-treated materials are indicated, use materials complying with requirements in this Article, that are acceptable to authorities having jurisdiction, and with fire-test-response characteristics specified.
 - 1. Do not use treated materials that do not comply with requirements of referenced woodworking standard or that are warped, discolored, or otherwise defective.
 - 2. Use fire-retardant-treatment formulations that do not bleed through or otherwise adversely affect finishes. Do not use colorants to distinguish treated materials from untreated materials.
 - 3. Identify fire-retardant-treated materials with appropriate classification marking of UL, U.S. Testing, Timber Products Inspection, or another testing and inspecting agency acceptable to authorities having jurisdiction.
- B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Comply with performance requirements of AWPAC20 (lumber) and AWPAC27 (plywood). Use the following treatment type:
 - 1. Exterior Type: Organic-resin-based formulation thermally set in wood by kiln drying.
 - 2. Interior Type A: Low-hygroscopic formulation.
 - 3. Mill lumber after treatment within limits set for wood removal that do not affect listed fire-test-response characteristics, using a woodworking plant certified by testing and inspecting agency.
 - 4. Mill lumber before treatment and implement special procedures during treatment and drying processes that prevent lumber from warping and developing discolorations from drying sticks or other causes, marring, and other defects affecting appearance of treated woodwork.
 - 5. Kiln-dry materials before and after treatment to levels required for untreated materials.

2.4 CABINET HARDWARE AND ACCESSORIES

- A. General: Provide cabinet hardware and accessory materials associated with architectural cabinets, except for items specified in Division 08 Section "Door Hardware (Scheduled by Describing Products)."
- B. Frameless Concealed Hinges (European Type): BHMA A156.9, B01602, 100 degrees of opening, self-closing.
- C. Handles: Back mounted, Satin Chrome 4" wire pulls.
- D. Catches: Magnetic catches, BHMA A156.9, B03141.
- E. Adjustable Shelf Standards and Supports: BHMA A156.9, B04071; with shelf rests, B04081.
- F. Shelf Rests: BHMA A156.9, B04013; metal, two-pin type with shelf hold-down clip.
- G. Drawer Slides: BHMA A156.9, B05091.
 - 1. Heavy Duty (Grade 1HD-100 and Grade 1HD-200): Side mounted; full-extension type; zinc-plated steel ball-bearing slides.
 - 2. Box Drawer Slides: Grade 1; for drawers not more than 6 inches high and 24 inches wide.
 - 3. File Drawer Slides: Grade 1HD-100; for drawers more than 6 inches high or 24 inches wide.
 - 4. Keyboard Slides: Grade 1; for computer keyboard shelves.
- H. Door Locks: BHMA A156.11, E07121.
- I. Drawer Locks: BHMA A156.11, E07041.
- J. Grommets for Cable Passage through Countertops: 2-inch OD, black, molded-plastic grommets and matching plastic caps with slot for wire passage.
- K. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with BHMA A156.18 for BHMA finish number indicated.
 - 1. Satin Chromium Plated: BHMA 626 for brass or bronze base; BHMA 652 for steel base.
- L. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in BHMA A156.9.

2.5 MISCELLANEOUS MATERIALS

- A. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, kiln dried to less than 15 percent moisture content.
- B. Furring, Blocking, Shims, and Hanging Strips: Fire-retardant-treated softwood lumber, kiln dried to less than 15 percent moisture content.
- C. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide nonferrous-metal or hot-dip galvanized anchors and inserts on inside face of exterior walls and elsewhere as required for corrosion resistance. Provide toothed-steel or lead expansion sleeves for drilled-in-place anchors.

- D. Adhesives, General: Do not use adhesives that contain urea formaldehyde.
- E. VOC Limits for Installation Adhesives and Glues: Use installation adhesives 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. Contact Adhesive: 250 g/L.
- F. Adhesive for Bonding Plastic Laminate: Unpigmented contact cement.

2.6 FABRICATION, GENERAL

- A. Interior Woodwork Grade: Unless otherwise indicated, provide Custom-grade interior woodwork complying with referenced quality standard.
- B. Wood Moisture Content: Comply with requirements of referenced quality standard for wood moisture content in relation to ambient relative humidity during fabrication and in installation areas.
- C. Sand fire-retardant-treated wood lightly to remove raised grain on exposed surfaces before fabrication.
- D. Fabricate woodwork to dimensions, profiles, and details indicated. Ease edges to radius indicated for the following:
 - 1. Corners of Cabinets and Edges of Solid-Wood (Lumber) Members 3/4 Inch Thick or Less: 1/16 inch.
 - 2. Edges of Rails and Similar Members More Than 3/4 Inch Thick: 1/8 inch.
 - 3. Corners of Cabinets and Edges of Solid-Wood (Lumber) Members and Rails: 1/16 inch.
- E. Complete fabrication, including assembly, finishing, and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.
 - 1. Notify Architect seven days in advance of the dates and times woodwork fabrication will be complete.
 - 2. Trial fit assemblies at fabrication shop that cannot be shipped completely assembled. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting. Verify that various parts fit as intended and check measurements of assemblies against field measurements indicated on Shop Drawings before disassembling for shipment.
- F. Shop-cut openings to maximum extent possible to receive hardware, appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.
 - 1. Seal edges of openings in countertops with a coat of varnish.

2.7 PLASTIC-LAMINATE CABINETS

- A. Grade: Custom.
- B. AWI Type of Cabinet Construction: Flush overlay.
- C. Laminate Cladding for Exposed Surfaces: High-pressure decorative laminate complying with the following requirements:
 - 1. Horizontal Surfaces Other Than Tops: Grade HGS.
 - 2. Vertical Surfaces: Grade HGS.
 - 3. Edges: PVC edge banding, 0.12 inch thick. Color: White.
- D. Materials for Semi-exposed Surfaces:
 - 1. Surfaces Other Than Drawer Bodies: High-pressure decorative laminate, Grade VGS.
 - a. Edges of Plastic-Laminate Shelves: PVC edge banding, 0.12 inch thick, matching laminate in color, pattern, and finish.
 - b. For semi-exposed backs of panels with exposed plastic-laminate surfaces, provide surface of high-pressure decorative laminate, Grade VGS.
 - 2. Drawer Sides and Backs: Thermoset decorative panels.
 - 3. Drawer Bottoms: Hardwood plywood.
- E. Concealed Backs of Panels with Exposed Plastic Laminate Surfaces: High-pressure decorative laminate, Grade BKL.
- F. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:
 - 1. As selected by Architect from laminate manufacturer's full range in the following categories:
 - a. Solid colors.
 - b. Wood grains.
 - c. Patterns.

2.8 PLASTIC-LAMINATE COUNTERTOPS

- A. Grade: Custom.
- B. High-Pressure Decorative Laminate Grade: HGS.
- C. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:
 - 1. As selected by Architect from manufacturer's full range in the following categories:
 - a. Solid colors.
 - b. Wood grains.
 - c. Patterns.
- D. Grain Direction: Parallel to cabinet fronts.

- E. Edge Treatment: Plastic Laminate.
- F. Backer Sheet: Provide plastic-laminate backer sheet, Grade BKL, on underside of countertop substrate.
- G. Paper Backing: Provide paper backing on underside of countertop substrate.

2.9 CHEMICAL-RESISTANT PLASTIC-LAMINATE COUNTERTOPS

- A. Grade: Custom.
- B. High-Pressure Decorative Laminate Grade: S2
- C. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:
 - 1. As selected by Architect from manufacturer's full range in the following categories:
 - a. Solid colors.
 - b. Patterns.
- D. Edge Treatment: Chemical-resistant plastic-laminate.
- E. Thickness: .125"
- F. Substrate: Medium Density Fiberboard (MDF)

2.10 QUARTZ SURFACE COUNTERTOPS

- A. Grade: Slab (120"L x 55"W) cut to required countertop size.
- B. Thickness: 3/4" over substrate. See Architectural drawings.
- C. Colors: NQ66: Fresh Linens by Daltile.
- D. Edge Treatment: Quartz surface with eased corners.
- E. Finish: Polished
- F. Joints: Butt joints to create a single slab look. Provide color matching manufacturer approved joint material between joints.

2.11 SHOP FINISHING

- A. Grade: Provide finishes of same grades as items to be finished.
- B. General: Finish architectural woodwork at fabrication shop as specified in this Section. Defer only final touchup, cleaning, and polishing until after installation.
- C. General: Shop finish transparent-finished interior architectural woodwork at fabrication shop as specified in this Section. Refer to Division 09 painting Sections for finishing opaque-finished architectural woodwork.
- D. General: Drawings indicate items that are required to be shop finished. Finish such items at fabrication shop as specified in this Section. Refer to Division 09 painting Sections for finishing architectural woodwork not indicated to be shop finished.
- E. General: Install all face materials per manufacturer's recommendations.
- F. Shop Priming: Shop apply the prime coat including backpriming, if any, for transparent-finished items specified to be field finished. Refer to Division 09 painting Sections for material and application requirements.
- G. Preparation for Finishing: Comply with referenced quality standard for sanding, filling countersunk fasteners, sealing concealed surfaces, and similar preparations for finishing architectural woodwork, as applicable to each unit of work.
 - 1. Backpriming: Apply one coat of sealer or primer, compatible with finish coats, to concealed surfaces of woodwork. Apply two coats to back of paneling and to end-grain surfaces. Concealed surfaces of plastic-laminate-clad woodwork do not require backpriming when surfaced with plastic laminate, backing paper, or thermoset decorative panels.
- H. Transparent Finish:
 - 1. Grade: Custom.
 - 2. Staining: Match approved sample for color.
 - 3. Wash Coat for Stained Finish: Apply wash-coat sealer to woodwork made from closed-grain wood before staining and finishing.
 - 4. Open Finish for Open-Grain Woods: Do not apply filler to open-grain woods.
 - 5. Filled Finish for Open-Grain Woods: After staining (if any), apply paste wood filler to open-grain woods and wipe off excess. Tint filler to match stained wood.
 - a. Apply wash-coat sealer after staining and before filling.

PART 3 - EXECUTION

3.1 PREPARATION

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

3.2 INSTALLATION

- A. Grade: Install woodwork to comply with requirements for the same grade specified in Part 2 for fabrication of type of woodwork involved.
- B. Assemble woodwork and complete fabrication at Project site to comply with requirements for fabrication in Part 2, to extent that it was not completed in the shop.
- C. Install woodwork level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb (including tops) to a tolerance of 1/8 inch in 96 inches.
- D. Scribe and cut woodwork to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
- E. Fire-Retardant-Treated Wood: Handle, store, and install fire-retardant-treated wood to comply with chemical treatment manufacturer's written instructions, including those for adhesives used to install woodwork.
- F. Anchor woodwork to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing as required for complete installation. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with woodwork and matching final finish if transparent finish is indicated.
- G. Standing and Running Trim: Install with minimum number of joints possible, using full-length pieces (from maximum length of lumber available) to greatest extent possible. Do not use pieces less than 60 inches long, except where shorter single-length pieces are necessary.
 - 1. Fill gaps, if any, between top of base and wall with plastic wood filler, sand smooth, and finish same as wood base if finished.
 - 2. Install standing and running trim with no more variation from a straight line than 1/8 inch in 96 inches.
- H. Cabinets: Install without distortion so doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.
 - 1. Install cabinets with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.
 - 2. Maintain veneer sequence matching of cabinets with transparent finish.
 - 3. Fasten wall cabinets through back, near top and bottom, at ends and not more than 16 inches o.c. with No. 10 wafer-head screws sized for 1-inch penetration into wood framing, blocking, or hanging strips.
- I. Countertops: Anchor securely by screwing through corner blocks of base cabinets or other supports into underside of countertop.
 - 1. Align adjacent solid-surfacing-material countertops and form seams to comply with manufacturer's written recommendations using adhesive in color to match countertop. Carefully dress joints smooth, remove surface scratches, and clean entire surface.
 - 2. Install countertops with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.
 - 3. Secure backsplashes to tops with concealed metal brackets at 16 inches o.c. and to walls with adhesive.
 - 4. Calk space between backsplash and wall with sealant specified in Division 07 Section "Joint Sealants."

- J. Touch up finishing work specified in this Section after installation of woodwork. Fill nail holes with matching filler where exposed.
- K. Refer to Division 09 Sections for final finishing of installed architectural woodwork not indicated to be shop finished.

3.3 ADJUSTING AND CLEANING

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

END OF SECTION 06-4023

SECTION 07-2100 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. This Section includes the following:
 - 1. Perimeter insulation under slabs-on-grade.
 - 2. Concealed building insulation.
 - 3. Sound attenuation insulation.
- B. Related Sections include the following:
 - 1. Division 07 Section "Cold-Fluid-Applied Waterproofing" for insulation and insulated drainage panels installed with waterproofing.
 - 2. Division 07 Section "Thermoplastic Membrane Roofing" for insulation specified as part of roofing construction.
 - 3. Division 09 Sections "Gypsum Board"
 - 4. Division 21 Section "Fire-Suppression Systems Insulation."
 - 5. Division 22 Section "Plumbing Insulation."
 - 6. Division 23 Section "HVAC Insulation."

1.3 DEFINITIONS

- A. Mineral-Fiber Insulation: Insulation composed of rock-wool fibers, slag-wool fibers, or glass fibers; produced in boards and blanket with latter formed into batts (flat-cut lengths) or rolls.
- B. Natural Cotton Fiber Insulation: Insulation composed of natural fiber.

1.4 PERFORMANCE REQUIREMENTS

- A. Plenum Rating: Provide glass-fiber insulation where indicated in ceiling plenums whose test performance is rated as follows for use in plenums as determined by testing identical products per "Erosion Test" and "Mold Growth and Humidity Test" described in UL 181, or on comparable tests from another standard acceptable to authorities having jurisdiction.
 - 1. Erosion Test Results: Insulation shows no visible evidence of cracking, flaking, peeling, or delamination of interior surface of duct assembly, after testing for 4 hours at 2500-fpm air velocity.
 - 2. Mold Growth and Humidity Test Results: Insulation shows no evidence of mold growth, delamination, or other deterioration due to the effects of high humidity, after inoculation with *Chaetomium globosum* on all surfaces and storing for 60 days at 100 percent relative humidity in the dark.

1.5 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples for Verification: Full-size units for each type of exposed insulation indicated.
- C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency for insulation products.
- D. Provide location of manufacturer.
- E. Research/Evaluation Reports: For foam-plastic insulation.

1.6 QUALITY ASSURANCE

- A. Source Limitations: Obtain each type of building insulation through one source from a single manufacturer.
- B. Fire-Test-Response Characteristics: Provide insulation and related materials with the fire-test-response characteristics indicated, as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.
 - 1. Surface-Burning Characteristics: ASTM E 84.
 - 2. Fire-Resistance Ratings: ASTM E 119.
 - 3. Combustion Characteristics: ASTM E 136.
- C. Recycled Content:
 - a. Provide glass-fiber insulation with minimum 26% postindustrial and 9% postconsumer recycled content. (35% total recycled content.)
 - b. Provide Natural fiber insulation with minimum 80% post-industrial recycle content.
- D. Obtain insulation material from manufacturer located within 500 miles of the project site.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Protect insulation materials from physical damage and from deterioration by moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.
- B. Protect plastic insulation as follows:
 - 1. Do not expose to sunlight, except to extent necessary for period of installation and concealment.
 - 2. Protect against ignition at all times. Do not deliver 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.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.

2.2 BLANKET INSULATION/FOAM-PLASTIC BOARD INSULATION

- A. Manufacturers:
1. Owens Corning.
 2. Bonded Logic Inc.
 3. Dow Chemical Company.
- B. Type 'A' Batt Insulation: Type II – with nonreflective membrane on side ASTM C665 friction fit, conforming to the following:
1. Thermal Resistance: R38
 2. Flame Spread Rating: 0-25 Class A
 3. Facing: Facing on one side to be a scrim reinforced flame resistant kraft (FSK-25) vapor barrier. Facing installed towards warm side of building.
 4. Attachment: Tie back to structure with manufacturer approved strapping at 24" o.c. max
- C. Type 'B' Batt Insulation: Type II – with reflective membrane on side ASTM C665 friction fit, conforming to the following:
1. Thermal Resistance: R21
 2. Flame Spread Rating: 0-25 Class A
 3. Facing: Facing on one side to be a scrim reinforced flame resistant foil (FSK-25) vapor barrier. Facing installed towards warm side of building.
- D. Type 'C' Extruded-Polystyrene Board (XPS) Insulation: ASTM C 578, of type and density indicated below, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively. Provide foam plastic perimeter board insulation to be R5 per inch (total required R10) and 2 inch thick board as indicated on drawing.
1. Manufacturers: Subject to compliance with requirements, available manufactures offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Owens Corning or equal.
 - b. Dow Chemical Company
 2. Provide Type VI, 40 psi or Type VII, 60 psi.

- E. Type 'D' Batt Insulation: Sound Attenuation Batt (SAFB) Insulation – Type I conforming to the following:
 - 1. Thickness: 3-1/2 inches.
 - 2. Facing: Unfaced.
- F. Tape: Bright Aluminum self-adhering type, mesh reinforced, 2 inches wide.
- G. Wire Mesh: Galvanized steel, hexagonal wire mesh.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements of Sections in which substrates and related work are specified and for other conditions affecting performance.
 - 1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

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

3.3 INSTALLATION, GENERAL

- A. Comply with insulation manufacturer's written instructions applicable to products and application indicated.
- B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed at any time to ice, rain, and snow.
- C. Extend insulation in thickness indicated to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.
- D. Water-Piping Coordination: If water piping is located within insulated exterior walls, coordinate location of piping to ensure that it is placed on warm side of insulation and insulation encapsulates piping.
- E. For preformed insulating units, 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.

3.4 INSTALLATION OF PERIMETER INSULATION

- A. On vertical surfaces, set insulation units in adhesive applied according to manufacturer's written instructions. Use adhesive recommended by insulation manufacturer.
- B. On horizontal surfaces, loosely lay insulation units according to manufacturer's written instructions. Stagger end joints and tightly abut insulation units.
- C. Protect below-grade insulation on vertical surfaces from damage during backfilling by applying protection course with joints butted. Set in adhesive according to insulation manufacturer's written instructions.
- D. Protect top surface of horizontal insulation from damage during concrete work by applying protection course with joints butted.

3.5 INSTALLATION OF GENERAL BUILDING INSULATION

- 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. Seal joints between foam-plastic insulation units by applying adhesive, mastic, or sealant to edges of each unit to form a tight seal as units are shoved into place. Fill voids in completed installation with adhesive, mastic, or sealant as recommended by insulation manufacturer.
- C. Install mineral-fiber insulation 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 cavity, 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.
 - 4. Install eave ventilation troughs between roof framing members in insulated attic spaces at vented eaves.
 - 5. For metal-framed wall cavities where cavity heights exceed 96 inches, support unfaced blankets mechanically and support faced blankets by taping flanges of insulation to flanges of metal studs.
- D. Install board insulation on concrete substrates by adhesively attached, spindle-type insulation anchors as follows:
 - 1. Fasten insulation anchors to concrete substrates with insulation anchor adhesive according to anchor manufacturer's written instructions. Space anchors according to insulation manufacturer's written instructions for insulation type, thickness, and application indicated.
 - 2. Apply insulation standoffs to each spindle to create cavity width indicated between concrete substrate and insulation.
 - 3. After adhesive has dried, install board insulation by pressing insulation into position over spindles and securing it tightly in place with insulation-retaining washers, taking care not to compress insulation below indicated thickness.
 - 4. Where insulation will not be covered by other building materials, apply capped washers to tips of spindles.

- E. Stuff glass-fiber loose-fill insulation into miscellaneous voids and cavity spaces where shown. Compact to approximately 40 percent of normal maximum volume equaling a density of approximately 2.5 lb/cu. ft.
- F. Install Polypropylene scrim sheet on interior side of exterior studs.

3.6 INSTALLATION OF INSULATION IN CEILINGS FOR SOUND ATTENUATION

- A. Install where indicated in the drawings and partition types.

3.7 PROTECTION

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

3.8 INSULATION SCHEDULE (refer to architectural drawings for additional location information)

- A. Insulation Type 'A' Insulation: Install under existing pre-engineered metal building roof deck and structure. Also install under new roof decking. (provide vinyl face sheet under insulation and tied back to structure with manufacturer approved strapping at 24" o.c. max)
- B. Insulation Type 'B' Insulation: Install between new metal studs adjacent to existing exterior walls or between new metal studs at new exterior walls.
- C. Insulation Type 'C' Insulation: Install adjacent to concrete stem wall and under concrete floor slab.
- D. Insulation Type 'D' Insulation: Install between metal studs of interior partitions.

END OF SECTION 07-2100

**SECTION 07-6200
SHEET METAL FLASHING AND TRIM**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Manufactured Products:
 - a. Manufactured reglets and counterflashing.
2. Formed Products:
 - a. Formed roof drainage sheet metal fabrications.
 - b. Formed low-slope roof sheet metal fabrications.

B. Related Sections:

1. Division 06 Section "Rough Carpentry and Miscellaneous Rough Carpentry" for wood nailers, curbs, and blocking.
2. Division 07 Section "Metal Roof Panels" for sheet metal flashing and trim integral with metal roof panels.
3. Division 07 Section "Metal Wall Panels" for sheet metal flashing and trim integral with metal wall panels.
4. Division 07 Section "Fully Adhered Thermoplastic Pololefin (TPO) Roofing" for installing sheet metal flashing and trim integral with membrane roofing.
5. Division 07 Section "Roof Specialties" for manufactured roof specialties not part of sheet metal flashing and trim.
6. Division 07 Section "Roof Accessories" for set-on-type curbs, equipment supports, roof hatches, vents, and other manufactured roof accessory units.

1.3 PERFORMANCE REQUIREMENTS

- A. General: Sheet metal flashing and trim assemblies as indicated shall withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.
- B. Thermal Movements: Provide sheet metal flashing and trim that allows for thermal movements from ambient and surface temperature changes.

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. Include the following:
 - 1. Identification of material, thickness, weight, and finish for each item and location in Project.
 - 2. Details for forming sheet metal flashing and trim, including profiles, shapes, seams, and dimensions.
 - 3. Details for joining, supporting, and securing sheet metal flashing and trim, including layout of fasteners, cleats, clips, and other attachments. Include pattern of seams.
 - 4. Details of termination points and assemblies, including fixed points.
 - 5. Details of expansion joints and expansion-joint covers, including showing direction of expansion and contraction.
 - 6. Details of edge conditions, including eaves, ridges, valleys, rakes, crickets, and counterflashings as applicable.
 - 7. Details of special conditions.
 - 8. Details of connections to adjoining work.
- C. Samples for Initial Selection: For each type of sheet metal flashing, trim, and accessory indicated with factory-applied color finishes involving color selection.
- D. Qualification Data: For qualified fabricator.
- E. Maintenance Data: For sheet metal flashing, trim, and accessories to include in maintenance manuals.
- F. Warranty: Sample of special warranty.

1.5 QUALITY ASSURANCE

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

1.6 DELIVERY, STORAGE, AND HANDLING

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

1.7 WARRANTY

- A. Special Warranty on Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace sheet metal flashing and trim that shows evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
 - b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
 - 2. Finish Warranty Period: 15 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SHEET METALS

- A. General: Protect mechanical and other finishes on exposed surfaces from damage by applying a strippable, temporary protective film before shipping.
- B. Metallic-Coated Steel Sheet: Restricted flatness steel sheet, metallic coated by the hot-dip process and prepainted by the coil-coating process to comply with ASTM A 755/A 755M.
 - 1. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 coating designation; structural quality.
 - 2. Surface: Embossed and with manufacturer's standard clear acrylic coating on both sides.

2.2 UNDERLAYMENT MATERIALS

- A. Polyethylene Sheet: 6-mil- thick polyethylene sheet complying with ASTM D 4397.
- B. Felt: ASTM D 226, Type II (No. 30), asphalt-saturated organic felt, nonperforated.
- C. Slip Sheet: Building paper, 3-lb/100 sq. ft. minimum, rosin sized.

2.3 MISCELLANEOUS MATERIALS

- A. General: Provide materials and types of fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and recommended by manufacturer of primary sheet metal or manufactured item unless otherwise indicated.
- B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal or manufactured item.
 - 1. General: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.
 - a. Exposed Fasteners: Heads matching color of sheet metal using plastic caps or factory-applied coating.

- b. Blind Fasteners: High-strength aluminum or stainless-steel rivets suitable for metal being fastened.
 - c. Spikes and Ferrules: Same material as gutter; with spike with ferrule matching internal gutter width.
 - 2. Fasteners for Zinc-Coated (Galvanized) Steel Sheet: Hot-dip galvanized steel according to ASTM A 153/A 153M or ASTM F 2329 or Series 300 stainless steel.
 - 3. Fasteners for Zinc Sheet: Hot-dip galvanized steel according to ASTM A 153/A 153M or ASTM F 2329 or Series 300 stainless steel.
- C. Solder:
- 1. For Zinc-Coated (Galvanized) Steel: ASTM B 32, Grade Sn50, 50 percent tin and 50 percent lead or Grade Sn60, 60 percent tin and 40 percent lead.
- D. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch wide and 1/8 inch thick.
- E. Elastomeric Sealant: ASTM C 920, elastomeric silicone polymer sealant; low modulus; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.
- F. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type expansion joints with limited movement.
- G. Epoxy Seam Sealer: Two-part, noncorrosive, aluminum seam-cementing compound, recommended by aluminum manufacturer for exterior nonmoving joints, including riveted joints.

2.4 MANUFACTURED SHEET METAL FLASHING AND TRIM

- A. Reglets: Units of type, material, and profile indicated, formed to provide secure interlocking of separate reglet and counterflashing pieces, and compatible with flashing indicated with interlocking counterflashing on exterior face, of same metal as reglet.
- 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Cheney Flashing Company.
 - b. Fry Reglet Corporation.
 - c. Keystone Flashing Company, Inc.
 - d. National Sheet Metal Systems, Inc.
 - 2. Material: Galvanized steel, 0.022 inch thick.
 - 3. Surface-Mounted Type: Provide with slotted holes for fastening to substrate, with neoprene or other suitable weatherproofing washers, and with channel for sealant at top edge.
 - 4. Accessories:
 - a. Flexible-Flashing Retainer: Provide resilient plastic or rubber accessory to secure flexible flashing in reglet where clearance does not permit use of standard metal counterflashing or where Drawings show reglet without metal counterflashing.

- b. Counterflashing Wind-Restraint Clips: Provide clips to be installed before counterflashing to prevent wind uplift of counterflashing lower edge.

5. Finish: Mill.

2.5 FABRICATION, GENERAL

- A. General: Custom fabricate sheet metal flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, geometry, metal thickness, and other characteristics of item indicated. Fabricate items at the shop to greatest extent possible.
 - 1. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.
 - 2. Obtain field measurements for accurate fit before shop fabrication.
 - 3. Form sheet metal flashing and trim without excessive oil canning, buckling, and tool marks and true to line and levels indicated, with exposed edges folded back to form hems.
 - 4. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces exposed to view.
- B. Fabrication Tolerances: Fabricate sheet metal flashing and trim that is capable of installation to a tolerance of 1/4 inch in 20 feet on slope and location lines as indicated and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.
- C. Fabrication Tolerances: Fabricate sheet metal flashing and trim that is capable of installation to tolerances specified in MCA's "Guide Specification for Residential Metal Roofing."
- D. Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant.
- E. Expansion Provisions: Where lapped expansion provisions cannot be used, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with butyl sealant concealed within joints.
- F. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.
- G. Fabricate cleats and attachment devices of sizes as recommended by SMACNA's "Architectural Sheet Metal Manual" for application, but not less than thickness of metal being secured.
- H. Seams: Fabricate nonmoving seams with flat-lock seams. Tin edges to be seamed, form seams, and solder.
- I. Seams: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with elastomeric sealant unless otherwise recommended by sealant manufacturer for intended use. Rivet joints where necessary for strength.
- J. Do not use graphite pencils to mark metal surfaces.

2.6 LOW-SLOPE ROOF SHEET METAL FABRICATIONS

- A. Base Flashing: Fabricate from the following materials:
 - 1. Galvanized Steel: 0.028 inch thick.
- B. Counterflashing: Fabricate from the following materials:
 - 1. Galvanized Steel: 0.022 inch thick.
- C. Flashing Receivers: Fabricate from the following materials:
 - 1. Galvanized Steel: 0.022 inch thick.
- D. Roof-Penetration Flashing: Fabricate from the following materials:
 - 1. Galvanized Steel: 0.028 inch thick.
- E. Roof-Drain Flashing: Fabricate from the following materials:
 - 1. Zinc-Tin Alloy-Coated Stainless Steel: 0.015 inch thick.

2.7 MISCELLANEOUS SHEET METAL FABRICATIONS

- A. Equipment Support Flashing: Fabricate from the following materials:
 - 1. Galvanized Steel: 0.028 inch thick.

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 INSTALLATION, GENERAL

- A. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.

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

3.3 ROOF DRAINAGE SYSTEM INSTALLATION

- A. General: Install sheet metal roof drainage items to produce complete roof drainage system according to SMACNA recommendations and as indicated. Coordinate installation of roof perimeter flashing with installation of roof drainage system.

3.4 ROOF FLASHING INSTALLATION

- A. General: Install sheet metal flashing and trim to comply with performance requirements, sheet metal manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, set units true to line, and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.
- B. Roof Edge Flashing: Anchor to resist uplift and outward forces according to recommendations in SMACNA's "Architectural Sheet Metal Manual" and as indicated. Interlock bottom edge of roof edge flashing with continuous cleat anchored to substrate at staggered 3-inch centers.
- C. Copings: Anchor to resist uplift and outward forces according to recommendations in SMACNA's "Architectural Sheet Metal Manual" and as indicated.
- D. Pipe or Post Counterflashing: Install counterflashing umbrella with close-fitting collar with top edge flared for elastomeric sealant, extending a minimum of 4 inches over base flashing. Install stainless-steel draw band and tighten.
- E. Counterflashing: Coordinate installation of counterflashing with installation of base flashing. Insert counterflashing in reglets or receivers and fit tightly to base flashing. Extend counterflashing 4 inches over base flashing. Lap counterflashing joints a minimum of 4 inches and bed with sealant. Secure in a waterproof manner by means of interlocking folded seam or blind rivets and sealant] [anchor and washer at 36-inch centers.
- F. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Seal with roof manufacturer's recommended sealant.

3.5 WALL FLASHING INSTALLATION

- A. General: Install sheet metal wall flashing to intercept and exclude penetrating moisture according to SMACNA recommendations and as indicated. Coordinate installation of wall flashing with installation of wall-opening components such as windows, doors, and louvers.

3.6 MISCELLANEOUS FLASHING INSTALLATION

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

3.7 ERECTION TOLERANCES

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

3.8 CLEANING AND PROTECTION

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

END OF SECTION 07-6200

SECTION 07-7100 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. Reglets and counterflashings.

- B. Related Sections:

- 1. Division 06 Section "Rough Carpentry and Miscellaneous Rough Carpentry" for wood nailers, curbs, and blocking.
- 2. Division 07 Section "Composite Wall Panels" for copings and trim associated with Composite Wall Panel Systems.
- 3. Division 07 Section "Sheet Metal Flashing and Trim" for custom- and site-fabricated sheet metal flashing and trim.
- 4. Division 07 Section "Joint Sealants" for field-applied sealants between roof specialties and adjacent materials.

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. FM Approvals' Listing: Manufacture and install copings and roof-edge flashings that are listed in FM Approvals' "RoofNav" and approved for windstorm classifications indicated in the Drawings. Identify materials with FM Approvals' markings.
- C. SPRI Wind Design Standard: Manufacture and install copings and roof-edge flashings tested according to SPRI ES-1 and capable of resisting the following design pressures:
 - 1. Design Pressure: As indicated on Drawings.
- D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, hole elongation, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Provide clips that resist rotation and avoid shear stress as a result of thermal movements. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 - 1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Shop Drawings: For roof specialties. Include plans, elevations, expansion-joint locations, keyed details, and attachments to other work. Distinguish between plant- and field-assembled work. Include the following:
 - 1. Details for expansion and contraction; locations of expansion joints, including direction of expansion and contraction.
 - 2. Pattern of seams and layout of fasteners, cleats, clips, and other attachments.
 - 3. Details of termination points and assemblies, including fixed points.
 - 4. Details of special conditions.
- C. Samples for Initial Selection: For each type of roof specialty indicated with factory-applied color finishes.
- D. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for copings and roof-edge flashings.
- E. Maintenance Data: For roofing specialties to include in maintenance manuals.
- F. Warranty: Sample of special warranty.

1.5 QUALITY ASSURANCE

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

1.6 DELIVERY, STORAGE, AND HANDLING

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

1.7 WARRANTY

- A. Special Warranty on Painted Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace roof specialties that show evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Fluoropolymer Finish: Deterioration includes, but is not limited to, the following:

- a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
 - b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 EXPOSED METALS

- A. Aluminum Sheet: ASTM B 209, alloy as standard with manufacturer for finish required, with temper to suit forming operations and performance required.
 1. Exposed Coil-Coated Finishes: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - a. Two-Coat Fluoropolymer: AAMA 620. System consisting of primer and fluoropolymer color topcoat containing not less than 70 percent PVDF resin by weight.
 - b. Concealed Surface: 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: ASTM B 221, alloy and temper recommended by manufacturer for type of use and finish indicated, finished as follows:
 1. Exposed High-Performance Organic Finish: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - a. Two-Coat Fluoropolymer: AAMA 2605. System consisting of primer and fluoropolymer color topcoat containing not less than 70 percent PVDF resin by weight.
- C. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 coating designation.
 1. Surface: Smooth finish.
 2. Mill-Phosphatized Finish: Manufacturer's standard for field painting.

2.2 CONCEALED METALS

- A. Aluminum Sheet: ASTM B 209, alloy and temper recommended by manufacturer for type of use and structural performance indicated, mill finished.
- B. Aluminum Extrusions: ASTM B 221, alloy and temper recommended by manufacturer for type of use and structural performance indicated, mill finished.
- C. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 coating designation.

2.3 UNDERLAYMENT MATERIALS

- A. Felt: ASTM D 226, Type II (No. 30), asphalt-saturated organic felt, non-perforated.
- B. Slip Sheet: Building paper, 3-lb/100 sq. ft. minimum, rosin sized.

2.4 MISCELLANEOUS MATERIALS

- A. General: Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items required by manufacturer for a complete installation.
- B. Fasteners: Manufacturer's recommended fasteners, suitable for application and designed to meet performance requirements. Furnish the following unless otherwise indicated:
 - 1. Exposed Penetrating Fasteners: Gasketed screws with hex washer heads matching color of sheet metal.
 - 2. Fasteners for Copper Sheet: Copper, hardware bronze, or passivated Series 300 stainless steel.
 - 3. Fasteners for Aluminum: Aluminum or Series 300 stainless steel.
 - 4. Fasteners for Stainless-Steel Sheet: Series 300 stainless steel.
 - 5. Fasteners for Zinc-Coated (Galvanized) Steel Sheet: Series 300 stainless steel or hot-dip zinc-coated steel according to ASTM A 153/A 153M or ASTM F 2329.
- C. Elastomeric Sealant: ASTM C 920, elastomeric polymer sealant of type, grade, class, and use classifications required by roofing-specialty manufacturer for each application.
- D. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type expansion joints with limited movement.

2.5 COPINGS

- A. Copings: Manufactured coping system consisting of formed-metal coping cap in section lengths not exceeding 12 feet, concealed anchorage; corner units, end cap units, and concealed splice plates with same finish as coping caps.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Architectural Products Company.
 - b. Castle Metal Products.
 - c. Cheney Flashing Company.
 - d. Johns Manville.
 - e. National Sheet Metal Systems, Inc.
 - f. Perimeter Systems; a division of Southern Aluminum Finishing Company, Inc.
 - g. Petersen Aluminum Corporation.
 - 2. Coping-Cap Material: Extruded aluminum, thickness as required to meet performance requirements.
 - a. Finish: Two-coat fluoropolymer.
 - b. Color: As selected by Architect from manufacturer's full range.

3. Corners: Factory mitered and soldered.
4. Special Fabrications: Two-way sloped coping cap.
5. Coping-Cap Attachment Method: Face leg hooked to continuous cleat with back leg fastener exposed, fabricated from coping-cap material.
6. Snap-on-Coping Anchor Plates: Concealed, galvanized-steel sheet, 12 inches wide, with integral cleats.
7. Face Leg Cleats: Concealed, continuous galvanized-steel sheet.
8. Provide neoprene hold-down strips at each hold-down clamp.

2.6 ROOF-EDGE FLASHINGS

- A. One-Piece Gravel Stops: Manufactured, one-piece, metal gravel stop in section lengths not exceeding 12 feet, with a horizontal flange and vertical leg fascia terminating in a drip edge, and concealed splice plates of same material, finish, and shape as gravel stop. Provide matching corner units.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Architectural Products Company.
 - b. Castle Metal Products.
 - c. Cheney Flashing Company.
 - d. National Sheet Metal Systems, Inc.
 - e. Petersen Aluminum Corporation.
 2. Fabricate from the following exposed metal:
 - a. Extruded Aluminum: Thickness as required to meet performance requirements.
 3. Corners: Factory mitered and soldered.
- B. Aluminum Finish: Two-coat fluoropolymer.
1. Color: As selected by Architect from manufacturer's full range.

2.7 REGLETS AND COUNTERFLASHINGS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Castle Metal Products.
 2. Cheney Flashing Company.
 3. Fry Reglet Corporation.
 4. National Sheet Metal Systems, Inc.
- B. Reglets: Manufactured units formed to provide secure interlocking of separate reglet and counterflashing pieces, from the following exposed metal:
1. Zinc-Coated Steel: Nominal 0.022-inch thickness.
 2. Corners: Factory mitered and soldered.

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. Zinc-Coated Steel: Nominal 0.022-inch thickness.
- D. Accessories:
 1. Flexible-Flashing Retainer: Provide resilient plastic or rubber accessory to secure flexible flashing in reglet where clearance does not permit use of standard metal counterflashing or where reglet is provided separate from metal counterflashing.
 2. Counterflashing Wind-Restraint Clips: Provide clips to be installed before counterflashing to prevent wind uplift of counterflashing lower edge.
- E. Zinc-Coated Steel Finish: Mill phosphatized for field painting.
 1. Color: As selected by Architect from manufacturer's full range.

2.8 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical 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. Felt Underlayment: Install with adhesive for temporary anchorage to minimize use of mechanical fasteners under roof specialties. Apply in shingle fashion to shed water, with lapped joints of not less than 2 inches.
- B. Slip Sheet: Install with tape or adhesive for temporary anchorage to minimize use of mechanical fasteners under 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. Underlayment: Where installing metal flashing directly on cementitious or wood substrates, install a course of felt underlayment and cover with a slip sheet.
 - 2. Bed flanges in thick coat of asphalt roofing cement where required by manufacturers of roof specialties for waterproof performance.
- 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 30 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 substrate not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.
- E. Seal joints with 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.
- G. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pre-tin edges of sheets to be soldered to a width of 1-1/2 inches except reduce pre-tinning where pre-tinned surface would show in completed Work. Tin edges of uncoated copper sheets using solder for copper. Do not use torches for soldering. Heat surfaces to receive solder and flow

solder into joint. Fill joint completely. Completely remove flux and spatter from exposed surfaces.

3.4 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 manufacturer's required spacing that meets performance requirements.
 - 2. Interlock face leg drip edge into continuous cleat anchored to substrate at manufacturer's required spacing that meets performance requirements. Anchor back leg of coping with screw fasteners and elastomeric washers at manufacturer's required spacing that meets performance requirements.

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 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 sealant recommended by roof manufacturer. Fit counterflashings tightly to base flashings.

3.7 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 07-7100

SECTION 07-9200 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. Acoustical joint sealants.

- B. Related Sections:

1. Division 08 Section "Glazing" for glazing sealants.
2. Division 09 Section "Gypsum Board" for sealing perimeter joints.
3. Division 09 Section "Tiling" for sealing tile joints.
4. Division 32 Section "Concrete Paving Joint Sealants" for sealing joints in pavements, walkways, and curbing.

1.3 SUBMITTALS

- A. Product Data: For each joint-sealant product indicated.
- B. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.
- C. Joint-Sealant Schedule: Include the following information:
 - 1. Joint-sealant application, joint location, and designation.
 - 2. Joint-sealant manufacturer and product name.
 - 3. Joint-sealant formulation.
 - 4. Joint-sealant color.
- D. Qualification Data: For qualified Installer.
- E. Product Certificates: For each kind of joint sealant and accessory, from manufacturer.
- F. Sealant, Waterproofing, and Restoration Institute (SWRI) Validation Certificate: For each sealant specified to be validated by SWRI's Sealant Validation Program.
- G. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating that sealants comply with requirements.

- H. Field-Adhesion Test Reports: For each sealant application tested.
- I. Warranties: Sample of special warranties.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.
- B. Source Limitations: Obtain each kind of joint sealant from single source from single manufacturer.
- C. Product Testing: Test joint sealants using a qualified testing agency.
 - 1. Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated.
 - 2. Test according to SWRI's Sealant Validation Program for compliance with requirements specified by reference to ASTM C 920 for adhesion and cohesion under cyclic movement, adhesion-in-peel, and indentation hardness.

1.5 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.
 - 2. When joint substrates are wet.
 - 3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
 - 4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.6 WARRANTY

- A. Special Installer's Warranty: 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.

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 nonstaining to porous substrates, provide products that have undergone testing according to ASTM C 1248 and have not stained porous joint substrates indicated for Project.
- E. 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: ASTM C 920, Type S, Grade NS, Class 100/50, for Use NT.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Dow Corning Corporation.
 - b. GE Advanced Materials.
 - c. Pecora Corporation.
 - d. Sika Corporation, Construction Products Division.
 - e. Tremco Incorporated.
- B. Single-Component, Nonsag, Neutral-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 50, for Use NT.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. BASF Building Systems.
 - b. Dow Corning Corporation.
 - c. GE Advanced Materials - Silicones.
 - d. Pecora Corporation.
 - e. Sika Corporation, Construction Products Division.
 - f. Tremco Incorporated.
- C. Single-Component, Nonsag, Neutral-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 25, for Use NT.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Dow Corning Corporation.
 - b. GE Advanced Materials.
 - c. Polymeric Systems, Inc.
 - d. Tremco Incorporated.
- D. Single-Component, Nonsag, Acid-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 25, for Use NT.
 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Bostik, Inc.; Chem-Calk.
 - b. Dow Corning Corporation.
 - c. GE Advanced Materials.
 - d. Pecora Corporation.
 - e. Polymeric Systems, Inc.
 - f. Tremco Incorporated.
- E. Single-Component, Nonsag, Traffic-Grade, Neutral-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 100/50, for Use T.
 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Dow Corning Corporation.
 - b. Pecora Corporation.
 - c. Tremco Incorporated.
- F. Mildew-Resistant, Single-Component, Acid-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 25, for Use NT.
 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. BASF Building Systems.
 - b. Dow Corning Corporation.
 - c. GE Advanced Materials.
 - d. Tremco Incorporated; Tremsil 200 Sanitary.

2.3 URETHANE JOINT SEALANTS

- A. Multicomponent, Nonsag, Urethane Joint Sealant: ASTM C 920, Type M, Grade NS, Class 25, for Use NT.
 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. BASF Building Systems.
 - b. Pecora Corporation.
 - c. Sika Corporation, Construction Products Division.
 - d. Tremco Incorporated.

2.4 LATEX JOINT SEALANTS

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

2.5 ACOUSTICAL JOINT SEALANTS

- A. Acoustical Joint Sealant: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Pecora Corporation.
 - b. USG Corporation.

2.6 JOINT SEALANT BACKING

- A. General: Provide sealant backings of material that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
- B. Cylindrical Sealant Backings: ASTM C 1330, or any of the preceding types, as approved in writing by joint-sealant manufacturer for joint application indicated, and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.
- C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.

2.7 MISCELLANEOUS MATERIALS

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

PART 3 - EXECUTION

3.1 EXAMINATION

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

3.2 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:
 - 1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
 - 2. Clean porous joint substrate surfaces by brushing, grinding, 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. Unglazed surfaces of ceramic tile.
 - c. 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 bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.
- E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
 - 1. Place sealants so they directly contact and fully wet joint substrates.
 - 2. Completely fill recesses in each joint configuration.
 - 3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
- F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
 - 1. Remove excess sealant from surfaces adjacent to joints.
 - 2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
 - 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.
- G. 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. 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.

- 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. Joint-Sealant Application: Exterior joints in horizontal traffic surfaces.

1. Joint Locations:

- a. Isolation and contraction joints in cast-in-place concrete slabs.
- b. Joints between plant-precast architectural concrete paving units.
- c. Tile control and expansion joints.
- d. Joints between different materials listed above.

2. Silicone Joint Sealant: Single component, nonsag, traffic grade, neutral curing.

3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

- B. Joint-Sealant Application: Exterior joints in vertical surfaces and horizontal nontraffic surfaces.

1. Joint Locations:

- a. Construction joints in cast-in-place concrete.
- b. Joints in exterior insulation and finish systems.
- c. Joints between different materials listed above.
- d. Perimeter joints between materials listed above and frames of doors and windows.
- e. Control and expansion joints in ceilings and other overhead surfaces.

2. Silicone Joint Sealant: Single component, nonsag, neutral curing, Class 100/50. Multicomponent, nonsag, neutral curing.
 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- C. Joint-Sealant Application: Interior joints in horizontal traffic surfaces.
1. Joint Locations:
 - a. Isolation joints in cast-in-place concrete slabs.
 - b. Control and expansion joints in stone flooring.
 - c. Control and expansion joints in tile flooring.
 2. Silicone Joint Sealant: Single component, nonsag, traffic grade, neutral curing.
 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- D. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces.
1. Joint Locations:
 - a. Control and expansion joints on exposed interior surfaces of exterior walls.
 - b. Perimeter joints of exterior openings where indicated.
 - c. Tile control and expansion joints.
 - d. Perimeter joints between interior wall surfaces and frames of interior doors, windows, and elevator entrances.
 2. Joint Sealant: Latex.
 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- E. Joint-Sealant Application: Mildew-resistant interior joints in vertical surfaces and horizontal nontraffic surfaces.
1. Joint Sealant Location:
 - a. Joints between plumbing fixtures and adjoining walls, floors, and counters.
 - b. Tile control and expansion joints where indicated.
 2. Joint Sealant: Mildew resistant, single component, nonsag, neutral curing, Silicone.
 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- F. Joint-Sealant Application: Interior acoustical joints in vertical surfaces and horizontal nontraffic surfaces.
1. Joint Location:
 - a. Acoustical joints where indicated.
 2. Joint Sealant: Acoustical.
 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range.

END OF SECTION 07-9200

SECTION 08-1113 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 and frames.
- B. Related Sections:
 - 1. Division 08 Section "Door Hardware" for door hardware for hollow metal doors.
 - 2. Division 09 Sections "Exterior Painting" and "Interior Painting" for field painting hollow metal doors and frames.
 - 3. Division 26 Sections for electrical connections including conduit and wiring for door controls and operators.

1.3 DEFINITIONS

- A. Minimum Thickness: Minimum thickness of base metal without coatings.
- B. Standard Hollow Metal Work: Hollow metal work fabricated according to ANSI/SDI A250.8.
- C. Custom Hollow Metal Work: Hollow metal work fabricated according to ANSI/NAAMM-HMMA 861.

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. 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.

C. 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.

D. 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 work from single source from single 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 according to NFPA 252.

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.

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 or UL 1784.

E. Pre-installation Conference: Conduct conference at Project site.

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 nonvented 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.

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, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Amweld Building Products, LLC.
 - 2. Benchmark; a division of Therma-Tru Corporation.
 - 3. Curries Company; an Assa Abloy Group company.
 - 4. Deansteel Manufacturing Company, Inc.
 - 5. Firedoor Corporation.
 - 6. Habersham Metal Products Company.
 - 7. Kewanee Corporation (The).
 - 8. Steelcraft; an Ingersoll-Rand company.
 - 9. Windsor Republic Doors.

2.2 MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.
- B. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.
- C. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum G60 or A60 metallic coating.
- D. Frame Anchors: ASTM A 591/A 591M, Commercial Steel (CS), 40Z coating designation; mill phosphatized.
 - 1. For anchors built into exterior walls, steel sheet complying with ASTM A 1008/A 1008M or ASTM A 1011/A 1011M, hot-dip galvanized according to ASTM A 153/A 153M, Class B.
- E. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.
- 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. Grout: ASTM C 476, except with a maximum slump of 4 inches, as measured according to ASTM C 143/C 143M.
- H. Mineral-Fiber Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool with 6- to 12-lb/cu. ft. density; with maximum

flame-spread and smoke-development indexes of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics.

- I. 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: As indicated in Drawings.
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. Thermal-Rated (Insulated) Doors: Where indicated, provide doors fabricated with thermal-resistance value (R-value) of not less than 6.0 deg F x h x sq. ft./Btu when tested according to ASTM C 1363.

- 1) Locations: Exterior doors.

3. Vertical Edges for Single-Acting Doors: Beveled edge.

- a. Beveled Edge: 1/8 inch in 2 inches.

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."

- 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 2 and Physical Performance Level B (Heavy Duty), Model 1 (Full Flush).

- C. Interior Doors: Face sheets fabricated from cold-rolled 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 1 and Physical Performance Level C (Standard Duty), Model 1 (Full Flush).

- a. Width: 1-3/4 inches.

- 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 full profile welded unless otherwise indicated.
 - 3. Frames for Level 2 Steel Doors: 0.053-inch- thick steel sheet.
- C. Interior Frames: Fabricated from cold-rolled steel sheet.
 - 1. Fabricate frames with mitered or coped corners.
 - 2. Fabricate frames as face welded unless otherwise indicated.
 - 3. Frames for Level 1 Steel Doors: 0.042-inch- thick steel sheet.
 - 4. Frames for Wood Doors: 0.042-inch-thick steel sheet.
 - 5. Frames for Borrowed Lights: 0.042-inch- thick steel sheet.
- D. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 with reinforcement plates from same material as frames.

2.5 FRAME ANCHORS

- A. Jamb Anchors:
 - 1. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.042 inch thick.
 - 2. Post-installed Expansion Type for In-Place Concrete or Masonry: Minimum 3/8-inch-diameter bolts with expansion shields or inserts. Provide pipe spacer from frame to wall, with throat reinforcement plate, welded to frame at each anchor location.
- B. Floor Anchors: Formed from same material as frames, not less than 0.042 inch thick, and as follows:
 - 1. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.
 - 2. Separate Topping Concrete Slabs: Adjustable-type anchors with extension clips, allowing not less than 2-inch height adjustment. Terminate bottom of frames at finish floor surface.

2.6 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.
- D. Terminated Stops: Where indicated on interior door frames, 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.

1. Provide terminated stops unless otherwise indicated.

2.7 ACCESSORIES

- A. Mullions and Transom Bars: Join to adjacent members by welding or rigid mechanical anchors.
- B. Ceiling Struts: Minimum 1/4-inch-thick by 1-inch- wide steel.
- C. Grout Guards: Formed from same material as frames, not less than 0.016 inch thick.

2.8 FABRICATION

- A. Fabricate hollow metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.
- B. Tolerances: Fabricate hollow metal work to tolerances indicated in SDI 117.
- C. Hollow Metal Doors:
 1. Exterior Doors: Provide weep-hole openings in bottom of exterior doors to permit moisture to escape. Seal joints in top edges of doors against water penetration.
 2. Glazed Lites: Factory cut openings in doors.
 3. Astragals: Provide overlapping astragal on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated. Extend minimum 3/4 inch beyond edge of door on which astragal is mounted.
- D. Hollow Metal Frames: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.
 1. 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. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
 4. Grout Guards: Weld guards to frame at back of hardware mortises in frames to be grouted.
 5. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.
 6. Jamb Anchors: Provide number and spacing of anchors as follows:
 - a. Stud-Wall Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
 - 1) Three anchors per jamb up to 60 inches high.
 - 2) Four anchors per jamb from 60 to 90 inches high.

- 3) Five anchors per jamb from 90 to 96 inches high.
 - 4) Five anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 96 inches high.
 - 5) Two anchors per head for frames above 42 inches wide and mounted in metal-stud partitions.
- b. Compression Type: Not less than two anchors in each jamb.
 - c. Postinstalled Expansion Type: Locate anchors not more than 6 inches from top and bottom of frame. Space anchors not more than 26 inches o.c.
7. Door Silencers: Except on weather-stripped doors, drill stops to receive door silencers as follows. Keep holes clear during construction.
 - a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
 - b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.
- E. Fabricate concealed stiffeners, edge channels, and hardware reinforcement from either cold- or hot-rolled steel sheet.
- F. Hardware Preparation: Factory prepare hollow metal work to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to the Door Hardware Schedule and templates furnished as specified in 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 nontemplated, mortised and surface-mounted door hardware.
 3. Comply with applicable requirements in ANSI/SDI A250.6 and ANSI/DHI A115 Series specifications for preparation of hollow metal work for hardware.
 4. Coordinate locations of conduit and wiring boxes for electrical connections with Division 26 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.

2.9 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.

- B. Factory-Applied Paint Finish: Manufacturer's standard, complying with ANSI/SDI A250.3 for performance and acceptance criteria.

2.10 Color and Gloss: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances 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. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.
- B. Prior to installation, adjust and securely brace welded hollow metal frames for squareness, alignment, twist, and plumbness to the following tolerances:
 - 1. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
 - 2. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
 - 3. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
 - 4. Plumbness: Plus or minus 1/16 inch, measured at jambs on a perpendicular line from head to floor.
- C. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

3.3 INSTALLATION

- A. General: Install hollow metal work plumb, rigid, properly aligned, and securely fastened in place; comply with Drawings and manufacturer's written instructions.
- B. Hollow Metal Frames: Install hollow metal frames of size and profile indicated. Comply with ANSI/SDI A250.11.

1. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.
 - a. At fire-protection-rated openings, install frames according to NFPA 80.
 - b. Where frames are fabricated in sections because of shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
 - c. Install frames with removable glazing stops located on secure side of opening.
 - d. Install door silencers in frames before grouting.
 - e. Remove temporary braces necessary for installation only after frames have been properly set and secured.
 - f. Check plumbness, squareness, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
 2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with postinstalled expansion anchors.
 - a. Floor anchors may be set with powder-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.
 3. Metal-Stud Partitions: Solidly pack mineral-fiber insulation behind frames.
 4. Concrete Walls: Solidly fill space between frames and concrete with grout. Take precautions, including bracing frames, to ensure that frames are not deformed or damaged by grout forces.
 5. In-Place Gypsum Board Partitions: Secure frames in place with postinstalled expansion anchors through floor anchors at each jamb. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
 6. 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.
 7. 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.

3.4 ADJUSTING AND CLEANING

- A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow metal work that is warped, bowed, or otherwise unacceptable.
- B. Remove grout and other bonding material from hollow metal work immediately after installation.
- C. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.
- D. Metallic-Coated Surfaces: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.

END OF SECTION 08-1113

SECTION 08-1416 FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:

1. Solid-core doors with wood-veneer faces.
2. Factory finishing flush wood doors.
3. Factory fitting flush wood doors to frames and factory machining for hardware.

- B. Related Sections:

1. Division 06 Section "Interior Architectural Woodwork" for requirements for veneers from the same flitches for both flush wood doors and wood paneling.
2. Division 08 Section "Glazing" for glass view panels in flush wood doors.
3. Division 09 Sections "Exterior Painting", "Interior Painting" and "Staining and Transparent Finishing" for field finishing doors.

1.3 SUBMITTALS

- A. Product Data: For each type of door indicated. Include details of core and edge construction and trim for openings. Include factory-finishing specifications.
- B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; location and extent of hardware blocking; and other pertinent data.
 1. Indicate dimensions and locations of mortises and holes for hardware.
 2. Indicate dimensions and locations of cutouts.
 3. Indicate requirements for veneer matching.
 4. Indicate doors to be factory finished and finish requirements.
 5. Indicate fire-protection ratings for fire-rated doors.
- C. Samples for Initial Selection: For factory-finished doors.
- D. 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."
 - 1. Provide AWI Quality Certification Labels or an AWI letter of licensing for Project indicating that doors comply with requirements of grades specified.
- D. Forest Certification: Provide doors made with all wood products obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship."
- E. Fire-Rated Wood Doors: Doors complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated.
- F. Pre-installation Conference: Conduct conference at Project site.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Comply with requirements of referenced standard and manufacturer's written instructions.
- B. Package doors individually in cardboard cartons and wrap bundles of doors in plastic sheeting.
- C. Mark each door on 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.
- B. Environmental Limitations: Do not deliver or install doors until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and HVAC system is operating and maintaining temperature between 60 and 90 deg F and relative humidity between and 50 percent 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.
 - 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 the following:

1. 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. WDMA I.S.1-A Performance Grade: Heavy Duty.
- C. Staved Core Doors certified by the FSC.
- D. Fire-Protection-Rated Doors: Provide core specified or mineral core as needed to provide fire-protection rating indicated.

2.3 VENEERED-FACED DOORS FOR TRANSPARENT FINISH

- A. Interior Solid-Core Doors (Marshfield: DPC-1, DFP-20 & DFM -45PPFM)

1. Grade: Custom Grade a faces.
2. Species: Birch
3. Cut: Plain sliced (flat sliced)
4. Match between Veneer Leaves: Book match.
5. Assembly of Veneer Leaves on Door Faces: Running match.
6. Pair and Set Match: Provide for doors hung in same opening.
7. Room Match: Match door faces within each separate room or area of building. Corridor-door faces do not need to match where they are separated by 20 feet or more.
8. Room Match: Provide door faces of compatible color and grain within each separate room or area of building.
9. Exposed Vertical and Top Edges: Same species as faces. Retain one of five options in first subparagraph below.
10. Core: Particleboard and Mineral Core
11. Construction: Five plies. Stiles and rails are bonded to core, then entire unit abrasive planed before veneering.

2.4 LOUVERS AND LIGHT FRAMES

- A. Wood Beads for Light Openings in Wood Doors: Provide manufacturer's standard wood beads as follows unless otherwise indicated.

1. Wood Species: Same species as door faces.
2. Profile: Flush rectangular beads.
3. At wood-core doors with 20-minute fire-protection ratings, provide wood beads and metal glazing clips approved for such use.

- B. Wood-Veneered Beads for Light Openings in Fire-Rated Doors: Manufacturer's standard wood-veneered noncombustible beads matching veneer species of door faces and approved for use in doors of fire-protection rating indicated. Include concealed metal glazing clips where required for opening size and fire-protection rating indicated.

2.5 FABRICATION

- A. Factory fit doors to suit frame-opening sizes indicated. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.
 - 1. Comply with 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.
- 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."

2.6 FACTORY FINISHING

- A. General: Comply with referenced quality standard for factory finishing. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.
 - 1. Finish faces, all four edges, edges of cutouts, and mortises. Stains and fillers may be omitted on top and 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: AWI Division 1500-S-4 Finish System Standards.
 - 3. Staining: As selected by Architect from manufacturer's full range.
 - 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. Job-Fitted Doors: Align and fit doors in frames with uniform clearances and bevels as indicated below; do not trim stiles and rails in excess of limits set by manufacturer or permitted for fire-rated doors. Machine doors for hardware. Seal edges of doors, edges of cutouts, and mortises after fitting and machining.
 - 1. Clearances: Provide 1/8 inch at heads, jambs, and between pairs of doors. Provide 1/8 inch from bottom of door to top of decorative floor finish or covering unless otherwise indicated. Where threshold is shown or scheduled, provide 1/4 inch from bottom of door to top of threshold unless otherwise indicated.
 - a. Comply with NFPA 80 for fire-rated doors.
 - 2. Bevel non-fire-rated doors 1/8 inch in 2 inches at lock and hinge edges.
 - 3. Bevel fire-rated doors 1/8 inch in 2 inches at lock edge; trim stiles and rails only to extent permitted by labeling agency.
- 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 08-1416

SECTION 08-3113 ACCESS 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. This Section includes the following:
 - 1. Access doors and frames for walls and ceilings.
- B. Related Sections include the following:
 - 1. Division 03 Section "Cast-in-Place Concrete" for blocking out openings for access doors and frames in concrete.
 - 2. Division 08 Section "Door Hardware" for mortise or rim cylinder locks and master keying.
 - 3. Division 09 Section "Acoustical Tile Ceilings" for suspended acoustical tile ceilings.
 - 4. Division 22 Section "Facility Storm Drainage Piping" for connection of floor door drainage couplings to drains.
 - 5. Division 23 Section "Air Duct Accessories" for heating and air-conditioning duct access doors.

1.3 SUBMITTALS

- A. Product Data: For each type of access door and frame indicated. Include construction details, fire ratings, materials, individual components and profiles, and finishes.
- B. Shop Drawings: Show fabrication and installation details of access doors and frames for each type of substrate. Include plans, elevations, sections, details, and attachments to other work.
- C. Access Door and Frame Schedule: Provide complete access door and frame schedule, including types, locations, sizes, latching or locking provisions, and other data pertinent to installation.

1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain each type of access door(s) and frame(s) through one source from a single manufacturer.
- B. Fire-Rated Access Doors and Frames: Units complying with NFPA 80 that are identical to access door and frame assemblies tested for fire-test-response characteristics per the following test method and that are listed and labeled by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:
 - 1. NFPA 252 for vertical access doors and frames.

2. ASTM E 119 for horizontal access doors and frames.

- C. Size Variations: Obtain Architect's acceptance of manufacturer's standard-size units, which may vary slightly from sizes indicated.

1.5 COORDINATION

- A. Verification: Determine specific locations and sizes for access doors needed to gain access to concealed plumbing, mechanical, or other concealed work, and indicate in the schedule specified in "Submittals" Article.

PART 2 - PRODUCTS

2.1 ALUMINUM MATERIALS

- A. Aluminum Extrusions: ASTM B 221, Alloy 6063-T6.
1. Mill finish, AA-M10 (Mechanical Finish: as fabricated, unspecified).
- B. Aluminum-Alloy Rolled Tread Plate: ASTM B 632/B 632M, Alloy 6061-T6.
1. Mill finish, AA-M10 (Mechanical Finish: as fabricated, unspecified).
- C. Aluminum Sheet: ASTM B 209, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with not less than strength and durability properties of Alloy 5005-H15; with minimum sheet thickness indicated representing specified thickness according to ANSI H35.2.
1. Baked-Enamel Finish: AA-C12C42R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: acid-chromate-fluoride-phosphate conversion coating; Organic Coating: as specified below). Apply baked enamel complying with paint manufacturer's written specifications for cleaning, conversion coating, and painting.

2.2 ACCESS DOORS AND FRAMES FOR WALLS AND CEILINGS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Acudor Products, Inc.
 2. Babcock-Davis; A Cierra Products Co.
 3. Cendrex Inc.
 4. Dur-Red Products.
 5. Jensen Industries.
 6. J. L. Industries, Inc.
 7. Larsen's Manufacturing Company.
 8. MIFAB, Inc.
 9. Milcor Inc.
 10. Nystrom, Inc.

- C. Aluminum Flush Access Doors and Frames with Exposed Trim: Fabricated from aluminum sheet and extruded-aluminum shapes.
 - 1. Locations: Wall and ceiling surfaces.
 - 2. Door: Minimum 0.080-inch-thick aluminum sheet.
 - 3. Frame: Minimum 0.060-inch-thick extruded aluminum with 1-1/4-inch- wide rolled flange.
 - 4. Hinges: Concealed continuous aluminum.
 - 5. Latch: Screwdriver-operated cam latch.
- D. Exterior Flush Access Doors and Frames with Exposed Trim: Weatherproof with extruded door gasket.
 - 1. Locations: Wall and ceiling surfaces.
 - 2. Door: Minimum 0.040-inch- thick, metallic-coated steel sheet; flush panel construction with manufacturer's standard 2-inch- thick fiberglass insulation.
 - 3. Frame: Minimum 0.060-inch- thick extruded aluminum.
 - 4. Hinges: Continuous piano, zinc plated.
 - 5. Lock: Dual-action handles with key lock.
- E. Fire-Rated, Insulated, Flush Access Doors and Trimless Frames: Fabricated from steel sheet.
 - 1. Locations: Wall and ceiling surfaces.
 - 2. Fire-Resistance Rating: Not less than that of adjacent construction.
 - 3. Temperature Rise Rating: 250 deg F at the end of 30 minutes.
 - 4. Door: Flush panel with a core of mineral-fiber insulation enclosed in sheet metal with a minimum thickness of 0.036 inch.
 - 5. Frame: Minimum 0.060-inch- thick sheet metal with drywall bead.
 - 6. Hinges: Continuous piano.
 - 7. Automatic Closer: Spring type.
 - 8. Latch: Self-latching device operated by ring turn with interior release.
 - 9. Lock: Self-latching device with cylinder lock.

2.3 FABRICATION

- A. General: Provide access door and frame assemblies manufactured as integral units ready for installation.
- B. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.
- C. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish attachment devices and fasteners of type required to secure access panels to types of supports indicated.
 - 1. For trimless frames with drywall bead, provide edge trim for gypsum board securely attached to perimeter of frames.
 - 2. For trimless frames with plaster bead for full-bed plaster applications, provide zinc-coated expanded metal lath and exposed casing bead welded to perimeter of frames.
 - 3. Provide mounting holes in frames for attachment of units to metal or wood framing.
- D. Latching Mechanisms: Furnish number required to hold doors in flush, smooth plane when closed.

1. For cylinder lock, furnish two keys per lock and key all locks alike.
 2. For recessed panel doors, provide access sleeves for each locking device. Furnish plastic grommets and install in holes cut through finish.
- E. Extruded Aluminum: After fabrication, apply manufacturer's standard protective coating on aluminum that will come in contact with concrete.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with manufacturer's written instructions for installing access doors and frames.
- B. Set frames accurately in position and attach securely to supports with plane of face panels aligned with adjacent finish surfaces.
- C. Install doors flush with adjacent finish surfaces or recessed to receive finish material.

3.2 ADJUSTING AND CLEANING

- A. Adjust doors and hardware after installation for proper operation.
- B. Remove and replace doors and frames that are warped, bowed, or otherwise damaged.

END OF SECTION 08-3113

SECTION 08-4113
ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:

- 1. Exterior and interior storefront framing.
- 2. Storefront framing for punched openings.
- 3. Exterior and interior manual-swing entrance doors and door-frame units.

- B. Related Sections:

- 1. Division 08 Section "Glazed Aluminum Curtain Walls" for curtain-wall systems that mechanically retain glazing on four sides.
- 2. Division 08 Section "Sliding Aluminum-Framed Glass Doors (Interior)".

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. Glazing-to-glazing contact.
 - e. Noise or vibration created by wind and by thermal and structural movements.
 - f. Loosening or weakening of fasteners, attachments, and other components.
 - g. Sealant failure.
 - h. Failure of operating units.

- B. Structural Loads:
1. Wind Loads: As indicated on Drawings.
 2. Seismic Loads: As indicated on Drawings
- C. 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.
- D. 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. Test Durations: As required by design wind velocity, but not fewer than 10 seconds.
- E. Windborne-Debris-Impact-Resistance Performance: Provide aluminum-framed systems that pass missile-impact and cyclic-pressure tests when tested according to ASTM E 1886 and testing information in ASTM E 1996.
- F. Story Drift: Provide aluminum-framed systems that accommodate design displacement of adjacent stories indicated.
- 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: According to AAMA 501.1. 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 45 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. 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.
- C. Samples for Initial Selection: For units with factory-applied color finishes.
- D. 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.
- E. Qualification Data: For qualified Installer.
- F. Seismic Qualification Certificates: For aluminum-framed systems, accessories, and components, from manufacturer.
 - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
- G. Source quality-control reports.
- H. Quality-Control Program for Structural-Sealant-Glazed System: Include reports.
- I. Field quality-control reports.
- J. Maintenance Data: For aluminum-framed systems to include in maintenance manuals.
- K. Warranties: Sample of special warranties.

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. Testing Agency Qualifications: Qualified according to ASTM E 699 for testing indicated.
- C. 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.
- D. Product Options: Information on Drawings and in Specifications establishes requirements for systems' aesthetic effects and performance characteristics. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction. Performance characteristics are indicated by criteria subject to verification by one or more methods including preconstruction testing, field testing, and in-service performance.
 - 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.
- E. Accessible Entrances: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines.
- F. Source Limitations for Aluminum-Framed Systems: Obtain from single source from single manufacturer.
- G. Welding Qualifications: Qualify procedures and personnel according to AWS D1.2, "Structural Welding Code - Aluminum."
- H. Pre-installation Conference: Conduct conference at Project site.

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. Adhesive or cohesive sealant failures.
 - e. Water leakage through fixed glazing and framing areas.

- f. Failure of operating components.
- 2. Warranty Period: 10 years from date of Substantial Completion.
- B. Special Finish Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components on which finishes do not comply with requirements or that fail in materials or workmanship within specified warranty period. Warranty does not include normal weathering.
 - 1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Kawneer North America; an Alcoa company.
 - 2. Tubelite.
 - 3. Vistawall Architectural Products; The Vistawall Group; a Bluescope Steel company.

2.2 MATERIALS

- A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
 - 1. Sheet and Plate: ASTM B 209.
 - 2. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221.
 - 3. Extruded Structural Pipe and Tubes: ASTM B 429.
 - 4. Structural Profiles: ASTM B 308/B 308M.
 - 5. Welding Rods and Bare Electrodes: AWS A5.10/A5.10M.
- B. Steel Reinforcement: Manufacturer's standard zinc-rich, corrosion-resistant primer, complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods according to recommendations in SSPC-SP COM and prepare surfaces according to applicable SSPC standard.
 - 1. Structural Shapes, Plates, and Bars: ASTM A 36/A 36M.
 - 2. Cold-Rolled Sheet and Strip: ASTM A 1008/A 1008M.
 - 3. Hot-Rolled Sheet and Strip: ASTM A 1011/A 1011M.

2.3 FRAMING SYSTEMS

- A. Framing Members: Manufacturer's standard extruded-aluminum framing members of thickness required and reinforced as required to support imposed loads.
 - 1. Construction:
 - a. Interior Frames: Non-Thermal
 - b. Exterior Frames: Thermally Broken.

2. Glazing System: Retained mechanically with gaskets on four sides.
 3. Glazing Plane: Center
- B. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.
- C. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.
1. 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.
- D. Concealed Flashing: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding 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.
- D. Bond-Breaker Tape: Manufacturer's standard TFE-fluorocarbon or polyethylene material to which sealants will not develop adhesion.
- E. Glazing Sealants: For structural-sealant-glazed systems, as recommended by manufacturer for joint type, and as follows:
1. Weatherseal Sealant: ASTM C 920 for Type S, Grade NS, Class 25, Uses NT, G, A, and O; single-component neutral-curing formulation that is compatible with structural sealant and other system components with which it comes in contact; recommended by structural-sealant, weatherseal-sealant, and aluminum-framed-system manufacturers for this use.
 - a. 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. Color: Matching structural sealant.

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.
 - a. Thermal Construction: High-performance plastic connectors separate aluminum members exposed to the exterior from members exposed to the interior.
 2. Door Design: As indicated.
 - a. Accessible Doors: Smooth surfaced for width of door in area within 10 inches above floor or ground plane.
 3. Glazing Stops and Gaskets: Square, snap-on, extruded-aluminum stops and preformed gaskets.
 - a. Provide nonremovable glazing stops on outside of door.
- B. Entrance Door Hardware: As specified in Division 08 Section "Door Hardware."

2.6 ENTRANCE DOOR HARDWARE

- A. General: Provide entrance door hardware as specified in Division 08 Section "Door Hardware" and entrance door hardware sets indicated in "Entrance Door Hardware Sets" Article of this specification for each entrance door to comply with requirements in this Section.
1. Entrance Door Hardware Sets: Provide quantity, item, size, finish or color indicated, and products equivalent in function and comparable in quality to named products.
 2. Sequence of Operation: Provide electrified door hardware function, sequence of operation, and interface with other building control systems indicated.
 3. Opening-Force Requirements:
 - a. Egress Doors: Not more than 15 lbf to release the latch and not more than 30 lbf to set the door in motion.
 - b. Accessible Interior Doors: Not more than 5 lbf to fully open door.
- B. Designations: Requirements for design, grade, function, finish, size, and other distinctive qualities of each type of entrance door hardware are indicated in "Entrance Door Hardware Sets" Article. Products are identified by using entrance door hardware designations as follows:
1. Named Manufacturers' Products: Manufacturer and product designation are listed for each door hardware type required for the purpose of establishing minimum requirements. Manufacturers' names are abbreviated in "Entrance Door Hardware Sets" Article.
 2. References to BHMA Standards: Provide products complying with these standards and requirements for description, quality, and function.
- C. Opening-Force Requirements:
1. Delayed-Egress Locks: Lock releases within 15 seconds after applying a force of not more than 15 lbf for not more than 3 seconds.
 2. Latches and Exit Devices: Not more than 15 lbf required to release latch.
- D. Continuous-Gear Hinges: Manufacturer's standard with stainless-steel bearings between knuckles, fabricated to full height of door and frame.

- E. Mortise Auxiliary Locks: BHMA A156.5, Grade 1.
- F. Manual Flush Bolts: BHMA A156.16, Grade 1.
- G. Automatic and Self-Latching Flush Bolts: BHMA A156.3, Grade 1.
- H. Panic Exit Devices: BHMA A156.3, Grade 1, listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for panic protection, based on testing according to UL 305.
- I. Cylinders: BHMA A156.5, Grade 1.
 - 1. Keying: Master key system. Coordinate with Division 08 Section "Door Hardware."
- J. Strikes: Provide strike with black-plastic dust box for each latch or lock bolt; fabricated for aluminum framing.
- K. Operating Trim: BHMA A156.6.
- L. Closers: BHMA A156.4, Grade 1, with accessories required for a complete installation, sized as required by door size, exposure to weather, and anticipated frequency of use; adjustable to meet field conditions and requirements for opening force.
- M. Surface-Mounted Holders: BHMA A156.16, Grade 1.
- N. Door Stops: BHMA A156.16, Grade 1, floor or wall mounted, as appropriate for door location indicated, with integral rubber bumper.
- O. Weather Stripping: Manufacturer's standard replaceable components.
- P. Weather Sweeps: Manufacturer's standard exterior-door bottom sweep with concealed fasteners on mounting strip.
- Q. Silencers: BHMA A156.16, Grade 1.
- R. Thresholds: BHMA A156.21, raised thresholds beveled with a slope of not more than 1:2, with maximum height of 1/2 inch. Coordinate size with details indicated in drawings.

2.7 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.

2.8 FABRICATION

- A. Form or extrude aluminum shapes before finishing.

- B. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.
- C. 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.
 - 7. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.
- D. Mechanically Glazed Framing Members: Fabricate for flush glazing without projecting stops.
- E. Storefront Framing: Fabricate components for assembly using shear-block system.
- F. 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.
- G. 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.
- H. Entrance Door Hardware Installation: Factory install entrance door hardware to the greatest extent possible. Cut, drill, and tap for factory-installed entrance door hardware before applying finishes.
- I. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.9 ALUMINUM FINISHES

- A. High-Performance Organic Finish: 2-coat fluoropolymer finish complying with AAMA 2604 and containing not less than 50 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 1. Color and Gloss: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine 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 nonmovement joints.
 - 5. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration.
 - 6. Seal joints watertight unless otherwise indicated.
- B. Metal Protection:
 - 1. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or 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. Repair or remove work if test results and inspections indicate that it does not comply with specified requirements.
- B. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.5 ADJUSTING

- A. Adjust operating entrance door hardware to function smoothly as recommended by manufacturer.
 - 1. For entrance doors accessible to people with disabilities, adjust closers to provide a 3-second closer sweep period for doors to move from a 70-degree open position to 3 inches from the latch, measured to the leading door edge.

END OF SECTION 08-4113

SECTION 08-8000 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. Windows.
 - 2. Doors.
 - 3. 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.
 - 1. Design Wind Pressures: As indicated on Drawings.
 - 2. Design Wind Pressures: Determine design wind pressures applicable to Project according to ASCE/SEI 7, based on heights above grade indicated on Drawings.
 - a. Wind Design Data: As indicated on Drawings.
 - 3. Design Snow Loads: As indicated on Drawings.
 - 4. 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.
 - 5. Sloped Glazing: For glass surfaces sloped more than 15 degrees from vertical, design glass to resist each of the following combinations of loads:
 - a. Outward design wind pressure minus the weight of the glass. Base design on glass type factors for short-duration load.

- b. Inward design wind pressure plus the weight of the glass plus half of the design snow load. Base design on glass type factors for short-duration load.
 - c. Half of the inward design wind pressure plus the weight of the glass plus the design snow load. Base design on glass type factors for long-duration load.
 - 6. Glass Type Factors for Wired, Patterned, and Sandblasted Glass:
 - a. Short-Duration Glass Type Factor for Wired Glass: 0.5.
 - 7. 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.
 - 8. Differential Shading: Design glass to resist thermal stresses induced by differential shading within individual glass lites.
- B. 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 the following products; 12 inches square.
 - 1. Coated glass.
 - 2. Wired glass.
 - 3. Fire-resistive glazing products.
 - 4. Security Glazing
 - 5. Laminated glass
 - 6. Insulating glass.
 - 7. Spandrel glass
- C. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.
- D. Qualification Data: For installers and manufacturers of insulating-glass units with sputter-coated, low-e coatings.
- E. Product Certificates: For glass and glazing products, from manufacturer.
- F. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for coated glass, insulating glass, security glass, fire rated glazing, glazing sealants and glazing gaskets.
 - 1. For glazing sealants, provide test reports based on testing current sealant formulations within previous 36-month period.
- G. Warranties: Sample of special warranties.

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. Source Limitations for Glass: Obtain coated float glass, laminated glass, and insulating glass from single source from single manufacturer for each glass type.
- D. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below, unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.
 - 1. GANA Publications: GANA's "Laminated Glazing Reference Manual and GANA's "Glazing Manual."
 - 2. AAMA Publications: AAMA GDSG-1, "Glass Design for Sloped Glazing," and AAMA TIR-A7, "Sloped Glazing Guidelines."
 - 3. IGMA Publication for Sloped Glazing: IGMA TB-3001, "Guidelines for Sloped Glazing."
 - 4. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."
- E. Safety Glazing Labeling: Where safety glazing labeling is indicated, permanently mark glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction or the manufacturer. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.
- F. Fire-Protection-Rated Glazing Labeling: Permanently mark fire-protection-rated glazing with certification label of a testing agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, test standard, whether glazing is for use in fire doors or other openings, whether or not glazing passes hose-stream test, whether or not glazing has a temperature rise rating of 450 deg F, and the fire-resistance rating in minutes.
- G. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of IGCC.
- H. Pre-installation Conference: Conduct conference at Project site.

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 Laminated Glass: Manufacturer's standard form in which laminated-glass manufacturer agrees to replace laminated-glass units that deteriorate within specified warranty period. Deterioration of laminated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning laminated glass contrary to manufacturer's written instructions. Defects include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.
 - 1. Warranty Period: 5 years from date of Substantial Completion.
- C. Manufacturer's Special Warranty on Insulating Glass: Manufacturer's standard form in which insulating-glass manufacturer agrees to replace insulating-glass units that deteriorate within specified warranty period. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.
 - 1. Warranty Period: 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 1/4 inch.
 - 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. Where heat-strengthened glass is indicated,

provide Kind HS heat-treated float glass or Kind FT heat-treated float glass. Where fully tempered glass is indicated, provide Kind FT heat-treated float glass.

- C. Windborne-Debris-Impact Resistance: Provide exterior glazing that passes basic-protection testing requirements in ASTM E 1996 for wind zone indicated in Drawings when tested according to ASTM E 1886. Test specimens shall be no smaller in width and length than glazing indicated for use on the Project and shall be installed in same manner as glazing indicated for use on the Project.
1. Large-Missile Test: For glazing located within 30 feet of grade.
 2. Small-Missile Test: For glazing located more than 30 feet above grade.
 3. Large-Missile Test: For all glazing, regardless of height above grade.
- D. Thermal and Optical Performance Properties: Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:
1. For laminated-glass lites, properties are based on products of construction indicated.
 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.
- E. Reference Drawings for Glazing Schedule.

2.2 GLASS PRODUCTS

- A. Float Glass: ASTM C 1036, Type I, Quality-Q3, Class I (clear) unless otherwise indicated.
- B. Heat-Treated Float Glass: ASTM C 1048; Type I; Quality-Q3; Class I (clear) unless otherwise indicated; of kind and condition indicated.
1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.
 2. For uncoated glass, comply with requirements for Condition A.
 3. For coated vision glass, comply with requirements for Condition C (other coated glass).
- C. Tempered Glass: ASTM C 1036, Type II, Class 1 (clear), Form 1, Quality-Q6, complying with ANSI Z97.1, Class C.
1. Thickness: 1/4 inch

2.3 INSULATING GLASS

- A. Manufacturers: Subject to compliance with requirements, Basis of Design Specification:
1. PPG Industries Inc.
 2. Type: "Solarban" 70XL(2) "Starphire" Solar Control Low-E Clear Insulating Glass.
 3. Indoor Lite: Clear

4. Outdoor Lite: "Starphire" Glass with Solarban 70XL on second surface. A clear substrate may be required in conjunction with the Solarban 70XL coating system for heat treated applications.
 5. Coating: "Solarban" 70XL Solar Control Low-E (Sputtered) by PPG Industries, Inc.
 6. Location: Second Surface (2).
 7. Visible Light Transmission: 63%
 8. U-Value Winter: 0.29
 9. U-Value Summer: 0.27
 10. SHGC: 0.27
 11. Shading Coefficient: 0.31
 12. Outdoor Visible Light Reflectance: 11%
 13. Outdoor Appearance: Clear
 14. Insulating Unit Construction: 1/4 inch glass + 1/2 inch air space + 1/4 inch glass. Total glass thickness: 1 inch.
- 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.

2.4 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.
- B. Soft Compression Gaskets: Extruded or molded, closed-cell, integral-skinned neoprene gaskets complying with ASTM C 509, Type II, black; of profile and hardness required to maintain watertight seal.
1. Application: Use where soft compression gaskets will be compressed by inserting dense compression gaskets on opposite side of glazing or pressure applied by means of pressure-glazing stops on opposite side of glazing.
- C. Lock-Strip Gaskets: Neoprene extrusions in size and shape indicated, fabricated into frames with molded corner units and zipper lock-strips, complying with ASTM C 542, black.

2.5 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.

2.6 GLAZING TAPES

- A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; and complying with ASTM C 1281 and AAMA 800 for products indicated below:
 1. AAMA 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.
- B. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; and complying with AAMA 800 for the following types:
 1. AAMA 810.1, Type 1, for glazing applications in which tape acts as the primary sealant.
 2. AAMA 810.1, Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

2.7 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.

2.8 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.

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 LOCK-STRIP GASKET GLAZING

- A. Comply with ASTM C 716 and gasket manufacturer's written instructions. Provide supplementary wet seal and weep system unless otherwise indicated.

3.8 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 08-8000

SECTION 08-8100 SOLAR CONTROL COATED GLASS

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. Exterior Windows.
 - 2. Exterior Doors.
 - 3. Exterior Storefront Framing.

1.3 DEFINITIONS

- A. Sealed Insulating Glass Unit Surfaces:
 - 1. Surface No. 1: Exterior surface of outer lite.
 - 2. Surface No. 2: Interior surface of outer lite.
 - 3. Surface No. 3: Exterior surface of inner lite.
 - 4. Surface No. 4: Interior surface of inner lite.

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.
 - 1. Design Wind Pressures: As indicated on Drawings.
 - 2. Design Wind Pressures: Determine design wind pressures applicable to Project according to ASCE/SEI 7, based on heights above grade indicated on Drawings.
 - a. Wind Design Data: As indicated on Drawings.
 - 3. Design Snow Loads: As indicated on Drawings.
 - 4. 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.
 - 5. Sloped Glazing: For glass surfaces sloped more than 15 degrees from vertical, design glass to resist each of the following combinations of loads:
 - a. Outward design wind pressure minus the weight of the glass. Base design on glass type factors for short-duration load.
 - b. Inward design wind pressure plus the weight of the glass plus half of the design snow load. Base design on glass type factors for short-duration load.

- c. Half of the inward design wind pressure plus the weight of the glass plus the design snow load. Base design on glass type factors for long-duration load.
- 6. Glass Type Factors for Wired, Patterned, and Sandblasted Glass:
 - a. Short-Duration Glass Type Factor for Wired Glass: 0.5.
- 7. 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.
- 8. Differential Shading: Design glass to resist thermal stresses induced by differential shading within individual glass lites.
- B. 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 the following products; 12 inches square.
 - 1. Coated glass.
 - 2. Wired glass.
 - 3. Fire-resistive glazing products.
 - 4. Security Glazing
 - 5. Laminated glass
 - 6. Insulating glass.
 - 7. Spandrel glass
- C. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.
- D. Qualification Data: For installers and manufacturers of insulating-glass units with sputter-coated, low-e coatings.
- E. Product Certificates: For glass and glazing products, from manufacturer.
- F. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for coated glass, insulating glass, security glass, fire rated glazing, glazing sealants and glazing gaskets.
 - 1. For glazing sealants, provide test reports based on testing current sealant formulations within previous 36-month period.
- G. Warranties: Sample of special warranties.

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. Source Limitations for Glass: Obtain coated float glass, laminated glass, and insulating glass from single source from single manufacturer for each glass type.
- D. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below, unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.
 - 1. GANA Publications: GANA's "Laminated Glazing Reference Manual and GANA's "Glazing Manual."
 - 2. AAMA Publications: AAMA GDSG-1, "Glass Design for Sloped Glazing," and AAMA TIR-A7, "Sloped Glazing Guidelines."
 - 3. IGMA Publication for Sloped Glazing: IGMA TB-3001, "Guidelines for Sloped Glazing."
 - 4. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."
- E. Safety Glazing Labeling: Where safety glazing labeling is indicated, permanently mark glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction or the manufacturer. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.
- F. Fire-Protection-Rated Glazing Labeling: Permanently mark fire-protection-rated glazing with certification label of a testing agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, test standard, whether glazing is for use in fire doors or other openings, whether or not glazing passes hose-stream test, whether or not glazing has a temperature rise rating of 450 deg F, and the fire-resistance rating in minutes.
- G. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of IGCC.
- H. Pre-installation Conference: Conduct conference at Project site.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Delivery:
 - 1. Deliver glass to site in accordance with manufacturer's instructions.
 - 2. Deliver glass in manufacturer's or fabricator's original containers and packaging, with labels clearly identifying product name and manufacturer.
- B. Storage:
 - 1. Store glass in accordance with manufacturer's instructions.
 - 2. Store glass in clean, dry area indoors.
 - 3. Protect from exposure to direct sunlight and freezing temperatures.
 - 4. Apply temporary coverings loosely to allow adequate ventilation.
 - 5. Protect from contact with corrosive chemicals.
 - 6. Avoid placement of glass edge on concrete, metal, and other hard objects.

7. Rest glass on clean, cushioned pads at 1/4-points.

C. Handling:

1. Handle glass in accordance with manufacturer's instructions.
2. Protect glass from damage during handling and installation.
3. Do not slide 1 lite of glass against another.
4. Do not use sharp objects near unprotected glass.

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 Laminated Glass: Manufacturer's standard form in which laminated-glass manufacturer agrees to replace laminated-glass units that deteriorate within specified warranty period. Deterioration of laminated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning laminated glass contrary to manufacturer's written instructions. Defects include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.

1. Warranty Period: 5 years from date of Substantial Completion.

- C. Manufacturer's Special Warranty on Insulating Glass: Manufacturer's standard form in which insulating-glass manufacturer agrees to replace insulating-glass units that deteriorate within specified warranty period. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.

1. Warranty Period: 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 1/4 inch.
 - 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. Where heat-strengthened glass is indicated, provide Kind HS heat-treated float glass or Kind FT heat-treated float glass. Where fully tempered glass is indicated, provide Kind FT heat-treated float glass.
- C. Windborne-Debris-Impact Resistance: Provide exterior glazing that passes basic-protection testing requirements in ASTM E 1996 for wind zone indicated in Drawings when tested according to ASTM E 1886. Test specimens shall be no smaller in width and length than glazing indicated for use on the Project and shall be installed in same manner as glazing indicated for use on the Project.
 - 1. Large-Missile Test: For glazing located within 30 feet of grade.
 - 2. Small-Missile Test: For glazing located more than 30 feet above grade.
 - 3. Large-Missile Test: For all glazing, regardless of height above grade.
- D. Thermal and Optical Performance Properties: Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:
 - 1. For laminated-glass lites, properties are based on products of construction indicated.
 - 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.
- E. Reference Drawings for Glazing Schedule.

2.2 GLASS PRODUCTS

- A. Float Glass: ASTM C 1036, Type I, Quality-Q3, Class I (clear) unless otherwise indicated.
- B. Heat-Treated Float Glass: ASTM C 1048; Type I; Quality-Q3; Class I (clear) unless otherwise indicated; of kind and condition indicated.
 - 1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.
 - 2. For uncoated glass, comply with requirements for Condition A.
 - 3. For coated vision glass, comply with requirements for Condition C (other coated glass).

- C. Tempered Glass: ASTM C 1036, Type II, Class 1 (clear), Form 1, Quality-Q6, complying with ANSI Z97.1, Class C.

1. Thickness: 1/4 inch

2.3 INSULATING GLASS

- A. Manufacturers: Subject to compliance with requirements, Basis of Design Specification:

1. PPG Industries Inc.
2. Type: "Solarban" 70XL(2) "Starphire" Solar Control Low-E Clear Insulating Glass.
3. Indoor Lite: Clear
4. Outdoor Lite: "Starphire" Glass with Solarban 70XL on second surface. A clear substrate may be required in conjunction with the Solarban 70XL coating system for heat treated applications.
5. Coating: "Solarban" 70XL Solar Control Low-E (Sputtered) by PPG Industries, Inc.
6. Location: Second Surface (2).
7. Visible Light Transmission: 63%
8. U-Value Winter: 0.29
9. U-Value Summer: 0.27
10. SHGC: 0.27
11. Shading Coefficient: 0.31
12. Outdoor Visible Light Reflectance: 11%
13. Outdoor Appearance: Clear
14. Insulating Unit Construction: 1/4 inch glass + 1/2 inch air space + 1/4 inch glass. Total glass thickness: 1 inch.

- 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.

2.4 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.

- B. Soft Compression Gaskets: Extruded or molded, closed-cell, integral-skinned neoprene gaskets complying with ASTM C 509, Type II, black; of profile and hardness required to maintain watertight seal.

1. Application: Use where soft compression gaskets will be compressed by inserting dense compression gaskets on opposite side of glazing or pressure applied by means of pressure-glazing stops on opposite side of glazing.

- C. Lock-Strip Gaskets: Neoprene extrusions in size and shape indicated, fabricated into frames with molded corner units and zipper lock-strips, complying with ASTM C 542, black.

2.5 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.

2.6 GLAZING TAPES

- A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; and complying with ASTM C 1281 and AAMA 800 for products indicated below:

1. AAMA 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.

- B. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; and complying with AAMA 800 for the following types:

1. AAMA 810.1, Type 1, for glazing applications in which tape acts as the primary sealant.
2. AAMA 810.1, Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

2.7 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.

2.8 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.

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 LOCK-STRIP GASKET GLAZING

- A. Comply with ASTM C 716 and gasket manufacturer's written instructions. Provide supplementary wet seal and weep system unless otherwise indicated.

3.8 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 08-8000

SECTION 09-2216 NON-STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes non-load-bearing steel framing members for the following applications:
 - 1. Interior framing systems (e.g., supports for partition walls, framed soffits, furring, etc.).
 - 2. Interior suspension systems (e.g., supports for ceilings, suspended soffits, etc.).
- B. Related Sections include the following:
 - 1. Division 05 Section "Cold-Formed Metal Framing" for exterior and interior load-bearing and exterior non-load-bearing wall studs; floor joists; roof rafters and ceiling joists; and roof trusses.
 - 2. Division 07 Section "Thermal Insulation" for insulation installed with Z-shaped furring members.
 - 3. Division 09 Section "Portland Cement Plastering" for metal lath supported by non-load-bearing steel framing.

1.3 SUBMITTALS

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

1.4 QUALITY ASSURANCE

- A. Fire-Test-Response Characteristics: For fire-resistance-rated assemblies that incorporate non-load-bearing steel framing, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.
- B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

PART 2 - PRODUCTS

2.1 NON-LOAD-BEARING STEEL FRAMING, GENERAL

- A. Recycled Content of Steel Products: Provide products with average recycled content of steel products such that postconsumer recycled content plus one-half of pre-consumer recycled content is not less than 30% percent.

- B. Obtain products from a manufacturer that manufactures and sells within a 500 mile radius of the project site.
- C. Framing Members, General: Comply with ASTM C 754 for conditions indicated.
 - 1. Steel Sheet Components: Comply with ASTM C 645 requirements for metal, unless otherwise indicated.
 - 2. Protective Coating: ASTM A 653/A 653M, G40 hot-dip galvanized, unless otherwise indicated.

2.2 SUSPENSION SYSTEM COMPONENTS

- A. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.0625-inch-diameter wire, or double strand of 0.0475-inch-diameter wire.
- B. Hanger Attachments to Concrete:
 - 1. Anchors: Fabricated from corrosion-resistant materials with holes or loops for attaching wire hangers and capable of sustaining, without failure, a load equal to 5 that imposed by construction as determined by testing according to ASTM E 488 by an independent testing agency.
 - 2. Powder-Actuated Fasteners: Suitable for application indicated, fabricated from corrosion-resistant materials with clips or other devices for attaching hangers of type indicated, and capable of sustaining, without failure, a load equal to 10 times that imposed by construction as determined by testing according to ASTM E 1190 by an independent testing agency.
- C. Wire Hangers: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.162-inch diameter.
- D. Flat Hangers: Steel sheet, 1 by 3/16 inch by length indicated.
- E. Carrying Channels: Cold-rolled, commercial-steel sheet with a base-metal thickness of 0.0538 inch and minimum 1/2-inch-wide flanges.
 - 1. Depth: As indicated on Drawings.
- F. Furring Channels (Furring Members):
 - 1. Cold-Rolled Channels: 0.0538-inch bare-steel thickness, with minimum 1/2-inch-wide flanges, 3/4 inch deep.
 - 2. Steel Studs: ASTM C 645.
 - a. Minimum Base-Metal Thickness: 0.0179 inch.
 - b. Depth: As indicated on Drawings.
 - 3. Hat-Shaped, Rigid Furring Channels: ASTM C 645, 7/8 inch deep.
 - a. Minimum Base Metal Thickness: As indicated on Drawings.
- G. Grid Suspension System for Ceilings: ASTM C 645, direct-hung system composed of main beams and cross-furring members that interlock.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Armstrong World Industries, Inc.; Drywall Grid Systems.
 - b. Chicago Metallic Corporation; Drywall Furring System.
 - c. USG Corporation; Drywall Suspension System.

2.3 STEEL FRAMING FOR FRAMED ASSEMBLIES

A. Steel Studs and Runners: ASTM C 645.

1. Minimum Base-Metal Thickness: As indicated on Drawings.
2. Depth: As indicated on Drawings.

B. Slip-Type Head Joints: Where indicated, provide the following:

1. Single Long-Leg Runner System: ASTM C 645 top runner with 2-inch- deep flanges in thickness not less than indicated for studs, installed with studs friction fit into top runner and with continuous bridging located within 12 inches of the top of studs to provide lateral bracing.
2. Double-Runner System: ASTM C 645 top runners, inside runner with 2-inch- deep flanges in thickness not less than indicated for studs and fastened to studs, and outer runner sized to friction fit inside runner.
3. Deflection Track: Steel sheet top runner manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above; in thickness not less than indicated for studs and in width to accommodate depth of studs.
 - a. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - 1) Steel Network Inc. (The); VertiClip SLD Series.
 - 2) Superior Metal Trim; Superior Flex Track System (SFT).

C. Firestop Tracks: Top runner manufactured to allow partition heads to expand and contract with movement of the structure while maintaining continuity of fire-resistance-rated assembly indicated; in thickness not less than indicated for studs and in width to accommodate depth of studs.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Fire Trak Corp.; Fire Trak attached to studs with Fire Trak Slip Clip.
 - b. Metal-Lite, Inc.; The System.

D. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.

E. Cold-Rolled Channel Bridging: 0.0538-inch bare-steel thickness, with minimum 1/2-inch-wide flanges.

1. Depth: 1-1/2 inches.
2. Clip Angle: Not less than 1-1/2 by 1-1/2 inches, 0.068-inch-thick, galvanized steel.

F. Hat-Shaped, Rigid Furring Channels: ASTM C 645.

1. Minimum Base Metal Thickness: 0.0179 inch.
 2. Depth: As indicated on Drawings.
- G. Cold-Rolled Furring Channels: 0.0538-inch bare-steel thickness, with minimum 1/2-inch- wide flanges.
1. Depth: As indicated on Drawings.
 2. Furring Brackets: Adjustable, corrugated-edge type of steel sheet with minimum bare-steel thickness of 0.0312 inch.
 3. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.0625-inch- diameter wire, or double strand of 0.0475-inch- diameter wire.
- H. Z-Shaped Furring: With slotted or nonslotted web, face flange of 1-1/4 inches, wall attachment flange of 7/8 inch, minimum bare-metal thickness of 0.0179 inch, and depth required to fit insulation thickness indicated.

2.4 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced installation standards.
1. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.
- B. Isolation Strip at Exterior Walls: Provide the following:
1. Asphalt-Saturated Organic Felt: ASTM D 226, Type I (No. 15 asphalt felt), non-perforated.
 2. Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8 inch thick, in width to suit steel stud size.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance.
1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Suspended Assemblies: Coordinate installation of suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive hangers at spacing required to support the Work and that hangers will develop their full strength.
1. Furnish concrete inserts and other devices indicated to other trades for installation in advance of time needed for coordination and construction.
- B. Coordination with Sprayed Fire-Resistive Materials:

1. Before sprayed fire-resistive materials are applied, attach offset anchor plates or ceiling runners (tracks) to surfaces indicated to receive sprayed fire-resistive materials. Where offset anchor plates are required, provide continuous plates fastened to building structure not more than 24 inches o.c.
2. After sprayed fire-resistive materials are applied, remove them only to extent necessary for installation of non-load-bearing steel framing. Do not reduce thickness of fire-resistive materials below that required for fire-resistance ratings indicated. Protect adjacent fire-resistive materials from damage.

3.3 INSTALLATION, GENERAL

- A. Installation Standard: ASTM C 754, except comply with framing sizes and spacing indicated.
 1. Gypsum Plaster Assemblies: Also comply with requirements in ASTM C 841 that apply to framing installation.
 2. Portland Cement Plaster Assemblies: Also comply with requirements in ASTM C 1063 that apply to framing installation.
 3. Gypsum Board Assemblies: Also comply with requirements in ASTM C 840 that apply to framing installation.
- B. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.
- C. Install bracing at terminations in assemblies.
- D. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

3.4 INSTALLING SUSPENSION SYSTEMS

- A. Install suspension system components in sizes and spacings indicated on Drawings, but not less than those required by referenced installation standards for assembly types and other assembly components indicated.
- B. Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.
- C. Suspend hangers from building structure as follows:
 1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or suspension system.
 - a. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
 2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with locations of hangers required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.
 - a. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced installation standards.

3. Wire Hangers: Secure by looping and wire tying, either directly to structures or to inserts, eye screws, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause hangers to deteriorate or otherwise fail.
 4. Flat Hangers: Secure to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices and fasteners that are secure and appropriate for structure and hanger, and in a manner that will not cause hangers to deteriorate or otherwise fail.
 5. Do not attach hangers to steel roof deck.
 6. Do not attach hangers to permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.
 7. Do not attach hangers to rolled-in hanger tabs of composite steel floor deck.
 8. Do not connect or suspend steel framing from ducts, pipes, or conduit.
- D. Fire-Resistance-Rated Assemblies: Wire tie furring channels to supports.
- E. Seismic Bracing: Sway-brace suspension systems with hangers used for support.
- F. Grid Suspension Systems: Attach perimeter wall track or angle where grid suspension systems meet vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.
- G. Installation Tolerances: Install suspension systems that are level to within 1/8 inch in 12 feet measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

3.5 INSTALLING FRAMED ASSEMBLIES

- A. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.
- B. Install studs so flanges within framing system point in same direction.
- C. Install tracks (runners) at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings, except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts penetrating partitions above ceiling.
1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
 2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.
 - a. Install two studs at each jamb, unless otherwise indicated.
 - b. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch clearance from jamb stud to allow for installation of control joint in finished assembly.
 - c. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.
 3. Other Framed Openings: Frame openings other than door openings the same as required for door openings, unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.

4. Fire-Resistance-Rated Partitions: Install framing to comply with fire-resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.
 - a. Firestop Track: Where indicated, install to maintain continuity of fire-resistance-rated assembly indicated.
 5. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.
 6. Curved Partitions:
 - a. Bend track to uniform curve and locate straight lengths so they are tangent to arcs.
 - b. Begin and end each arc with a stud, and space intermediate studs equally along arcs. On straight lengths of not less than 2 studs at ends of arcs, place studs 6 inches o.c.
- D. Direct Furring:
1. Screw to metal framing.
 2. Attach to concrete or masonry with stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.
- E. Z-Furring Members:
1. Erect insulation (specified in Division 07 Section "Thermal Insulation") vertically and hold in place with Z-furring members spaced 24 inches o.c.
 2. Except at exterior corners, securely attach narrow flanges of furring members to wall with concrete stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.
 3. At exterior corners, attach wide flange of furring members to wall with short flange extending beyond corner; on adjacent wall surface, screw-attach short flange of furring channel to web of attached channel. At interior corners, space second member no more than 12 inches from corner and cut insulation to fit.
- F. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch from the plane formed by faces of adjacent framing.

END OF SECTION 09-2216

SECTION 09-2900 GYPSUM BOARD

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Interior gypsum board.
 - 2. Exterior gypsum board for ceilings and soffits.
- B. Related Sections include the following:
 - 1. Division 05 Section "Cold-Formed Metal Framing" for load-bearing steel framing that supports gypsum board.
 - 2. Division 06 Section "Rough Carpentry" for wood framing and furring that supports gypsum board.
 - 3. Division 07 Section "Thermal Insulation" for insulation and vapor retarders installed in assemblies that incorporate gypsum board.
 - 4. Division 09 Section "Non-Structural Metal Framing" for non-structural framing and suspension systems that support gypsum board.
 - 5. Division 09 Section "Tiling" for cementitious backer units installed as substrates for ceramic tile.
 - 6. Division 09 painting Sections for primers applied to gypsum board surfaces.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples: For the following products:
 - 1. Textured Finishes: Manufacturer's standard size for each textured finish indicated and on same backing indicated for Work.

1.4 QUALITY ASSURANCE

- A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.
- B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

1.5 STORAGE AND HANDLING

- A. Store materials inside under cover and keep them dry and protected against damage from weather, condensation, direct sunlight, construction traffic, and other causes. Stack panels flat to prevent sagging.

1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.
- B. Do not install interior products until installation areas are enclosed and conditioned.
- C. Do not install panels that are wet, those that are moisture damaged, and those that are mold damaged.
 - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 PANELS, GENERAL

- A. Recycled Content: Provide gypsum panel products with recycled content such that postconsumer recycled content plus one-half of pre-consumer recycled content constitutes a minimum of 4 percent by weight.
- B. Size: Provide in maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

2.2 INTERIOR GYPSUM BOARD

- A. General: Complying with ASTM C 36/C 36M or ASTM C 1396/C 1396M, as applicable to type of gypsum board indicated and whichever is more stringent.
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Manufactured within 500 miles of project site.
- B. Type X:
 - 1. Thickness: 5/8 inch.
 - 2. Long Edges: Tapered.
 - 3. Surface Paper: 100% recycled content paper on front, back, and long edges.
- C. Ceiling Type: Manufactured to have more sag resistance than regular-type gypsum board.

1. Thickness: 1/2 inch.
2. Long Edges: Tapered.
3. Surface Paper: 100% recycled content paper on front, back, and long edges.

D. Moisture- and Mold-Resistant Type: With moisture- and mold-resistant core and surfaces.

1. Core: 5/8 inch, Type X.
2. Long Edges: Tapered.
3. Surface Paper: 100% recycled content moisture, mold, mildew resistant paper on front, back, and long edges.

2.3 EXTERIOR GYPSUM BOARD FOR CEILINGS AND SOFFITS

A. Exterior Gypsum Soffit Board: ASTM C 931/C 931M or ASTM C 1396/C 1396M, with manufacturer's standard edges.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. American Gypsum Co.
 - b. Lafarge North America Inc.
 - c. National Gypsum Company.
 - d. USG Corporation.
2. Core: As indicated.
3. Surface Paper: 100% recycled content paper on front, back, and long edges.

2.4 TILE BACKING PANELS

A. Water-Resistant Gypsum Backing Board: ASTM C 630/C 630M or ASTM C 1396/C 1396M.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. American Gypsum Co.
 - b. Lafarge North America Inc.
 - c. National Gypsum Company.
 - d. USG Corporation.
2. Core: As indicated on Drawings.
3. Surface Paper: 100% recycled content moisture, mold, mildew resistant paper on front, back, and long edges.

B. Cementitious Backer Units: ANSI A118.9.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Custom Building Products; Wonderboard.

- b. FinPan, Inc.; Util-A-Crete Concrete Backer Board.
- c. USG Corporation; DUROCK Cement Board.

2. Thickness: As indicated on Drawings.

2.5 TRIM ACCESSORIES

A. Interior Trim: ASTM C 1047.

- 1. Material: Galvanized or aluminum-coated steel sheet, rolled zinc, plastic, or paper-faced galvanized steel sheet.
- 2. Shapes:
 - a. Cornerbead.
 - b. LC-Bead: J-shaped; exposed long flange receives joint compound.
 - c. L-Bead: L-shaped; exposed long flange receives joint compound.
 - d. U-Bead: J-shaped; exposed short flange does not receive joint compound.
 - e. Expansion (control) joint.

B. Exterior Trim: ASTM C 1047.

- 1. Material: Hot-dip galvanized steel sheet or rolled zinc.
- 2. Shapes:
 - a. Cornerbead.
 - b. LC-Bead: J-shaped; exposed long flange receives joint compound.
 - c. Expansion (Control) Joint: One-piece, rolled zinc with V-shaped slot and removable strip covering slot opening.

C. Aluminum Trim: Extruded accessories of profiles and dimensions indicated.

- 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Fry Reglet Corp.
 - b. Gordon, Inc.
 - c. Pittcon Industries.
- 2. Aluminum: Alloy and temper with not less than the strength and durability properties of ASTM B 221, Alloy 6063-T5.
- 3. Finish: Corrosion-resistant primer compatible with joint compound and finish materials specified.

2.6 JOINT TREATMENT MATERIALS

A. General: Plain or Perforated comply with ASTM C 475/C 475M.

B. Joint Tape:

- 1. Interior Gypsum Wallboard: Paper.
- 2. Exterior Gypsum Soffit Board: Paper.
- 3. Tile Backing Panels: As recommended by panel manufacturer.

- C. Joint Compound for Interior Gypsum Wallboard: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats. Do not use joint compounds which contain asbestos fiber.
 - 1. Pre-filling: At open joints, rounded or beveled panel edges, and damaged surface areas, use setting-type taping compound.
 - 2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping compound.
 - a. Use setting-type compound for installing paper-faced metal trim accessories.
 - 3. Fill Coat: For second coat, use setting-type, sandable topping compound.
 - 4. Finish Coat: For third coat, use setting-type, sandable topping compound.
 - 5. Skim Coat: For final coat of Level 5 finish, use setting-type, sandable topping compound.
- D. Joint Compound for Exterior Applications:
 - 1. Exterior Gypsum Soffit Board: Use setting-type taping compound and setting-type, sandable topping compound.
- E. Joint Compound for Tile Backing Panels:
 - 1. Water-Resistant Gypsum Backing Board: Use setting-type taping compound and setting-type, sandable topping compound.
 - 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. Use adhesives that 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. Acoustical Sealant: As specified in Division 07 Section "Joint Sealants."
 - 1. Provide sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- E. Thermal Insulation: As specified in Division 07 Section "Thermal Insulation."
- F. Vapor Retarder: As specified in Division 07 Section "Thermal Insulation."

2.8 TEXTURE FINISHES

- A. Primer: As recommended by textured finish manufacturer.
- B. Aggregate Finish: Water-based, job-mixed, aggregated, drying-type texture finish for spray application.
 - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - a. G-P Gypsum; Georgia-Pacific Ceiling Textures/Vermiculite.
 - b. USG Corporation; SHEETROCK Wall and Ceiling Spray Texture (Aggregated).
 - 2. Texture: Spatter knock-down.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames and framing, for compliance with requirements and other conditions affecting performance.
- B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 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: As indicated on Drawings.
 2. Ceiling Type: As indicated on Drawings.
 3. Moisture- and Mold-Resistant Type: As indicated on Drawings.
- B. Single-Layer Application:
 1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing, unless otherwise indicated.
 2. On partitions/walls, apply gypsum panels vertically (parallel to framing) unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.
 - a. Stagger abutting end joints not less than one framing member in alternate courses of panels.
 - b. At stairwells and other high walls, install panels horizontally, unless otherwise indicated or required by fire-resistance-rated assembly.
 3. On Z-furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.
 4. Fastening Methods: Apply gypsum panels to supports with steel drill screws.
- C. Multilayer Application:
 1. On ceilings, apply gypsum board indicated for base layers before applying base layers on walls/partitions; apply face layers in same sequence. Apply base layers at right angles to framing members and offset face-layer joints 1 framing member, 16 inches minimum, from parallel base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly.
 2. On partitions/walls, apply gypsum board indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring

- member and face-layer joints offset at least one stud or furring member with base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.
3. On Z-furring members, apply base layer vertically (parallel to framing) and face layer either vertically (parallel to framing) or horizontally (perpendicular to framing) with vertical joints offset at least one furring member. Locate edge joints of base layer over furring members.
 4. Fastening Methods: Fasten base layers and face layers separately to supports with screws.
- 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.
- E. Curved Surfaces:
1. Install panels horizontally (perpendicular to supports) and unbroken, to extent possible, across curved surface plus 12-inch- long straight sections at ends of curves and tangent to them.
 2. For double-layer construction, fasten base layer to studs with screws 16 inches o.c. Center gypsum board face layer over joints in base layer, and fasten to studs with screws spaced 12 inches o.c.

3.4 APPLYING EXTERIOR GYPSUM PANELS FOR CEILINGS AND SOFFITS

- A. Apply panels perpendicular to supports, with end joints staggered and located over supports.
1. Install with 1/4-inch open space where panels abut other construction or structural penetrations.
 2. Fasten with corrosion-resistant screws.

3.5 APPLYING TILE BACKING PANELS

- A. Water-Resistant Gypsum Backing Board: Install at showers, tubs, and where indicated. Install with 1/4-inch gap where panels abut other construction or penetrations.
- B. Cementitious Backer Units: ANSI A108.11, at locations indicated to receive tile.
- C. Areas Not Subject to Wetting: Install regular-type gypsum wallboard panels to produce a flat surface except at showers, tubs, and other locations indicated to receive water-resistant panels.
- D. Where tile backing panels abut other types of panels in same plane, shim surfaces to produce a uniform plane across panel surfaces.

3.6 INSTALLING TRIM ACCESSORIES

- A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.

- B. Control Joints: Install control joints according to ASTM C 840 and in specific locations approved by Architect for visual effect.
- C. Interior Trim: Install in the following locations:
 - 1. Cornerbead: Use at outside corners.
 - 2. LC-Bead: Use at exposed panel edges.
 - 3. L-Bead: Use where indicated.
 - 4. U-Bead: Use at exposed panel edges.
 - 5. Curved-Edge Cornerbead: Use at curved openings.
- D. Exterior Trim: Install in the following locations:
 - 1. Cornerbead: Use at outside corners.
 - 2. LC-Bead: Use at exposed panel edges.
- E. Aluminum Trim: Install in locations indicated on Drawings.

3.7 FINISHING GYPSUM BOARD

- A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.
- B. Prefill open joints, rounded or beveled edges, and damaged surface areas.
- C. Apply joint tape over gypsum board joints, except those with trim having flanges not intended for tape.
- D. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C 840:
 - 1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
 - 2. Level 2: Panels that are substrate for tile.
 - 3. Level 3: Where indicated on Drawings.
 - 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. Cementitious Backer Units: Finish according to manufacturer's written instructions.

3.8 APPLYING TEXTURE FINISHES

- A. Surface Preparation and Primer: Prepare and apply primer to gypsum panels and other surfaces receiving texture finishes. Apply primer to surfaces that are clean, dry, and smooth.
- B. Texture Finish Application: Mix and apply finish using powered spray equipment, to produce a uniform texture free of starved spots or other evidence of thin application or of application patterns.

- C. Prevent texture finishes from coming into contact with surfaces not indicated to receive texture finish by covering them with masking agents, polyethylene film, or other means. If, despite these precautions, texture finishes contact these surfaces, immediately remove droppings and overspray to prevent damage according to texture-finish manufacturer's written recommendations.
- D. Apply joint tape over gypsum board joints and to flanges of trim accessories as recommended by trim accessory manufacturer.
- E. Levels of Gypsum Board Finish: Provide the following levels of gypsum board finish per Gypsum Association GA-214.
 - 1. Level 1: For ceiling plenum areas, concealed areas, and where indicated, unless a higher level of finish is required for fire-resistance-rated assemblies and sound-rated assemblies.
 - 2. Level 2: Where panels form substrates for tile and where indicated.
 - 3. Level 4: For gypsum board surfaces, unless otherwise indicated.
- F. Use the following joint compound combination as applicable to the finish levels specified:
 - 1. Embedding and First Coat: Setting-type joint compound. Fill (Second) Coat: Setting-type joint compound. Finish (Third) Coat: Ready-mixed, drying-type, all purpose or topping compound.
- G. For Level 4 gypsum board finish, embed tape in joint compound and apply first, fill (second), and finish (third) coats of joint compound over joints, angles, fasteners heads, and accessories. Touch up and sand between coats and after last coat as needed to produce a surface free of visual defects and ready for decoration.
- H. Where Level 2 gypsum board finish is indicated, embed tape in joint compound and apply first coat of joint compound.
- I. Where Level 1 gypsum board finish is indicated, embed tape in joint compound.
- J. Texture Top Coat Finish:
 - 1. At all textured areas, provide light spatter knock-down finish coat.

3.9 PROTECTION

- A. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.
- B. Remove and replace panels that are wet, moisture damaged, and mold damaged.
 - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 09-2900

SECTION 09-5123 ACOUSTICAL TILE 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 tiles for ceilings and the following:
 - 1. Concealed suspension systems.
- B. Related Sections include the following:
 - 1. Division 09 Section "Suspended Decorative Grids."
- C. Products furnished, but not installed under this Section, include anchors, clips, and other ceiling attachment devices to be cast in concrete at 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. Samples for Initial Selection: For components with factory-applied color finishes.
- C. Samples for Verification: For each component indicated and for each exposed finish required, prepared on Samples of size indicated below.
 - 1. Acoustical Tile: Set of full-size Samples of each type, color, pattern, and texture.
 - 2. Concealed Suspension System Members: 12-inch- long Sample of each type.
- D. Maintenance Data: For finishes to include in maintenance manuals.

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: Obtain each type of acoustical ceiling tile and supporting suspension system through one source from a single manufacturer.
- C. Seismic Standard: Provide acoustical tile ceilings designed and installed to withstand the effects of earthquake motions according to the following:
 - 1. Standard for Ceiling Suspension Systems Requiring Seismic Restraint: Comply with ASTM E 580.
 - 2. CISCA's Recommendations for Acoustical Ceilings: Comply with CISCA's "Recommendations for Direct-Hung Acoustical Tile and Lay-in Panel Ceilings--Seismic Zones 0-2."
 - 3. CISCA's Guidelines for Systems Requiring Seismic Restraint: Comply with CISCA's "Guidelines for Seismic Restraint of Direct-Hung Suspended Ceiling Assemblies--Seismic Zones 3 & 4."
 - 4. UBC Standard 25-2, "Metal Suspension Systems for Acoustical Tile and for Lay-in Panel Ceilings."
 - 5. ASCE 7, "Minimum Design Loads for Buildings and Other Structures": Section 9, "Earthquake Loads."

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver acoustical tiles, 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 tiles, permit them to reach room temperature and a stabilized moisture content.
- C. Handle acoustical tiles carefully to avoid chipping edges or damaging units in any way.

1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install acoustical tile 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.

1.8 COORDINATION

- A. Coordinate layout and installation of acoustical tiles 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 Units: Full-size tiles equal to 2.0 percent of quantity installed.
 - 2. Suspension System Components: Quantity of each concealed grid and exposed component equal to 2.0 percent of quantity installed.

PART 2 - PRODUCTS

2.1 ACOUSTICAL TILES, GENERAL

- A. Recycled Content: Provide acoustical tiles with recycled content such that postconsumer recycled content plus one-half of pre-consumer recycled content constitutes a minimum of percent by weight as scheduled in Section 2.2 of this specification.
- B. Acoustical Tile Standard: Provide manufacturer's standard tiles 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 Tile Colors and Patterns: Match appearance characteristics indicated for each product type.
 - 1. Where appearance characteristics of acoustical tiles 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 TILES FOR ACOUSTICAL TILE CEILING

- A. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:

Armstrong Ceiling and Suspension Systems: Cirrus – Open Plan – Tegalur

- a. Provide 24"x48" Cirrus tiles as indicated on plans.

Armstrong Ceiling and Suspension Systems: Optima – Health Zone – Tegalur

- b. Provide 24"x48" Optima Health Zone tiles as indicated on plans.

2.3 METAL SUSPENSION SYSTEMS, GENERAL

- A. Recycled Content: Provide products made from steel sheet with average recycled content such that postconsumer recycled content plus one-half of pre-consumer recycled content is not less than 25 percent.
- B. Metal Suspension System Standard: Provide manufacturer's standard 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.
 - 1. Anchors in Concrete: Anchors of type and material indicated below, with holes or loops for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to five times that imposed by ceiling construction, as determined by testing per ASTM E 488 or ASTM E 1512 as applicable, conducted by a qualified testing and inspecting agency.
 - 2. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hangers of type indicated, and with capability to sustain, without failure, a load equal to 10 times that imposed by ceiling construction, as determined by testing per ASTM E 1190, conducted by a qualified testing and inspecting agency.
- E. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:
 - 1. Zinc-Coated, Carbon-Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper.
 - 2. 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.
- F. Hanger Rods and Flat Hangers: Mild steel, zinc coated or protected with rust-inhibitive paint.
- G. Angle Hangers: Angles with legs not less than 7/8 inch wide; formed with 0.04-inch-thick, galvanized steel sheet complying with ASTM A 653/A 653M, G90 coating designation; with bolted connections and 5/16-inch-diameter bolts.
- H. Seismic Struts: Manufacturer's standard compression struts designed to accommodate lateral forces.
- I. Seismic Clips: Manufacturer's standard seismic clips designed and spaced to secure acoustical tiles in-place.

2.4 METAL SUSPENSION SYSTEM FOR ACOUSTICAL TILE CEILING

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Armstrong Ceiling and Suspension Systems or a comparable product by one of the following:

1. Armstrong Ceiling and Suspension Systems: Prelude XL 15/16 inch Exposed Tee System.
 2. Color: White.
- B. Suspension System: Main and cross runners roll formed from and capped with cold-rolled steel sheet, hot-dip galvanized according to ASTM A 653/A 653M, G30 coating designation.

2.5 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.
 2. Acoustical Sealant for Concealed Joints:
 - a. OSI Sealants, Inc.; Pro-Series SC-175 Rubber Base Sound Sealant.
 - b. Pecora Corporation; BA-98.
 - c. Tremco, Inc.; Tremco Acoustical Sealant.
- B. Acoustical Sealant for Exposed and Concealed Joints: Manufacturer's standard nonsag, paintable, nonstaining 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, nonhardening, nonskinning, nonstaining, 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 and substrates to which acoustical tile 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 tile 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 tiles to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width tiles at borders, and comply with layout shown on reflected ceiling plans.

3.3 INSTALLATION, SUSPENDED ACOUSTICAL TILE CEILINGS

- A. General: Install acoustical tile ceilings to comply with ASTM C 636 and UBC Standard 25-2 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. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
 - 4. 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.
 - 5. 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.
 - 6. 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.
 - 7. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, postinstalled mechanical or adhesive anchors, or power-actuated fasteners that extend through forms into concrete.
 - 8. 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.
 - 9. Do not attach hangers to steel deck tabs.
 - 10. Do not attach hangers to steel roof deck. Attach hangers to structural members.
 - 11. 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.
 - 12. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.
- C. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers, without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast-in-place or postinstalled anchors.
- D. Install suspension system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

- E. Install acoustical tiles in coordination with suspension system. Place splines or suspension system flanges into kerfed edges so tile-to-tile joints are closed by double lap of material.
 - 1. Fit adjoining tile to form flush, tight joints. Scribe and cut tile for accurate fit at borders and around penetrations through tile.
 - 2. Hold tile field in compression by inserting leaf-type, spring-steel spacers between tile.
 - 3. Protect lighting fixtures and air ducts to comply with requirements indicated for fire-resistance-rated assembly.

3.4 FIELD QUALITY CONTROL

- A. Remove and replace acoustical tile ceiling hangers and anchors and fasteners that do not pass tests and inspections and retest as specified above.

3.5 CLEANING

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

END OF SECTION 09-5123

**SECTION 09 6726
EPOXY BROADCAST WITH URETHANE TOPCOAT**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings, general provisions of the Contract, and other related construction documents such as Division 01 specifications apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Quartz flooring system as shown on the drawings and in schedules.
- B. Related Sections include the following:
 - 1. Section 03 30 00, Cast-In-Place Concrete
 - 2. Section 03 39 00, Concrete Curing

1.3 SYSTEM DESCRIPTION

- A. The work shall consist of preparation of the substrate, the furnishing and application of an epoxy based multi roller applied flooring system with Q28 or Q11 colored quartz aggregate and urethane topcoat. The system shall have the color and texture as specified by the Owner with a nominal thickness of 1/8 inch. It shall be applied to the prepared area(s) as defined in the plans strictly in accordance with the Manufacturer's recommendations.
- B. Cove base (if required) to be applied where noted on plans and per manufacturers standard details unless otherwise noted.

1.4 SUBMITTALS

- A. Product Data: Submit manufacturer's product data and installation instructions for each material and product used. Include manufacturer's Material Safety Data Sheets.
- B. Samples: A 3 x 3 inch square sample of the proposed system. Color, texture, and thickness shall be representative of the overall appearance of the finished system subject to normal tolerances.

1.5 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: The manufacturer shall be a company with at least ten years experience and regularly engaged in the manufacture and marketing of products specified herein.
- B. Applicator Qualifications: The applicator shall have experience in installation of the flooring system as confirmed by the manufacturer in all phases of surface preparation and application of the product specified.
- C. Compliance Requirements: The system shall be in compliance with requirements of United States Department of Agriculture (USDA), Food, Drug Administration (FDA), and local Health Department.
- D. A pre-installation conference shall be held between Applicator, General Contractor, Architect, and the Owner to review and clarification of this specification, application procedure, quality control, inspection and acceptance criteria and production schedule.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Packing and Shipping
 - 1. All components of the system shall be delivered to the site in the Manufacturer's packaging, clearly identified with the product type and batch number.
- B. Storage and Protection
 - 1. The Applicator shall be provided with a storage area for all components. The area shall be between 60° and 90° F, dry, out of direct sunlight and in accordance with the Manufacturer's recommendations and relevant health and safety regulations.
 - 2. Copies of Material Safety Data Sheets (MSDS) for all components shall be kept on site for review by the Engineer or other personnel.
- C. Waste Disposal
 - 1. The Applicator shall be provided with adequate disposal facilities for non-hazardous waste generated during installation of the system.

1.7 PROJECT CONDITIONS

- A. Site Requirements
 - 1. Application may proceed while air, material and substrate temperatures are between 60° and 90° F providing the substrate temperature is above the dew point. Outside of this range, the Manufacturer shall be consulted.

2. The relative humidity in the specific location of the application shall be less than 85% and the surface temperature shall be at least 5° F above the dew point.
3. The Applicator shall ensure that adequate ventilation is available for the work area. This shall include the use of manufacturer's approved fans, smooth bore tubing and closure of the work area.
4. The Applicator shall be supplied with adequate lighting equal to the final lighting level during the preparation and installation of the system.

B. Conditions of new concrete to be coated with MMA material.

1. Concrete shall be moisture cured for a minimum of 7 days and have fully cured a minimum of twenty eight days in accordance with ACI-308 prior to the application of the coating system pending moisture tests.
2. Concrete shall have a flat rubbed finish, float or light steel trowel finish (a hard steel trowel finish is neither necessary or desirable).
3. Sealers and curing agents should not to be used.
4. Concrete surfaces on grade shall have been constructed with a vapor barrier to protect against the effects of vapor transmission and possible delamination of the system.

C. Safety Requirements

1. All open flames and spark-producing equipment shall be removed from the work area prior to commencement of application.
2. "No Smoking" signs shall be posted at the entrances to the work area.
3. The Owner shall be responsible for the removal of foodstuffs from the work area.
4. Non-related personnel in the work area shall be kept to a minimum.

1.8 WARRANTY

- A. Dur-A-Flex, Inc. warrants that material shipped to buyers at the time of shipment substantially free from material defects and will perform substantially to Dur-A-Flex, Inc. published literature if used in accordance with the latest prescribed procedures and prior to the expiration date.
- B. Dur-A-Flex, Inc. liability with respect to this warranty is strictly limited to the value of the material purchase.

PART 2 - PRODUCTS

2.1 FLOORING

A. Dur-A-Flex, Inc, Dur-A-Quartz, Epoxy-Based seamless flooring system.

1. System Materials:

- a. Primer Coat: Dur-A-Flex, Inc. Dur-A-Glaze #4 WB resin and hardener.
- b. Broadcast Coats: Dur-A-Flex, Inc. Dur-A-Glaze #4 resin and hardener.
- c. The quartz aggregate shall be Dur-A-Flex, Inc., Q-28 or Q-11 colored quartz aggregate.
- d. Grout Coat: Dur-A-Flex, Inc. Dur-A-Glaze #4 resin and Water Clear hardener.
- e. Topcoats: Dur-A-Flex, Inc. Amor Top resin, hardener and grit.

2. Patch Materials

- a. Shallow Filler/Patch Material: Use Dur-A-Flex, Dur-A-Glaze #4 Cove-Rez.
- b. Deep Fill and Sloping Material (over ¼ inch): Use Dur-A-Flex, Inc. Dur-A-Crete.

2.2 MANUFACTURER

- A. Dur-A-Flex, Inc., 95 Goodwin Street, East Hartford, CT 06108, Phone: (860) 528-9838, Fax: (860) 528-2802
- B. Manufacturer of Approved System shall be single source and made in the USA.

2.3 PRODUCT REQUIREMENTS

A. Primer		Dur-A-Glaze #4 WB
1.	Percent Solids	56 %
2.	VOC	2 g/L
3.	Bond Strength to Concrete ASTM D 4541	550 psi, substrates fails
4.	Hardness, ASTM D 3363	3H
5.	Elongation, ASTM D 2370	9 %
6.	Flexibility (1/4: Cylindrical mandrel), ASTM D 1737	Pass
7.	Impact Resistance, MIL D-2794	>160
8.	Abrasion Resistance ASTM D 4060, CS 17 wheel, 1,000 g Load	30 mg loss
B. Broadcast, and Grout Coat		Dur-A-Glaze #4
1.	Percent Solids	100 %
2.	VOC	3.8 g/L
3.	Compressive Strength, ASTM D 695	17,500 psi
4.	Tensile Strength, ASTM D 638	2,100 psi

- | | | |
|-----|---|-------------------------------|
| 5. | Flexural Strength, ASTM D 790 | 5,100 psi |
| 6. | Abrasion Resistance, ASTM D 4060
C-10 Wheel, 1,000 gm load, 1,000 cycles | 29 mg loss |
| 7. | Flame Spread/NFPA-101, ASTM E 84 | Class A |
| 8. | Impact Resistance MIL D-24613
delamination | 0.0007 inches, no cracking or |
| 9. | Water Absorption. MIL D-24613 | Nil |
| 10. | Potlife @ 70 F | 20 minutes |

C. Topcoat

Armor Top

- | | | |
|----|--|--------------------------------------|
| 1. | Percent Solids | 95 % |
| 2. | VOC | 0 g/L |
| 3. | Tensile Strength, ASTM D 2370 | 7,000 psi |
| 4. | Adhesion, ASTM 4541 | Substrate Failure |
| 5. | Hardness, ASTM D 3363 | 4H |
| 6. | 60° Gloss ASTM D 523 | 70 |
| 7. | Abrasion Resistance, ASTM D4060
CS 17 wheel (1,000 g load) 1,000 cycles | Gloss Satin |
| | | 4 8 mg loss with grit |
| | | 10 12 mg loss without grit |
| 8. | Pot Life, 70 F, 50% RH | 2 Hours |
| 9. | Full Chemical Resistance | 7 days |

PART 3 – EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas and conditions, with Applicator present, for compliance with requirements for maximum moisture content, bond test, installation tolerances and other conditions affecting flooring performance.
1. Verify that substrates and conditions are satisfactory for flooring installation and comply with requirements specified.

3.2 PREPARATION

A. General

1. New and existing concrete surfaces shall be free of oil, grease, curing compounds, loose particles, moss, algae growth, laitance, friable matter, dirt, and bituminous products.
2. Moisture Testing: Perform tests recommended by manufacturer and as follows.
 - a. Perform relative humidity test using is situ probes, ASTM F 2170. Proceed with installation only after substrates have a maximum 75% relative humidity level measurement.

- b. If the relative humidity exceeds 75% then Dur-A-Flex, Inc Dur-A-Glaze MVP Primer moisture mitigation system must be installed prior to resinous flooring installation. Slab-on grade substrates without a vapor barrier may also require the moisture mitigation system.
- 4. There shall be no visible moisture present on the surface at the time of application of the system. Compressed oil-free air and/or a light passing of a propane torch may be used to dry the substrate.
- 5. Mechanical surface preparation
 - a. Shot blast all surfaces to receive flooring system with a mobile steel shot, dust recycling machine (Blastrac or equal). All surface and embedded accumulations of paint, toppings hardened concrete layers, laitance, power trowel finishes and other similar surface characteristics shall be completely removed leaving a bare concrete surface having a minimum profile of CSP 5 as described by the International Concrete Repair Institute.
 - b. Floor areas inaccessible to the mobile blast machines shall be mechanically abraded to the same degree of cleanliness, soundness and profile using diamond grinders, needle guns, bush hammers, or other suitable equipment.
 - c. Where the perimeter of the substrate to be coated is not adjacent to a wall or curb, a minimum 1/4 inch key cut shall be made to properly seat the system, providing a smooth transition between areas. The detail cut shall also apply to drain perimeters and expansion joint edges.
 - d. Cracks and joints (non-moving) greater than 1/8 inch wide are to be chiseled or chipped-out and repaired.
- 6. At spalled or worn areas, mechanically remove loose or delaminated concrete to a sound concrete and patch per manufactures recommendations.

3.3 APPLICATION

A. General

- 1. The system shall be applied in seven distinct steps as listed below:
 - a. Substrate preparation
 - b. Priming
 - c. First broadcast coat application with first aggregate broadcast
 - d. Second broadcast coat with second aggregate broadcast
 - e. Grout coat application, sand floor (if required)
 - f. First topcoat application
 - g. Second topcoat application
- 2. Immediately prior to the application of any component of the system, the surface shall be dry and any remaining dust or loose particles shall be removed using a vacuum or clean, dry, oil-free compressed air.

3. The handling, mixing and addition of components shall be performed in a safe manner to achieve the desired results in accordance with the Manufacturer's recommendations.
4. The system shall follow the contour of the substrate unless pitching or other leveling work has been specified by the Architect.
5. A neat finish with well-defined boundaries and straight edges shall be provided by the Applicator.

B. Primer

1. The primer shall consist of a liquid resin and hardener that is mixed at the ratio of 1 part resin to 4 parts hardener per the manufacturer's instructions.
2. The primer shall be applied by 1/8 inch notched squeegee and back rolled at the rate of 200 sf/gal to yield a dry film thickness of 4 mils.

C. Broadcast Coat

1. The grout coat shall be comprised of liquid components, combined at a ratio of 2 parts resin to 1 part
2. The grout coat shall be squeegee applied with a coverage rate of 90 sf/gal (Q28) or 50 sf/gal (Q11).
3. Hardener by volume and shall be thoroughly blended by mechanical means such as a high speed paddle mixer.
4. The grout coat will be back rolled and cross rolled to provide a uniform texture and finish.
5. For orange-peel texture, sand screen the floor and apply a second grout coat of epoxy. The epoxy shall be applied by squeegee and back-roll with a coverage rate of 200 sf/gal (Q28) or 70 sf/gal (Q11).

D. Topcoat

1. The topcoat of Armor Top shall be roller applied at the rate of 500 sf/gal to yield a dry film thickness of 3 mils.
2. The topcoat shall be comprised of a liquid resin, hardener and grit that is mixed per the manufacturer's instructions
3. The finish floor will have a nominal thickness of 1/8 inch.

3.4 FIELD QUALITY CONTROL

A. Tests, Inspection

1. The following tests shall be conducted by the Applicator:
 - a. Temperature
 1. Air, substrate temperatures and, if applicable, dew point.
 - b. Coverage Rates
 1. Rates for all layers shall be monitored by checking quantity of material used against the area covered.

3.5 CLEANING AND PROTECTION

- A. Cure flooring material in compliance with manufacturer's directions, taking care to prevent their contamination during stages of application and prior to completion of the curing process.
- B. Remove masking. Perform detail cleaning at floor termination, to leave cleanable surface for subsequent work of other sections.

END OF SECTION

SECTION 09-9113 EXTERIOR PAINTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes surface preparation and the application of paint systems on the following exterior substrates:
 - 1. Concrete.
 - 2. Steel.
 - 3. Galvanized metal.
 - 4. Aluminum (not anodized or otherwise coated).
 - 5. Wood.
- B. Related Sections include the following:
 - 1. Division 05 Sections for shop priming of metal substrates with primers specified in this Section.
 - 2. Division 06 Sections for shop priming carpentry with primers specified in this Section.
 - 3. Division 08 Sections for factory priming windows and doors with primers specified in this Section.
 - 4. Division 09 Section "Interior Painting" for surface preparation and the application of paint systems on interior substrates.
 - 5. Division 09 Section "Staining and Transparent Finishing" for surface preparation and the application of wood stains and transparent finishes on exterior wood substrates.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples for Initial Selection: For each type of topcoat product indicated.
- C. Product List: For each product indicated, include the following:
 - 1. Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.
 - 2. Printout of current "MPI Approved Products List" for each product category specified in Part 2, with the proposed product highlighted.

1.4 QUALITY ASSURANCE

- A. MPI Standards:

1. Products: Complying with MPI standards indicated and listed in "MPI Approved Products List."
2. Preparation and Workmanship: Comply with requirements in "MPI Architectural Painting Specification Manual" for products and paint systems indicated.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.
 1. Maintain containers in clean condition, free of foreign materials and residue.
 2. Remove rags and waste from storage areas daily.

1.6 PROJECT CONDITIONS

- A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.
- B. Do not apply paints in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

1.7 EXTRA MATERIALS

- A. Furnish extra materials described below that are from same production run (batch mix) as materials applied and that are packaged for storage and identified with labels describing contents.
 1. Quantity: Furnish an additional 2 percent, but not less than 1 gal. of each material and color applied.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Benjamin Moore & Co.
 2. Dunn-Edwards Corporation.
 3. PPG Architectural Finishes, Inc.
 4. Sherwin-Williams Company (The).

2.2 PAINT, GENERAL

- A. Material Compatibility:

1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.

B. Colors: As selected by Architect from manufacturer's full range.

2.3 BLOCK FILLERS

A. Interior/Exterior Latex Block Filler: MPI #4.

1. VOC Content: E Range of E3.

2.4 PRIMERS/SEALERS

A. Alkali-Resistant Primer: MPI #3.

1. VOC Content: E Range of E3.

B. Bonding Primer (Water Based): MPI #17.

1. VOC Content: E Range of E3.

C. Bonding Primer (Solvent Based): MPI #69.

1. VOC Content: E Range of E2.

2.5 METAL PRIMERS

A. Alkyd Anticorrosive Metal Primer: MPI #79.

1. VOC Content: E Range of E1.

B. Quick-Drying Alkyd Metal Primer: MPI #76.

1. VOC Content: E Range of E2

C. Cementitious Galvanized-Metal Primer: MPI #26.

1. VOC Content: E Range of E0.

D. Waterborne Galvanized-Metal Primer: MPI #134.

1. VOC Content: E Range of E3
2. Environmental Performance Rating: GPS-2.

E. Quick-Drying Primer for Aluminum: MPI #95.

1. VOC Content: E Range of E3.

2.6 EXTERIOR LATEX PAINTS

- A. Exterior Latex (Flat): MPI #10 (Gloss Level 1).
 - 1. VOC Content: E Range of E3.
- B. Exterior Latex (Semigloss): MPI #11 (Gloss Level 5).
 - 1. VOC Content: E Range of E1
- C. Exterior Latex (Gloss): MPI #119 (Gloss Level 6, except minimum gloss of 65 units at 60 deg).
 - 1. VOC Content: E Range of E1.

2.7 EXTERIOR ALKYD PAINTS

- A. Exterior Alkyd Enamel (Flat): MPI #8 (Gloss Level 1).
 - 1. VOC Content: E Range of E1.
- B. Exterior Alkyd Enamel (Semigloss): MPI #94 (Gloss Level 5).
 - 1. VOC Content: E Range of E1.
- C. Exterior Alkyd Enamel (Gloss): MPI #9 (Gloss Level 6).
 - 1. VOC Content: E Range of E1.

2.8 QUICK-DRYING ENAMELS

- A. Quick-Drying Enamel (Semigloss): MPI #81 (Gloss Level 5).
 - 1. VOC Content: E Range of E3.
- B. Quick-Drying Enamel (High Gloss): MPI #96 (Gloss Level 7).
 - 1. VOC Content: E Range of E3.

2.9 ALUMINUM PAINT

- A. Aluminum Paint: MPI #1.
 - 1. VOC Content: E Range of E3.

2.10 FLOOR COATINGS

- A. Interior/Exterior Clear Concrete Floor Sealer (Water Based): MPI #99.
 - 1. VOC Content: E Range of E2.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of work.
- B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
 - 1. Concrete: 12 percent.
 - 2. Wood: 15 percent.
 - 3. Gypsum Board: 12 percent.
- C. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.
- D. Begin coating application only after unsatisfactory conditions have been corrected and surfaces are dry.
 - 1. Beginning coating application constitutes Contractor's acceptance of substrates and conditions.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and paint systems indicated.
- B. Remove plates, machined surfaces, and similar items already in place that are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
 - 1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.
 - 2. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
- C. Clean substrates of substances that could impair bond of paints, including dirt, oil, grease, and incompatible paints and encapsulants.
 - 1. Remove incompatible primers and reprime substrate with compatible primers as required to produce paint systems indicated.
- D. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.
- E. Steel Substrates: Remove rust and loose mill scale. Clean using methods recommended in writing by paint manufacturer.
- F. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal fabricated from coil stock by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.

- G. Aluminum Substrates: Remove surface oxidation.
- H. Wood Substrates:
 - 1. Scrape and clean knots, and apply coat of knot sealer before applying primer.
 - 2. Sand surfaces that will be exposed to view, and dust off.
 - 3. Prime edges, ends, faces, undersides, and backsides of wood.
 - 4. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.

3.3 APPLICATION

- A. Apply paints according to manufacturer's written instructions.
 - 1. Use applicators and techniques suited for paint and substrate indicated.
 - 2. Paint surfaces behind movable items same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed items with prime coat only.
- B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match color of topcoat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.
- C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.
- D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

3.4 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
- B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.
- D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.5 EXTERIOR PAINTING SCHEDULE

- A. Concrete Substrates, Non-traffic Surfaces:
 - 1. Latex System: MPI EXT 3.1A.
 - a. Prime Coat: Exterior latex matching topcoat.
 - b. Intermediate Coat: Exterior latex matching topcoat.

- c. Topcoat: Exterior latex flat.
- B. Concrete Substrates, Traffic Surfaces:
 - 1. Water-Based Clear Sealer System: MPI EXT 3.2H.
 - a. Prime Coat: Interior/exterior clear concrete floor sealer (water based).
 - b. Intermediate Coat: Interior/exterior clear concrete floor sealer (water based).
 - c. Topcoat: Interior/exterior clear concrete floor sealer (water based).
- C. Steel Substrates:
 - 1. Quick-Drying Enamel System: MPI EXT 5.1A.
 - a. Prime Coat: Quick-drying alkyd metal primer.
 - b. Intermediate Coat: Quick-drying enamel matching topcoat.
 - c. Topcoat: Quick-drying enamel semigloss.
 - 2. Aluminum Paint System: MPI EXT 5.1K.
 - a. Prime Coat: Alkyd anticorrosive metal primer.
 - b. Intermediate Coat: Aluminum paint.
 - c. Topcoat: Aluminum paint.
- D. Galvanized-Metal Substrates:
 - 1. Latex System: MPI EXT 5.3A.
 - a. Prime Coat: Cementitious galvanized-metal primer.
 - b. Intermediate Coat: Exterior latex matching topcoat.
 - c. Topcoat: Exterior latex flat.
- E. Aluminum Substrates:
 - 1. Latex System: MPI EXT 5.4H.
 - a. Prime Coat: Quick-drying primer for aluminum.
 - b. Intermediate Coat: Exterior latex matching topcoat.
 - c. Topcoat: Exterior latex flat.

END OF SECTION 09-9113

SECTION 09-9123 INTERIOR PAINTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes surface preparation and the application of paint systems on the following interior substrates:
 - 1. Concrete.
 - 2. Steel.
 - 3. Galvanized metal.
 - 4. Aluminum (not anodized or otherwise coated).
 - 5. Gypsum board.
- B. Related Sections include the following:
 - 1. Division 05 Sections for shop priming of metal substrates with primers specified in this Section.
 - 2. Division 06 Sections for shop priming carpentry with primers specified in this Section.
 - 3. Division 08 Sections for factory priming windows and doors with primers specified in this Section.
 - 4. Division 09 Section "Exterior Painting" for surface preparation and the application of paint systems on exterior substrates.
 - 5. Division 09 Section "Staining and Transparent Finishing" for surface preparation and the application of wood stains and transparent finishes on interior wood substrates.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples for Initial Selection: For each type of topcoat product indicated.
- C. Product List: For each product indicated, include the following:
 - 1. Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.
 - 2. Printout of current "MPI Approved Products List" for each product category specified in Part 2, with the proposed product highlighted.

1.4 QUALITY ASSURANCE

- A. MPI Standards:

1. Products: Complying with MPI standards indicated and listed in "MPI Approved Products List."
2. Preparation and Workmanship: Comply with requirements in "MPI Architectural Painting Specification Manual" for products and paint systems indicated.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.
 1. Maintain containers in clean condition, free of foreign materials and residue.
 2. Remove rags and waste from storage areas daily.

1.6 PROJECT CONDITIONS

- A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.
- B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

1.7 EXTRA MATERIALS

- A. Furnish extra materials described below that are from same production run (batch mix) as materials applied and that are packaged for storage and identified with labels describing contents.
 1. Quantity: Furnish an additional 2 percent, but not less than 1 gal. of each material and color applied.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Benjamin Moore & Co.
 2. Dunn-Edwards Corporation.
 3. PPG Architectural Finishes, Inc.
 4. Sherwin-Williams Company (The).

2.2 PAINT, GENERAL

- A. Material Compatibility:

1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
 2. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.
- B. VOC Content of Field-Applied Interior Paints and Coatings: Provide products that comply with the following limits for VOC content, exclusive of colorants added to a tint base, when calculated according to 40 CFR 59, Subpart D (EPA Method 24); these requirements do not apply to paints and coatings that are applied in a fabrication or finishing shop:
1. Flat Paints, Coatings, and Primers: VOC content of not more than 50 g/L.
 2. Nonflat Paints, Coatings, and Primers: VOC content of not more than 150 g/L.
 3. Anti-Corrosive and Anti-Rust Paints Applied to Ferrous Metals: VOC not more than 250 g/L.
 4. Floor Coatings: VOC not more than 100 g/L.
 5. Shellacs, Clear: VOC not more than 730 g/L.
 6. Shellacs, Pigmented: VOC not more than 550 g/L.
 7. Flat Topcoat Paints: VOC content of not more than 50 g/L.
 8. Nonflat Topcoat Paints: VOC content of not more than 150 g/L.
 9. Anti-Corrosive and Anti-Rust Paints Applied to Ferrous Metals: VOC not more than 250 g/L.
 10. Floor Coatings: VOC not more than 100 g/L.
 11. Shellacs, Clear: VOC not more than 730 g/L.
 12. Shellacs, Pigmented: VOC not more than 550 g/L.
 13. Primers, Sealers, and Undercoaters: VOC content of not more than 200 g/L.
 14. Dry-Fog Coatings: VOC content of not more than 400 g/L.
 15. Zinc-Rich Industrial Maintenance Primers: VOC content of not more than 340 g/L.
 16. Pre-Treatment Wash Primers: VOC content of not more than 420 g/L.
- C. Chemical Components of Field-Applied Interior Paints and Coatings: Provide topcoat paints and anti-corrosive and anti-rust paints applied to ferrous metals that comply with the following chemical restrictions; these requirements do not apply to paints and coatings that are applied in a fabrication or finishing shop:
1. Aromatic Compounds: Paints and coatings shall not contain more than 1.0 percent by weight of total aromatic compounds (hydrocarbon compounds containing one or more benzene rings).
 2. Restricted Components: Paints and coatings shall not contain any of the following:
 - a. Acrolein.
 - b. Acrylonitrile.
 - c. Antimony.
 - d. Benzene.
 - e. Butyl benzyl phthalate.
 - f. Cadmium.
 - g. Di (2-ethylhexyl) phthalate.
 - h. Di-n-butyl phthalate.
 - i. Di-n-octyl phthalate.
 - j. 1,2-dichlorobenzene.
 - k. Diethyl phthalate.
 - l. Dimethyl phthalate.
 - m. Ethylbenzene.
 - n. Formaldehyde.
 - o. Hexavalent chromium.
 - p. Isophorone.

- q. Lead.
- r. Mercury.
- s. Methyl ethyl ketone.
- t. Methyl isobutyl ketone.
- u. Methylene chloride.
- v. Naphthalene.
- w. Toluene (methylbenzene).
- x. 1,1,1-trichloroethane.
- y. Vinyl chloride.

D. Colors: As selected by Architect from manufacturer's full range.

2.3 PRIMERS/SEALERS

A. Interior Latex Primer/Sealer: MPI #50.

- 1. VOC Content: E Range of E1
- 2. Environmental Performance Rating: EPR-1

B. Interior Alkyd Primer/Sealer: MPI #45.

- 1. VOC Content: E Range of E2.

C. Wood-Knot Sealer: Sealer recommended in writing by topcoat manufacturer for use in paint systems indicated.

2.4 METAL PRIMERS

A. Alkyd Anticorrosive Metal Primer: MPI #79.

- 1. VOC Content: E Range of E1

B. Quick-Drying Alkyd Metal Primer: MPI #76.

- 1. VOC Content: E Range of E3.

C. Rust-Inhibitive Primer (Water Based): MPI #107.

- 1. VOC Content: E Range of E2.
- 2. Environmental Performance Rating: EPR-1.

D. Quick-Drying Primer for Aluminum: MPI #95.

- 1. VOC Content: E Range of E3.

2.5 WOOD PRIMERS

A. Interior Latex-Based Wood Primer: MPI #39.

- 1. VOC Content: E Range of E3
- 2. Environmental Performance Rating: EPR-2

2.6 LATEX PAINTS

- A. Interior Latex (Flat): MPI #53 (Gloss Level 1).
 - 1. VOC Content: E Range of E3
 - 2. Environmental Performance Rating: GPS-2
- B. Interior Latex (Low Sheen): MPI #44 (Gloss Level 2).
 - 1. VOC Content: E Range of E3
 - 2. Environmental Performance Rating: GPS-2
- C. Interior Latex (Eggshell): MPI #52 (Gloss Level 3).
 - 1. VOC Content: E Range of E2
 - 2. Environmental Performance Rating: GPS-1
- D. Interior Latex (Satin): MPI #43 (Gloss Level 4).
 - 1. VOC Content: E Range of E2
 - 2. Environmental Performance Rating: GPS-1
- E. Interior Latex (Semigloss): MPI #54 (Gloss Level 5).
 - 1. VOC Content: E Range of E1
 - 2. Environmental Performance Rating: EPR2
- F. Interior Latex (Gloss): MPI #114 (Gloss Level 6, except minimum gloss of 65 units at 60 deg).
 - 1. VOC Content: E Range of E1
 - 2. Environmental Performance Rating: EPR2

2.7 QUICK-DRYING ENAMELS

- A. Quick-Drying Enamel (Semigloss): MPI #81 (Gloss Level 5).
 - 1. VOC Content: E Range of E3.
- B. Quick-Drying Enamel (High Gloss): MPI #96 (Gloss Level 7).
 - 1. VOC Content: E Range of E3.

2.8 FLOOR COATINGS

- A. Interior/Exterior Clear Concrete Floor Sealer (Water Based): MPI #99.
 - 1. VOC Content: E Range of E2.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of work.
- B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
 - 1. Concrete: 12 percent.
 - 2. Wood: 15 percent.
 - 3. Gypsum Board: 12 percent.
- C. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.
- D. Begin coating application only after unsatisfactory conditions have been corrected and surfaces are dry.
 - 1. Beginning coating application constitutes Contractor's acceptance of substrates and conditions.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates indicated.
- B. Remove plates, machined surfaces, and similar items already in place that are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
 - 1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.
 - 2. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
- C. Clean substrates of substances that could impair bond of paints, including dirt, oil, grease, and incompatible paints and encapsulants.
 - 1. Remove incompatible primers and reprime substrate with compatible primers as required to produce paint systems indicated.
- D. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.
- E. Steel Substrates: Remove rust and loose mill scale. Clean using methods recommended in writing by paint manufacturer.
- F. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal fabricated from coil stock by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.

- G. Aluminum Substrates: Remove surface oxidation.
- H. Wood Substrates:
 - 1. Scrape and clean knots, and apply coat of knot sealer before applying primer.
 - 2. Sand surfaces that will be exposed to view, and dust off.
 - 3. Prime edges, ends, faces, undersides, and backsides of wood.
 - 4. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.
- I. Gypsum Board Substrates: Do not begin paint application until finishing compound is dry and sanded smooth.

3.3 APPLICATION

- A. Apply paints according to manufacturer's written instructions.
 - 1. Use applicators and techniques suited for paint and substrate indicated.
 - 2. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
 - 3. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
- B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match color of topcoat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.
- C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.
- D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.
- E. Painting Mechanical and Electrical Work: Paint items exposed in equipment rooms and occupied spaces including, but not limited to, the following: Paint items exposed to view through specified open cell ceiling systems.
 - 1. Mechanical Work:
 - a. Uninsulated metal piping.
 - b. Uninsulated plastic piping.
 - c. Pipe hangers and supports.
 - d. Tanks that do not have factory-applied final finishes.
 - e. Visible portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets.
 - f. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
 - g. Mechanical equipment that is indicated to have a factory-primed finish for field painting.
 - 2. Electrical Work:

- a. Switchgear.
- b. Panelboards.
- c. Electrical equipment that is indicated to have a factory-primed finish for field painting.\
- d. Conduit

3.4 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
- B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.
- D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.5 INTERIOR PAINTING SCHEDULE

- A. Concrete Substrates, Nontraffic Surfaces:
 - 1. Latex Over Sealer System: MPI INT 3.1A.
 - a. Prime Coat: Interior latex primer/sealer.
 - b. Intermediate Coat: Interior latex matching topcoat.
 - c. Topcoat: Interior latex flat.
- B. Concrete Substrates, Traffic Surfaces:
 - 1. Water-Based Clear Sealer System: MPI INT 3.2G.
 - a. First Coat: Interior/exterior clear concrete floor sealer (water based).
 - b. Topcoat: Interior/exterior clear concrete floor sealer (water based).
- C. Steel Substrates:
 - 1. Quick-Drying Enamel System: MPI INT 5.1A.
 - a. Prime Coat: Quick-drying alkyd metal primer.
 - b. Intermediate Coat: Quick-drying enamel matching topcoat.
 - c. Topcoat: Quick-drying enamel semigloss
 - 2. Aluminum Paint System: MPI INT 5.1M.
 - a. Prime Coat: Alkyd anticorrosive metal primer.
 - b. Intermediate Coat: Aluminum paint.
 - c. Topcoat: Aluminum paint.
- D. Galvanized-Metal Substrates:

1. Latex System: MPI INT 5.3A.
 - a. Prime Coat: Cementitious galvanized-metal primer.
 - b. Intermediate Coat: Interior latex matching topcoat.
 - c. Topcoat: Interior latex flat
- E. Aluminum (Not Anodized or Otherwise Coated) Substrates:
 1. Latex System: MPI INT 5.4H.
 - a. Prime Coat: Quick-drying primer for aluminum.
 - b. Intermediate Coat: Interior latex matching topcoat.
 - c. Topcoat: Interior latex flat.
 2. Aluminum Paint System: MPI INT 5.4D.
 - a. Prime Coat: Vinyl wash primer.
 - b. Intermediate Coat: Aluminum paint.
 - c. Topcoat: Aluminum paint.
- F. Gypsum Board Substrates – Wall/ Ceiling Paint at Dry Areas (Basis: Dunn Edwards)
 1. First Coat: #65 Primer- Sealer
 2. Second Coat: #90 Semi-gloss enamel
 3. Third Coat: #90 Semi-gloss enamel
- G. Gypsum Board Substrates – Wall/ Ceiling Paint at Wet Areas (Bases Dunn Edwards)
 1. First Coat: Dunn Edwards #65 primer- Sealer
 2. Second Coat: Epoxy E.
 3. Third Coat: Epoxy E.

END OF SECTION 09-9123

SECTION 10-1400 SIGNAGE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:

- 1. Dimensional characters.
- 2. Panel signs.

- B. Related Sections include the following:

- 1. Division 22 Section "Identification for Plumbing Piping and Equipment" for labels, tags, and nameplates for plumbing systems and equipment.
- 2. Division 23 Section "Identification for HVAC Piping and Equipment" for labels, tags, and nameplates for HVAC systems and equipment.
- 3. Division 26 Sections for electrical service and connections for illuminated signs.
- 4. Division 26 Section "Identification for Electrical Systems" for labels, tags, and nameplates for electrical equipment.
- 5. Division 26 Section "Interior Lighting" for illuminated Exit signs.

1.3 DEFINITIONS

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

1.4 SUBMITTALS

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

- B. Shop Drawings: Show fabrication and installation details for signs.

- 1. Show sign mounting heights, locations of supplementary supports to be provided by others, and accessories.
- 2. Provide message list, typestyles, graphic elements, including tactile characters and Braille, and layout for each sign.

- C. Samples for Initial Selection: Manufacturer's color charts consisting of actual units or sections of units showing the full range of colors available for the following:

- 1. Aluminum.

2. Acrylic sheet.
3. Polycarbonate sheet.
4. Fiberglass sheet.
5. Die-cut vinyl characters and graphic symbols. Include representative samples of available typestyles and graphic symbols.

- D. Sign Schedule: To be provided by Architect
- E. Qualification Data: For Installer and fabricator.
- F. Maintenance Data: For signs to include in maintenance manuals.
- G. Warranty: Special warranty specified in this Section.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Fabricator of products.
- B. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.
- C. Source Limitations for Signs: Obtain each sign type indicated from one source from a single manufacturer.
- D. Regulatory Requirements: Comply with applicable provisions in ADA-ABA Accessibility Guidelines.

1.6 PROJECT CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit installation of signs in exterior locations to be performed according to manufacturers' written instructions and warranty requirements.
- B. Field Measurements: Verify recess openings by field measurements before fabrication and indicate measurements on Shop Drawings.

1.7 COORDINATION

- A. Coordinate placement of anchorage devices with templates for installing signs.

1.8 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.
1. Failures include, but are not limited to, the following:
 - a. Deterioration of metal and polymer finishes beyond normal weathering.
 - b. Deterioration of embedded graphic image colors and sign lamination.

2. Warranty Period: 2 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Aluminum Castings: ASTM B 26/B 26M, of alloy and temper recommended by sign manufacturer for casting process used and for use and finish indicated.
- B. Aluminum Sheet and Plate: ASTM B 209, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with at least the strength and durability properties of Alloy 5005-H32.
- C. Aluminum Extrusions: ASTM B 221, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with at least the strength and durability properties of Alloy 6063-T5.
- D. Bronze Castings: ASTM B 584, Alloy UNS No. C86500 (No. 1 manganese bronze).
- E. Bronze Plate: ASTM B 36/B 36M.
- F. Acrylic Sheet: ASTM D 4802, Category A-1 (cell-cast sheet), Type UVA (UV absorbing).
- G. Polycarbonate Sheet: Of thickness indicated, manufactured by extrusion process, coated on both surfaces with abrasion-resistant coating:
 1. Impact Resistance: 16 ft-lbf/in. per ASTM D 256, Method A.
 2. Tensile Strength: 9000 lbf/sq. in. per ASTM D 638.
 3. Flexural Modulus of Elasticity: 340,000 lbf/sq. in. per ASTM D 790.
 4. Heat Deflection: 265 deg F at 264 lbf/sq. in. per ASTM D 648.
 5. Abrasion Resistance: 1.5 percent maximum haze increase for 100 revolutions of a Taber abraser with a load of 500 g per ASTM D 1044.
- H. Applied Vinyl: Die-cut characters from vinyl film of nominal thickness of 3 mils with pressure-sensitive adhesive backing, suitable for exterior applications.

2.2 DIMENSIONAL CHARACTERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 1. ACE Sign Systems, Inc.
 2. A. R. K. Ramos.
 3. ASI-Modulex, Inc.
 4. Gemini Incorporated.
- B. Cast Characters: Produce characters with smooth flat faces, sharp corners, and precisely formed lines and profiles, free of pits, scale, sand holes, and other defects. Cast lugs into back of characters and tap to receive threaded mounting studs. Alloy and temper recommended by sign manufacturer for casting process used and for use and finish indicated. Comply with the following requirements.

1. Character Material: Cast aluminum lettering
 2. Finish: Clear anodized, 1" return
 3. Letter Style: Avante Garde Medium, 8"
 4. Mounting: Stud mount with patter.
 5. Quantity: Reference Drawings.
 6. Size:
 - a. Height: 8 inches
 - b. Width, Ave: 6 inches
 - c. Stroke: 2 1/8 inch – 3 7/16 inch
 - d. Depth: 1 inch.
- C. Quantity: Provide the building address number on the exterior face of the building as directed by the local fire authority.

2.3 MODULAR INTERCHANGEABLE SIGNS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Diversity Sign System Interior Modular Interchangeable Signs by Century Sign Builders (2117 Commercial NE, Albuquerque, NM 87106 505-888-2901) or approved equal.
- B. General Characteristics:
- a. Regulatory Compliance: All signs shall conform to the requirements of regulations list in section 1.3 and shall be designed to meet the stated requirements for color, contrast, letter height, install location and other characteristics required for accessibility and by local, state and federal regulations.
 - b. Base material or chassis: Curved aluminum sign frame
 - i. Extruded aluminum sign frame consisting of a convex curved face, side channels and (2) end caps such that that the lens) with tactile lettering/graphics, changeable insert and printed graphic insert are held and contained within the sign frame.
 - ii. Overall size and depth/curvature of sign frame as per approved shop drawings.
 - iii. Finishes for aluminum frame and end caps as per approved shop drawings
 - c. Lens or cover material: lens and covers shall be constructed using 0.125" (342-101) or 0.0625" (322-101) clear single-ply non-glare acrylic multi-polymer (Rowmark).
 - d. Changeable message insert will be fabricated from commonly available transparency media no less than 5 mil thick that is compatible with inkjet or laser printers such as 3M CG3710 or equivalent.
 - e. Printed graphic inserts: Printed inserts will be created using a satin-coated, tear-resistant, rigid PVC media with eco-solvent waterfast & UV stable inks.
 - i. Printed background inserts must be manufactured in color managed workflow with the following capacities:

- i. All printing must be done using a profiled printer with transmissible ICC profile.
 - ii. All approved colors used in final design must have LAB values recorded and submitted to architect owner for future reference and duplication.
 - iii. Printing must be performed on calibrated printer such that future orders of insert can be reproduced within 5 Delta E of recorded LAB values.
- f. Tactile Raised Lettering/Graphic method: Tactile lettering and symbols shall be formed using rotary engraving method and bonded to sign plaque using 3M Scotch 467HP adhesive. Text, numbers and symbols must have 1/32" return cut to 22 degree angle. Text, numbers and symbols must be constructed with materials having embedded coloration that is the final approved color for the signs. Products with painted or otherwise applied coloration method are not acceptable.
- g. Braille Method: Braille must be constructed using the Edgerton Grade 2 Braille System using clear Raster beads.
- h. Vinyl Graphics: As indicated on the shop drawings, signs may have text, graphics or decorative elements created using applied vinyl graphics film. Such graphics shall:
 - i. Be constructed on high performance cast vinyl graphic film products such as 3M Scotchcal or equal with a 5 year or greater warranty.
 - ii. Signs shall be cut from sufficiently large rolls of material to minimize seams or joining of material to create one sign.
 - iii. All lettering and graphics shall be computer cut from professionally quality artwork. No hand cut vinyl film shall be installed.
 - iv. Signs shall be installed free of bubbles, wrinkles or other anomalies.
- i. Other features:
 - i. Signs may be configured in one, two or three sided configurations for various applications as wall mounted, suspended, flag mounted or free standing as per the approved shop drawings.
- j. Installation method:
 - i. Wall mounted signs: signs shall be mounted using double-sided vinyl foam tape (1/16" thickness), silicon adhesive or mechanical anchors as per the approved shop drawings.
 - ii. Flag mount hardware: provide custom mounting bracket for flag mounted signs as indicated on shop drawings.
 - iii. Wall mount hardware: provide custom mounting hardware for wall mounted signs as indicated on shop drawings.
 - iv. Suspended mount hardware: provide custom mounting hardware for ceiling suspended mounted signs as indicated on shop drawings.

- v. Free standing hardware: provide base plate and floor fasteners (optional) for free standing signs as indicated on the shop drawings.
- vi. Cubicle mounted hardware: provide removable mounting method for mounting sign at cubicles, workstations or systems furniture partitions as indicated on the shop drawings.
- vii. Work surface hardware: provide angle bottom flange or stand to allow signs to be displayed in a vertical (slightly angled) fashion when placed on transaction counters, desks, etc. as indicated on the shop drawings.

C. Color Selections

- a. Tactile lettering/graphics: As per approved shop drawings
- b. Graphic insert: As per approved shop drawings
- c. Changeable insert: As per approved shop drawings
- d. Frame and mounting hardware: As per approved shop drawings

D. Font Selections

- a. Tactile lettering: As per approved shop drawings
- b. Graphic insert lettering: As per approved shop drawings
- c. Changeable insert lettering: As per approved shop drawings

D. Quantity

- a. Provide one sign per interior room and as directed on the construction drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine signage for defects prior to installation. Do not install damaged signage.
- B. Inspect conditions of installation areas and other conditions which may affect installation of signage to ensure that conditions are suitable for installation.
- C. Do not begin installation until installation areas are within manufacturer's specified tolerances and have been prepared in accordance with manufacturer's instructions.
- D. If installation area preparation is the responsibility of another installer, do not proceed with installation. Notify Architect of unsatisfactory preparation immediately.
- E. Commencement of work is deemed as acceptance of installation conditions.

3.2 PREPARATION

- A. Verify mounting heights and locations for signage will comply with specified requirements.
- B. Clean mounting locations of dirt, dust, grease or similar conditions that would prevent proper installation.
- C. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- D. Verify completion of other installation conditions needed for sign installation including backing materials, reinforcement, electrical and data.

3.3 INSTALLATION

- E. Install in accordance with manufacturer's instructions.
- F. Locate signs in accordance with approved shop drawings and project requirements.

3.4 CLEANING, PROTECTION AND REPAIR

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

3.5 TRAINING & CLOSEOUT

- I. Provide manufacturer's written warranty and cleaning/maintenance instructions.
- J. Provide digital templates for end-user updatable inserts.
- K. Provide necessary tools and source for consumables for end-user updateable inserts.

END OF SECTION 10-1400

**SECTION 010-2600
RIGID VINYL SHEETS**

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Rigid vinyl sheet for wall protection and decoration, including necessary trim.

1.2 RELATED SECTIONS

- A. Division 09 Section "Gypsum Board"
- B. Division 09 Section "Non-Structural Metal Stud Framing"
- C. Division 09 Section "Interior Painting"
- D. Division 09 Section "Epoxy Broadcast with Urethane Topcoat"

1.3 REFERENCES

- A. American Society for Testing and Materials (ASTM)
- B. National Building Code of Canada (NBC)
- C. National Fire Protection Association (NFPA)
- D. Society of Automotive Engineers (SAE)
- E. Underwriters Laboratory (UL)
- F. Underwriters Laboratory of Canada (ULC)
- G. Uniform Building Code (UBC)

1.4 SUBMITTALS

- A. Product Data: Submit sufficient manufacturer's data to indicate compliance with these specifications, including:
 - 1. Preparation instructions and recommendations.
 - 2. Storage and handling requirements and recommendations.
 - 3. Installation methods.
- B. Shop Drawings: Submit elevations of each wall showing location of paneling and trim members with respect to all discontinuities in the wall elevation. Include mounting details with the appropriate adhesives for specific project substrates.

- C. Selection Samples: Submit manufacturer's standard color pattern selection samples representing manufacturer's full range of available colors and patterns.
- D. Samples for Verification: Submit appropriate section of panel for each finish selected indicating the color, texture, and pattern required.
 - 1. Submit complete with specified applied finish.
 - 2. For selected patterns show complete pattern repeat.
 - 3. Exposed Molding and Trim: Provide samples of each type, finish, and color.
- E. Manufacturers Material Safety Data Sheets (MSDS) for adhesives, sealants and other pertinent materials prior to their delivery to the site.

1.5 QUALITY ASSURANCE

- A. Impact Strength: 30.4 ft-lbs / inch of thickness per ASTM D-256-90b, Impact Resistance of Plastics.
- B. Chemical and Stain Resistance: Provide rigid vinyl resistant to stain when tested in accordance with ASTM D-543.
- C. GREENGUARD Certified: Provide GREENGUARD Certified material. Profiles shall meet the requirements of GREENGUARD Certification Standards for Low-Emitting Products.
- D. Fungal and Bacterial Resistance: Provide rigid vinyl that does not support fungal or bacterial growth as tested in accordance with ASTM G-21 and ASTM G-22.
- E. Fire Performance: Conform to building code requirements for interior finish for smoke and flame spread requirements as tested in accordance with:
 - 1. ASTM E 84 (Method of test for surface burning characteristics of building Materials)
 - a. Wall Required Rating – As indicated on drawings.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Deliver materials factory packaged on strong pallets.
- B. Inspect materials at delivery to assure that specified products have been received.
- C. Store panels and trim lying flat, under cover and protected from the elements away from direct sunlight.

1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Building are to be fully enclosed prior to installation with sufficient heat (70°) and ventilation consistent with good working conditions for finish work
- B. During installation and for not less than 48 hours before, maintain an ambient temperature and relative humidity within limits required by type of adhesive used and recommendation of adhesive manufacturer.

1. Provide ventilation to disperse fumes during application of adhesive as recommended by the adhesive manufacturer.

1.8 WARRANTY

- A. Furnish one year guarantee against defects in material and workmanship.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURER

- A. IPC Door and Wall Protection Systems, InPro Corporation, PO Box 406 Muskego, WI 53150 USA; Telephone: 800-222-5556, Fax: 888-715-8407, www.inprocorp.com
- B. Provide all Rigid Vinyl Sheet, wall protection, and trim from a single source.
- C. Product:
 1. Standard Rigid Vinyl Sheet

2.2 PANELS

- A. Rigid Vinyl Sheet.
 1. Coating: Multi-layer print, primer and finish coats or applied over-layer.
 2. Dimensions:
 - a. Thickness – 0.080 " (2mm) nominal
 - b. Width - 4'-0" (1.22m) nominal
 - c. Length – 8'-0" (2.4m) 8 nominal
 3. Tolerance:
 - a. Length and Width: +/-1/8 " (3.175mm)
 - b. Square - Not to exceed 1/8 " for 8 foot (2.4m) panels.
- B. Properties: Resistant to rot, corrosion, staining, denting, peeling, and splintering.
- C. Back Surface: Smooth. Imperfections which do not affect functional properties are not cause for rejection.
- D. Front Finish: In accordance with approved sample as selected by the Architect.
 - a. Color: As selected by Architect from available manufacturers standard colors.
 - b. Texture: Velvet
 - c. Fire Rating Class A (I).
 - d. Size: 48" x 96" [1.2 m x 2.4 m] x .080" (2mm) nom.

2.3 ACCESSORIES

- A. Top caps, inside corners, divider bard and outside corners shall be made of extruded PVC. Color or pattern to match rigid vinyl sheets.
- B. Vinyl:
 - 1. 407 Top Cap; Length: 8' (2.44m) standard, 10' (3.04m)
 - 2. 408 Vertical Divider Bar; Length: 8' (2.44m) standard, 10' (3.04m)
 - 3. 409 Inside Corner; Length: 8' (2.44m) standard, 10' (3.04m)
 - 4. 417 Top Cap for .080" sheet; Length: 8' (2.44m) standard, 10' (3.04m)
 - 5. 418 Vertical Divider Bar for .080" sheet; Length: 8' (2.44m) standard, 10' (3.04m)
 - 6. 419 Inside Corner for .080" sheet; Length: 8' (2.44m) standard, 10' (3.04m)
- C. Outside Corners:
 - 1. 3448, 3496, 11248, or 11296 Outside Corner
- D. Sealant:
 - 1. 580 Color matched VinylSeal.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Examine backup surfaces to determine that corners are plumb and straight, surfaces are smooth, uniform, clean and free from foreign matter, nails countersunk, joints and cracks filled flush and smooth with the adjoining surface.
 - 1. Verify that stud spacing does not exceed 24" (61cm) on-center.
- B. Repair defects prior to installation.
 - 1. Level wall surfaces to panel manufacturer's requirements. Remove protrusions and fill indentations.

3.2 INSTALLATION

- A. Comply with manufacturer's recommended procedures and installation sequence.
- B. Cut sheets to meet supports allowing 1/8" (3 mm) clearance for every 8 foot (2.4m) of panel.
 - 1. Cut and drill with carbide tipped saw blades or drill bits, or cut with shears.
 - 2. Pre-drill fastener holes 1/8" (3mm) oversize with high speed drill bit.
 - a. Space at 8" (200mm) maximum on center at perimeter, approximately 1" from panel edge.
 - b. Space at in field in rows 16' (40.64cm) on center, with fasteners spaced at 12" (30.48 cm) maximum on center.

- C. Apply panels to board substrate, above base, vertically oriented with seams plumb and pattern aligned with adjoining panels.
 - 1. Install panels with manufacturer's recommended gap for panel field and corner joints.
 - a. Adhesive trowel and application method to conform to adhesive manufacturer's recommendations.
 - b. Drive fasteners for snug fit. Do not over-tighten.
- D. Apply panel moldings to all panel edges using silicone sealant providing for required clearances.
 - 1. All moldings must provide for a minimum 1/8 " (3mm) of panel expansion at joints and edges, to insure proper installation.
 - 2. Apply sealant to all moldings, channels and joints between the system and different materials to assure watertight installation.

3.3 CLEANING

- A. Remove excess sealant from panels and moldings. Wipe panel down using a damp cloth and mild soap solution or cleaner.
- B. Refer to manufacturer's specific cleaning recommendations Do not use abrasive cleaners.

END OF SECTION 10-2600

SECTION 10-2800
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. This Section includes the following:
 - 1. Toilet room accessories.
 - 2. Underlavatory guards.
 - 3. Custodial accessories.
- B. Related Sections include the following:
 - 1. Division 09 Section "Tiling" for ceramic toilet and bath 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, quantities, sizes, and installation locations by room of each accessory required.
 - 1. Identify locations using room designations indicated on Drawings.
 - 2. Identify products using designations indicated on Drawings.
- C. Maintenance Data: For toilet and bath accessories to include in maintenance manuals.

1.4 QUALITY ASSURANCE

- A. Source Limitations: For products listed together in the same articles in Part 2, provide products of same manufacturer unless otherwise approved by Architect.

1.5 COORDINATION

- A. Coordinate accessory locations with other work to prevent interference with clearances required for access by people with disabilities, and for proper installation, adjustment, operation, cleaning, and servicing of accessories.
- B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

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, 0.0312-inch minimum nominal thickness, unless otherwise indicated.
- B. Steel Sheet: ASTM A 1008/A 1008M, Designation CS (cold rolled, commercial steel), 0.0359-inch minimum nominal thickness.
- C. Galvanized Steel Sheet: ASTM A 653/A 653M, with G60 hot-dip zinc coating.
- D. Galvanized Steel Mounting Devices: ASTM A 153/A 153M, 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).
- G. Mirrors: ASTM C 1503, Mirror Glazing Quality, clear-glass mirrors, nominal 6.0 mm thick.

2.2 TOILET ROOM ACCESSORIES: (Reference drawings for toilet accessory schedule and basis of design model numbers and locations)

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. A & J Washroom Accessories, Inc.
 - 2. American Specialties, Inc.
 - 3. Bobrick Washroom Equipment, Inc.
 - 4. Bradley Corporation.

2.3 UNDERLAVATORY GUARDS: (Provide at each exposed lavatory exposed pipe condition.)

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Plumberex Specialty Products, Inc.
 - 2. TCI Products.
 - 3. Truebro, Inc.
- B. Underlavatory Guard: Provide at each exposed lavatory exposed pipe condition.
 - 1. Description: Insulating pipe covering for supply and drain piping assemblies, that prevent direct contact with and burns from piping, and allow service access without removing coverings.
 - 2. Material and Finish: Antimicrobial, molded-plastic, white.

2.4 CUSTODIAL ACCESSORIES (Reference drawings for toilet accessory schedule and basis of design model numbers and locations)

- A. Basis-of-Design Product: The design for accessories is based on products indicated. Subject to compliance with requirements, provide the named product or a comparable product by one of the following:
 - 1. A & J Washroom Accessories, Inc.
 - 2. American Specialties, Inc.
 - 3. Bobrick Washroom Equipment, Inc.
 - 4. Bradley Corporation.

2.5 FABRICATION

- A. General: Fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with full-length, continuous hinges. Equip units for concealed anchorage and with corrosion-resistant backing plates.
- B. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to Owner's representative.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.
- B. Grab Bars: Install to withstand a downward load of at least 250 lbf, when tested according to method in ASTM F 446.

3.2 ADJUSTING AND CLEANING

- A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.
- B. Remove temporary labels and protective coatings.
- C. Clean and polish exposed surfaces according to manufacturer's written recommendations.

END OF SECTION 10-2800

SECTION 10-4413 FIRE EXTINGUISHER 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.
- B. Related Sections:
 - 1. Division 10 Section "Fire Extinguishers."
 - 2. Division 21 Section "Water-Based Fire-Suppression Systems" for hose systems, racks, and valves.
 - 3. Division 26 Sections for low-voltage wiring for fire protection cabinet alarms.

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. Product Schedule: For fire protection cabinets. Coordinate final fire protection cabinet schedule with fire extinguisher schedule to ensure proper fit and function.
- D. Maintenance Data: For fire protection cabinets to include in maintenance manuals.

1.4 COORDINATION

- A. Coordinate size of fire protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.

- B. Coordinate 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.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Stainless-Steel Sheet: ASTM A 666, Type 304.
- B. Clear Float Glass: ASTM C 1036, Type I, Class 1, Quality q3, [3] [6] mm thick.
- C. Tempered Break Glass: ASTM C 1048, Kind FT, Condition A, Type I, Quality q3, 1.5 mm thick.

2.2 FIRE PROTECTION CABINET

- A. Cabinet Type: Suitable for fire extinguisher.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Fire End & Croker Corporation;
 - b. J. L. Industries, Inc., a division of Activar Construction Products Group;
 - c. Larsen's Manufacturing Company;
- B. Cabinet Construction: Nonrated
- C. Cabinet Material: Stainless-steel sheet.
 - 1. Shelf: Same metal and finish as cabinet.
- D. Semirecessed 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 semirecessed cabinet installation.
 - 1. Square-Edge Trim: 1-1/4- to 1-1/2-inch backbend depth.
- E. Cabinet Trim Material: Stainless-steel sheet.
- F. Door Material: Stainless-steel sheet.
- G. Door Style: Fully glazed panel with frame.
- H. Door Glazing: Tempered break glass.
- 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 recessed door pull and friction latch.

2. Provide concealed hinge 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. Door Lock: Cam lock that allows door to be opened during emergency by pulling sharply on door handle. Provide door lock at Fire Extinguisher cabinets located in Security 101, Lobby 102, Exitway 103 and Hall 151 only. All other indicated cabinets do not require a door lock.
3. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location.
 - a. Identify fire extinguisher in fire protection cabinet with the words FIRE EXTINGUISHER.
 - 1) Location: Applied to cabinet glazing.
 - 2) Application Process: Decals.
 - 3) Lettering Color: Red.
 - 4) Orientation: Vertical.

K. Finishes:

1. Stainless Steel: No. 4.

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 of one-piece construction with edges flanged.
 2. Miter and weld perimeter door frames.
- C. Cabinet Trim: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

2.4 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces of fire protection cabinets from damage by applying a strippable, temporary protective covering before shipping.

- C. Finish fire protection cabinets after assembly.
- D. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.5 STAINLESS-STEEL FINISHES

- A. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
- B. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.
 - 1. Run grain of directional finishes with long dimension of each piece.
 - 2. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.
 - 3. Directional Satin Finish: No. 4.

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 semirecessed cabinets will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prepare recesses for semirecessed fire protection cabinets as required by type and size of cabinet and trim style.

3.3 INSTALLATION

- A. General: Install fire protection cabinets in locations and at mounting heights indicated or, if not indicated, at heights acceptable to authorities having jurisdiction.
- B. Fire Protection Cabinets: Fasten cabinets to structure, square and plumb.
 - 1. Provide inside latch and lock for break-glass panels.
 - 2. Fasten mounting brackets to inside surface of fire protection cabinets, square and plumb.

3.4 ADJUSTING AND CLEANING

- A. Remove temporary protective coverings and strippable films, if any, as fire protection cabinets are installed unless otherwise indicated in manufacturer's written installation instructions.

- B. Adjust fire protection cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.
- C. On completion of fire protection cabinet installation, clean interior and exterior surfaces as recommended by manufacturer.
- D. Touch up marred finishes, or replace fire protection cabinets that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by fire protection cabinet and mounting bracket manufacturers.
- E. Replace fire protection cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 10-4413

SECTION 10-4416 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.
- B. Related Sections:
 - 1. Division 10 Section "Fire Extinguisher Cabinets."
 - 2. Division 21 Section "Water-Based Fire-Suppression Systems" for hose systems, racks, and valves.

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.
- B. Operation and Maintenance Data: For fire extinguishers to include in maintenance manuals.
- C. 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:
 - a. Failure of hydrostatic test according to NFPA 10.
 - b. Faulty operation of valves or release levers.
 - 2. Warranty Period: Six years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS

- A. Fire Extinguishers: Type, size, and capacity for each fire protection cabinet indicated.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Fire End & Croker Corporation.
 - b. J. L. Industries, Inc.; a division of Activar Construction Products Group.
 - c. Kidde Residential and Commercial Division; Subsidiary of Kidde plc.
 - d. Larsen's Manufacturing Company.
 - 2. Valves: Manufacturer's standard.
 - 3. Handles and Levers: Manufacturer's standard.
 - 4. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B.
- B. Multipurpose Dry-Chemical Type in Steel Container: UL-rated 4-A:60-B:C, 10-lb nominal capacity, with monoammonium phosphate-based dry chemical in enameled-steel container.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine fire extinguishers for proper charging and tagging.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Install fire extinguishers in cabinets and locations indicated and in compliance with requirements of authorities having jurisdiction.

END OF SECTION 10-4416

**SECTION 13-3419
METAL BUILDING SYSTEMS**

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Metal Building System:
 - 1. Structural steel framing system.
 - 2. Metal roof system.
 - 3. Metal wall system.
 - 4. Roof and wall insulation systems.

1.2 RELATED REQUIREMENTS

- A. Section 08-1113 Hollow Metal Doors and Frames
- B. Section 08-3613 Sectional Doors
- C. Section 08-7100 Door Hardware

1.3 REFERENCE STANDARDS

- A. American Institute of Steel Construction (AISC):
 - 1. AISC - Specification for Structural Steel Buildings.
 - 2. AISC – Seismic Provisions for Structural Steel Buildings (when appropriate).
 - 3. AISC Design Guide 3 – Serviceability for Steel Buildings
- B. American Iron and Steel Institute (AISI):
 - 1. AISI S100 - North American Specification for the Design of Cold-Formed Steel Structural Members
- C. American Welding Society (AWS):
 - 1. AWS D1.1 / D1.1M – Structural Welding Code – Steel.
 - 2. AWS D1.3 / D1.3M – Structural Welding Code – Sheet Steel.
- D. Association for Iron and Steel Technology (AISE):
 - 1. AISE 13 – Specifications for Design and Construction of Mill Buildings.
- E. ASTM International (ASTM):
 - 1. ASTM A 325 – Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.
 - 2. ASTM A 653 / A 653M – Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - 3. ASTM A 792 / A 792M – Standard Specification for Steel Sheet, 55 % Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.
 - 4. ASTM B 117 – Standard Practice for Operating Salt Spray (Fog) Apparatus.

5. ASTM C 518 – Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
 6. ASTM C 1363 – Standard Test Method for Thermal Performance of Building Materials and Envelope Assemblies by Means of a Hot Box Apparatus.
 7. ASTM D 522 – Standard Test Methods for Mandrel Bend Test of Attached Organic Coatings.
 8. ASTM D 523 – Standard Test Method for Specular Gloss.
 9. ASTM D 968 – Standard Test Methods for Abrasion Resistance of Organic Coatings by Falling Abrasive.
 10. ASTM D 1308 – Standard Test Method for Effect of Household Chemicals on Clear and Pigmented Organic Finishes.
 11. ASTM D 2244 – Standard Practice for Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates.
 12. ASTM D 2247 – Standard Practice for Testing Water Resistance of Coatings in 100% Relative Humidity.
 13. ASTM D 2794 – Standard Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact).
 14. ASTM D 3361 – Standard Practice for Unfiltered Open-Flame Carbon-Arc Exposures of Paint and Related Coatings.
 15. ASTM D 4214 – Standard Test Methods for Evaluating the Degree of Chalking of Exterior Paint Films.
 16. ASTM E 84 – Standard Test Method for Surface Burning Characteristics of Building Materials.
 17. ASTM E 96 / E 96M – Standard Test Methods for Water Vapor Transmission of Materials.
 18. ASTM E 1592 – Standard Test Method for Structural Performance of Sheet Metal Roof and Siding Systems by Uniform Static Air Pressure Difference.
 19. ASTM G 87 – Standard Practice for Conducting Moist SO₂ Tests.
- F. FM Global:
1. FMRC Standard 4471 – Approval Standard for Class 1 Roofs for Hail Damage Resistance, Combustibility, and Wind Uplift Resistance.
- G. Metal Building Manufacturers Association (MBMA):
1. MBMA Metal Building Systems Manual.
 2. Seismic Design Guide for Metal Building Systems.
- H. North American Insulation Manufacturers Association (NAIMA):
1. NAIMA 202 – Standard For Flexible Fiber Glass Insulation to be Laminated for Use in Metal Buildings.
- I. The Society of Protective Coatings (SSPC):
1. SSPC-Paint 15 - Primer for Use Over Hand Cleaned Steel performs to SSPC-Paint 15 standards.
 2. SSPC-SP2 – Hand Tool Cleaning.
- J. Underwriters Laboratories (UL):
1. UL 580 – Standard for Tests for Uplift Resistance of Roof Assemblies.
 2. UL 723 – Standard for Test for Surface Burning Characteristics of Building Materials.
- K. US Army Corps of Engineers (COE):

1. COE Unified Facilities Guide Specification Section 07 61 13.

1.4 PRE-INSTALLATION MEETINGS

- A. Convene preinstallation meeting 2 weeks before start of installation of metal building system.
- B. Require attendance of parties directly affecting work of this section, including Contractor, Architect, Engineer, installer, and metal building system manufacturer's representative.
- C. Review materials, installation, protection, and coordination with other work.

1.5 SUBMITTALS

- A. Comply with Section 01 – Submittal Procedures.
- B. Product Data: Submit metal building system manufacturer's product information, specifications, and installation instructions for building components and accessories.
- C. Erection Drawings: Submit metal building system manufacturer's erection drawings, including plans, elevations, sections, and details, indicating roof framing, transverse cross-sections, covering and trim details, and accessory installation details to clearly indicate proper assembly of building components.
- D. Certification: Submit written "Certificate of design and manufacturing conformance" prepared and signed by a Professional Engineer, registered to practice in the State of New Mexico verifying that the metal building system design and metal roof system design (including panels, clips, and support system components) meet indicated loading requirements and codes of authorities having jurisdiction.
 1. Certification shall reference specific dead loads, live loads, snow loads, wind loads/speeds, tributary area load reductions (if applicable), concentrated loads, collateral loads, seismic loads, end-use categories, governing code bodies, including year, and load applications.
 2. Submit certification 1 week before bid date on the metal building system manufacturer's letterhead.
- E. Submit certification verifying that the metal roof system has been tested and approved by Underwriter's Laboratory as Class 90.
- F. Submit certification verifying that the metal roof system has been tested and approved by Factory Mutual as Class described in structural drawings.
- G. Submit certification verifying that the metal standing seam roof system has been tested in accordance with ASTM E 1592 test protocols.
- H. Dealer Certification: Submit certification that the metal building system supplier or metal roof system supplier is a manufacturer's authorized and franchised dealer of the system to be furnished.
 1. Certification shall state date on which authorization was granted.

- I. Installer Certification: Submit certification that the metal building system or roof system installer has been regularly engaged in the installation of building systems of the same or equal construction to the system specified.
- J. Warranty Documentation: Submit manufacturer's standard warranty.

1.6 QUALITY ASSURANCE

A. Manufacturer's Qualifications:

- 1. Manufacturer regularly engaged, for past 10 years, in manufacture of metal building systems of similar type to that specified.
- 2. Accredited based on IAS Accreditation Criteria AC472 and requirements in International Building Code (IBC).

B. Installer's Qualifications:

- 1. Installer regularly engaged, for past 5 years, in installation of metal building systems of similar type to that specified.
- 2. Employ persons trained for installation of metal building systems.

C. Certificate of design and manufacturing conformance:

- 1. Metal building system manufacturer shall submit written certification prepared and signed by a Professional Engineer, registered to practice in the State of New Mexico verifying that building system design and metal roof system design (including panels, clips, and support system components) meet indicated loading requirements and codes of authorities having jurisdiction.
- 2. Certification shall reference specific dead loads, live loads, snow loads, wind loads/speeds, tributary area load reductions (if applicable), concentrated loads, collateral loads, seismic loads, end-use categories, governing code bodies, including year, and load applications.
- 3. Certificate shall be on metal building system manufacturer's letterhead.
- 4. Refer to Submittals article of this specification section.

D. Material Testing:

- 1. In addition to material certifications of structural steel, metal building system manufacturer shall provide, upon request at time of order, evidence of compliance with specifications through testing.
- 2. This quality assurance testing shall include testing of structural bolts, nuts, screw fasteners, mastics, and metal coatings (primers, metallic coated products, and painted coil products).

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver and Acceptance Requirements: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.

B. Storage and Handling Requirements:

- 1. Store and handle materials in accordance with manufacturer's instructions.

2. Keep materials in manufacturer's original, unopened containers and packaging until installation.
3. Do not store materials directly on ground.
4. Store materials on flat, level surface, raised above ground, with adequate support to prevent sagging.
5. Protect materials and finish during storage, handling, and installation to prevent damage.

1.8 WARRANTY

- A. Metal building system manufacturer shall provide a written weathertightness warranty for a maximum of 25 years against leaks in standing seam roof panels, arising out of or caused by ordinary wear and tear under normal weather and atmospheric conditions.
 1. Warranty shall be signed by both the metal roof system manufacturer and the metal roof system installer.
 2. Maximum liability of warranty shall be no less than \$0.70 per square foot of roof area.
- B. Metal building system manufacturer shall provide a written warranty for 25 years against perforation of metal roof panels due to corrosion under normal weather and atmospheric conditions.
 1. Warranty shall be signed by metal roof system manufacturer.
- C. Metal building system manufacturer shall provide a paint film written warranty for 25 years against cracking, peeling, chalking, and fading of exterior coating on painted roof and wall panels.
 1. Warranty shall be signed by metal building system or roof system manufacturer and state that the coating contains 70 percent "Kynar 500" or "Hylar 5000" resin.
 2. Metal building system manufacturer shall warrant that the coating shall not peel, crack, or chip for 25 years.
 3. For a period of 25 years, chalking shall not exceed ASTM D 4214, #8 rating and shall not fade more than 5 color difference units in accordance with ASTM D 2244.
- D. Metal Building System Manufacturer's Certification: Metal building system manufacturer shall submit a signed written Certification 1 week before bid date, stating that the metal roof system manufacturer or approved representative will provide warranties and Inspection and Report Service specified in this specification section.
 1. Warranty terms shall be submitted with bid.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide **Butler Manufacturing, P.O. Box 419917, Kansas City, Missouri 64141. Phone: 816-968-3000. Website: www.butlermfg.com** or comparable product:

2.2 METAL BUILDING DESCRIPTION

A. Building Dimensions: Indicated on Drawings.

1. Horizontal Dimensions: Measure to inside face of wall sheets.
2. Eave Height: Measure from top of finished floor to intersection of insides of roof and sidewall sheets.
3. Clear Height Between Finished Floor and Bottom of Roof Beams: Indicated on the Drawings.

B. Primary Structural Members:

1. Primary Framing System: Butler Manufacturing framing system as specified in this specification section.
2. Frames Welded-up plate section columns and roof beams, complete with necessary splice plates for bolted field assembly as specified in this specification section.
3. Bolts for Field Assembly of Primary Steel: High-strength bolts as indicated on erection drawings of metal building system manufacturer.
4. Beam and Post Endwall Frames: Endwall corner posts, endwall roof beams, and endwall posts as required by design criteria.
5. Exterior Columns: Welded-up "H" sections or cold-formed "C" sections.
6. Interior Columns: "H" sections or tube columns.
7. Connection of Primary Structural Members: ASTM A 325 bolts through factory-punched holes.
8. Primary Structural Members: Paint with metal building system manufacturer's standard primer with surface preparation as specified in this specification section.

C. Secondary Structural Members:

1. Secondary Framing System: Butler Manufacturing framing system as specified in this specification section.
2. C/Z Purlins and Girts: Acrylic-coated G30 galvanized finish.
3. Truss Purlins: Acrylic-coated G30 galvanized finish.

D. Metal Roof System: Butler Manufacturing metal roof system as specified in this specification section.

E. Metal Wall System: Butler Manufacturing metal wall system as specified in this specification section.

F. Where metal panels are required to be painted, use coating system as specified in this specification section.

2.3 DESIGN REQUIREMENTS

A. Governing Design Code:

1. Structural design for the building structural system shall be provided by the metal building system manufacturer for the following design criteria as shown in structural drawings.
2. Insulation requirements for the building system shall be provided by for the following energy code or energy standard criteria:
 - a. Governing Energy Code (IECC)
 - b. Climatic Zone: See structural drawings

B. Roof Live Load:

1. Roof live loads are loads produced during the life of the structure by moveable objects.
2. Wind, snow, seismic, or dead loads are not live loads.
3. Roof live loads are applied based on the Tributary Area as stated in code.

C. Roof Snow Load:

1. Roof snow load used for designing the structure shall not be reduced and shall be as described in the structural drawings.
2. Design snow load shall include the effects of minimum flat roof load limits, rain on snow, drifting snow, and unbalanced snow load as defined in the governing building code specified above.

D. Wind Load:

1. Wind Load used for designing the structure shall be as shown in structural drawings.
2. Wind Pressure Coefficients and the design pressures shall be applied in accordance with the governing code.

E. Seismic Load:

1. Seismic load used for designing the structure shall be as shown in structural drawings.
2. Seismic loads shall be applied in accordance with the governing code.

F. Dead Load: Dead load shall consist of the weight of building system construction, such as roof, framing, and covering members.

G. Collateral Load:

1. Collateral load in pounds per square foot shall be applied to the entire structure to account for the weight of additional permanent materials other than the building system, such as sprinklers, mechanical systems, electrical systems, hung partitions, and ceilings.
2. This allowance does not include the weight of hung equipment weighing 50 pounds or more.
3. Equipment loads of 50 pounds or more shall be indicated on the Drawings and the structure shall be strengthened as required.
4. Architect will provide the metal building system manufacturer with the magnitude and approximate location of concentrated loads greater than 50 pounds before design of the building starts.

H. Load Combinations: Load combinations used to design primary and secondary structural members shall be in accordance with the governing code.

2.4 DEFLECTIONS

A. Structural Members

1. Maximum deflection of main framing members shall not exceed criteria shown in structural drawings.

- B. Lateral deflections, or drift, at the roof level of the structure in relation to the floor or slab on grade, caused by deflection of horizontal force resisting elements, shall not exceed criteria shown in structural drawings.
- C. Calculations
 - 1. Reductions based on engineering judgment using the assumed composite stiffness of the building envelope shall not be allowed.
 - 2. Drift shall be in accordance with AISC Serviceability Design Considerations for Low-Rise Buildings.
 - 3. Use of composite stiffness for deflection calculations is permitted only when actual calculations for the stiffness are included with the design for the specific project.
 - 4. When maximum deflections are specified, calculations shall be included in the design data.

2.5 STRUCTURAL STEEL FRAMING SYSTEM

- A. General
 - 1. Design of Structural System: Clear or multi-span rigid frame with tapered or straight columns and roof beams, with gable or single-slope roof.
 - 2. Actual Building Length:
 - a. Structural line to structural line.
 - b. Same as nominal; i.e., number of bays times length of bays.
 - c. Structural Line: Defined as inside face of wall sheets.
 - 3. Actual Building Width:
 - a. Structural line to structural line
 - b. Nominal building width
 - 4. Minimum Roof Slope: 4 inch in 12 inches.
 - 5. Maximum Roof Slope: 4 inch in 12 inches.
 - 6. Components and Parts of Structural System:
 - a. Indicated on Drawings or the Specifications
 - b. Clearly marked.
 - c. Erection Drawings: Supply for identification and assembly of parts.
 - d. Drawings: Carry stamp of a registered professional engineer.
 - 7. Foundations
 - a. Foundations
 - b. Reactions
 - c. Anchor Bolts:
- B. Structural Steel Design
 - 1. Structural Mill Sections or Welded-up Plate Sections: Design in accordance with AISC Specification for Structural Steel Buildings.
 - 2. Cold-Formed Steel Structural Members: Design in accordance with AISI North American Specification for the Design of Cold-Formed Steel Structural Members.
 - 3. Structural System: Design in accordance with specified building code (Refer to Design Loads and Building Codes).

C. Primary Framing

1. Rigid Frames:
 - a. Frames: Welded-up plate section columns and roof beams, complete with necessary splice plates for bolted field assembly.
 - 1) Base Plates, Cap Plates, Compression Splice Plates, and Stiffener Plates: Factory welded into place and connection holes factory fabricated.
 - 2) Columns and Roof Beams: Fabricated complete with holes in webs and flanges for attachment of secondary structural members and bracing, except for fieldwork as noted on erection drawings furnished by metal building system manufacturer.
 - b. Bolts for Field Assembly of Frame Members: ASTM A 325 high-strength bolts as indicated on erection drawings furnished by metal building system manufacturer.
2. Endwall Structural Members: Cold-formed channel members designed in accordance with AISI North American Specification for the Design of Cold-Formed Steel Structural Members or welded-up plate sections designed in accordance with AISC Specification for Structural Steel Buildings.
 - a. Endwall Frames: Endwall corner posts, endwall roof beams, and endwall posts as required by design criteria.
 - 1) Splice Plates and Base Clips: Shop fabricated complete with bolt connection holes.
 - 2) Base Plates, Cap Plates, Compression Splice Plates, and Stiffener Plates: Factory welded into place and connection holes shop fabricated.
 - 3) Beams and Posts: Factory fabricated complete with holes for attachment of secondary structural members, except for field work as noted on erection drawings furnished by metal building system manufacturer.
 - b. Intermediate Frames: Substituted for end-wall roof beams, when specified.
 - 1) Factory fabricate necessary endwall posts and holes for connection to intermediate frame used in endwall.

D. Secondary Structural Members:

1. Purlins:
 - a. Purlins:
 - 1) "Z" -shaped, precision-roll-formed, acrylic-coated G30 galvanized steel in different gauges to meet specified loading conditions.
 - 2) 7-inch, 8-1/2-inch, 10-inch, or 11-1/2-inch-deep "Z" sections.
 - b. Outer Flange of Purlins: Factory-punched holes for panel connections.
 - c. Attach purlins to main frames and endwalls with 1/2-inch-diameter bolts.
 - d. Brace purlins at intervals indicated on erection drawings furnished by metal building system manufacturer.
 - e. Concentrated Loads: Hung at purlin panel points.
2. Eave Members:
 - a. Eave struts: Factory punched 7-inch, 8-1/2-inch, 10-inch, or 11-1/2-inch-deep "C" sections, precision-roll-formed, acrylic-coated G30 galvanized steel in different gauges to meet specified loading conditions.
3. Girts:
 - a. "Z" or "C"-shaped, precision-roll-formed, acrylic-coated G30 galvanized steel in different gauges to meet specified loading conditions.
 - b. 7-inch, 8-1/2-inch, 10-inch, or 11-1/2-inch-deep "Z" or "C" sections.
 - c. Outer Flange of Girts: Factory-punched holes for panel connections.
4. Bracing:

- a. Locate bracing as indicated on the Drawings.
- b. Diagonal Bracing:
 - 1) Hot-rolled rods of sizes indicated on the Drawings.
 - 2) Attach to columns and roof beams as indicated on the Drawings.
- c. Optional fixed-base wind posts or pinned-base portal frames may be substituted for wall rod bracing on buildings as required.
- d. Flange Braces and Purlin Braces: Cold formed and installed as indicated on the Drawings.

E. Welding

- 1. Welding Procedures, Operator Qualifications, and Welding Quality Standards: AWS D1.1 - Structural Welding Code – Steel and AWS D1.3 - Structural Welding Code – Sheet Steel.
- 2. Welding inspection, other than visual inspection as defined by AWS D1.1, paragraph 6.9, shall be identified and negotiated before bidding.
- 3. Certification of Welder Qualification: Supply when requested.

F. Painting of Steel Framing System

- 1. General:
 - a. Structural Steel: Prime paint as temporary protection against ordinary atmospheric conditions.
 - b. Perform subsequent finish painting, if required, in field as specified in the painting section.
 - c. Before painting, clean steel of loose rust, loose mill scale, dirt, and other foreign materials.
 - d. Steel Fabricator: Not required to sand blast, flame clean, or pickle steel before painting, unless otherwise specified.
- 2. Primary Frames:
 - a. Clean steel in accordance with SSPC-SP2.
 - b. Factory cover steel with 1 coat of gray water-reducible alkyd primer paint formulated to equal or exceed performance requirements SSPC-Paint 15.
 - c. Minimum Coating Thickness: 1.0 mil.
- 3. Secondary Structural Members – Roll-Formed:
 - a. Hot-dipped zinc coating, ASTM A 653, G30; followed by 1 coat of clear acrylic finish.
 - b. Acrylic-Coated G30 Galvanized Steel: Equal or exceed performance requirements of SSPC Paint-15.
- 4. Truss Purlins:
 - a. Hot-dipped zinc coating, ASTM A 653, G30; followed by 1 coat of clear acrylic finish
 - b. Acrylic-Coated G30 Galvanized Steel: Equal or exceed performance requirements of SSPC Paint-15

2.6 METAL ROOF SYSTEM

- A. Metal Roof System: Butler Manufacturing “CMR-24®” roof system.
- B. Roof System Design:

1. Design roof panels and liner panels in accordance with AISI North American Specification for the Design of Cold-Formed Steel Structural Members.
2. Design roof paneling system to support design live, snow, and wind loads.
3. Endwall Trim and Roof Transition Flashings: Allow roof panels to move relative to wall panels and/or parapets as roof expands and contracts with temperature changes.

C. Roof System Performance Testing:

1. UL Wind Uplift Classification Rating, UL 580: Class 90.
2. Structural Performance Under Uniform Static Air Pressure Difference: Test roof system in accordance with ASTM E 1592.
3. Roof system has been tested in accordance with U.S. Army Corps of Engineers Unified Facilities Guide Specification Section 07 61 13.
4. FM Global (Factory Mutual):
 - a. Roof system has been tested in accordance with FMRC Standard 4471 and approved as a Class 1 Panel Roof.
 - b. Metal Building System Manufacturer: Provide specific assemblies to meet required wind rating in accordance with FM Global.
 - c. Installation modifications or substitutions can invalidate FM Global approval.

D. Roof Panels:

1. Factory roll-formed, 24 inches wide, with 2 major corrugations, 2 inches high (2-3/4 inches including seam), 24 inches on center.
2. Flat of the Panel: Cross flutes 6 inches on center, perpendicular to major corrugations in entire length of panel to reduce wind noise.
3. Variable Width Panels:
 - a. For roof lengths not evenly divisible by the 2'-0" panel width, factory-manufactured variable-width (9-inch, 12-inch, 15-inch, 18-inch, and 21-inch-wide) panels shall be used to ensure modular, weathertight roof installation.
 - b. Minimum Length: 15 feet.
 - c. Supply maximum possible panel lengths.
4. Panel Material and Finish:
 - a. 24-gauge steel coated both sides with layer of Galvalume aluminum-zinc alloy (approximately 55 percent aluminum, 45 percent zinc) applied by continuous hot-dip method.
 - b. Minimum 0.55-ounce coated weight per square foot as determined by triple-spot test, ASTM A 792.
5. Use panels of maximum possible lengths to minimize end laps.
6. Extend eave panels beyond structural line of sidewalls.
7. Factory punch panels at panel end to match factory-punched holes in eave structural member.
8. Panel End Splices: Factory punched and factory notched.
9. Panel End Laps: Locate directly over, but not fastened to, a supporting secondary roof structural member and be staggered, to avoid 4-panel lap-splice condition.

10. End Laps: Floating. Allows roof panels to expand and contract with roof panel temperature changes.
 11. Self-Drilling Fasteners: Not permitted in weathering membrane of roof system.
 12. Ridge Assembly:
 - a. Design ridge assembly to allow roof panels to move lengthwise with expansion and contraction as roof panel temperature changes.
 - b. Factory punch parts for correct field assembly
 - c. Install panel closures and interior reinforcing straps to seal panel ends at ridge
 - d. Do not expose attachment fasteners on weather side.
 - e. Use lock seam plug to seal lock seam portion of panel.
 - f. High-Tensile Steel Ridge Cover: Span from panel closure to panel closure and flex as roof system expands and contracts.
- E. Insulation Board:
1. Rigid "Thermax" Metal Building Board glass-fiber-reinforced, polyisocyanurate foam plastic core.
 2. Width: 4 feet
 3. Maintain Class A fire rating.
 4. Approved for use without thermal barrier.
 5. Maximum Thickness: To achieve minimum 2021 International Energy Code (IEC) requirements of R-19+R-11LS.
 6. Covered with embossed aluminum facing - Metal Building Board.
- F. Vapor Retarder:
1. PSK Light Duty (WMP-VR) 0.0015-inch minimum thickness, UV-stabilized, white polypropylene, laminated to 11-pound Kraft paper / metalized polyester and reinforced with glass fiber and polyester scrim.
 2. Perm Rating: 0.09.
- G. Interior Liner Panels:
1. Form panels from 0.0149 - inch minimum total coated thickness coated steel with minimum yield strength of 80,000 psi.
 2. Unpainted Liner Panels: Galvalume aluminum-zinc alloy coated steel, AZ55 in accordance with ASTM A 792.
 3. Factory cut panels to lengths required.
- H. Provisions for Expansion and Contraction:
1. Provision for Thermal Expansion Movement of Roof Panels: Clips with movable tab.
 - a. Stainless Steel Tabs: Factory centered on roof clip to ensure full movement in either direction.
 - b. Maximum Force of 8 Pounds: Required to initiate tab movement.
 - c. Each Clip: Accommodates a minimum of 1.25-inch movement in either direction.
 2. Roof: Provide for thermal expansion and contraction without detrimental effects on roof panels, with plus or minus 100-degree F temperature difference between interior structural framework of building and of roof panels.

I. Fasteners:

1. Make connections of roof panels to structural members, except at eaves, with clips with movable stainless steel tabs, seamed into standing seam side lap.
2. Fasten insulation board, bearing plates, and panel clips to structural members with "Scrubolt™" fasteners in accordance with erection drawings furnished by metal building system manufacturer, using factory-punched or field-drilled holes in structural members.
 - a. Fasteners: Metal-backed rubber washer to serve as torque indicator.
3. Fasteners: penetrating metal membrane at the following locations do not exceed the frequency listed:
 - a. Basic Panel System: 0 per square foot.
 - b. High Eave Trim, No Parapet: 2 per linear foot
 - c. Exterior Eave Gutter: 2 per linear foot
 - d. Panel Splices: 2 per linear foot.
 - e. Gable: 0 per linear foot.
 - f. High Eave with Parapet: 0 per linear foot.
 - g. Ridge: 0 per linear foot.
 - h. Low Eave Structural: 1.5 per linear foot.

J. Accessories:

1. Accessories (i.e., ventilators, skylights, gutters, fascia): Standard with metal building system manufacturer, unless otherwise noted and furnished as specified.
2. Metal Coating on Gutters, Downspouts, Gable Trim, and Eave Trim: "Butler-Cote™" finish system, full-strength, 70 percent "Kynar 500" or "Hylar 5000" fluoropolymer (PVDF) coating.
3. Location of Standard Accessories: Indicated on erection drawings furnished by metal building system manufacturer.
4. Material used in flashing and transition parts and furnished as standard by metal building system manufacturer may or may not match roof panel material.
 - a. Parts: Compatible and not cause corrosive condition.
 - b. Copper and Lead Materials: Do not use with Galvalume or optional aluminum-coated panels.

K. Thermal Performance:

1. Determine thermal performance in accordance with ASTM C 1363 and test U-factors for composite roof section.
2. "Thermax" Insulation Thicknesses: Maximum 4 inches.

L. Physical Properties:

1. WMP-VR Vapor Retarder:
 - a. Water Vapor Permeance (perm) Rating, ASTM E 96: 0.09.
 - b. Minimum Workability Temperature: 40 degrees F.
2. Vapor Retarder UL Fire Hazard Classification Ratings, UL 723:
 - a. WMP-VR Vapor Retarder:
 - 1) Flame Spread: 10.
 - 2) Smoke Development: 10.
3. Insulation Board Facing:

- a. Water Vapor Permeance (perm) Rating, ASTM E 96: 0.03.
- 4. "Thermax" Metal Building Board Insulation:
 - a. Class I Factory Mutual Approval and UL Fire Hazard Classification Ratings, UL 723:
 - 1) Flame Spread: 25 or less.

2.7 METAL WALL SYSTEM

- A. Exterior Metal Wall System: Butler Manufacturing™ "Butler Thermawall™ Fluted" wall system.
- B. Wall System Design: Design wall panels in accordance with AISI North American Specification for the Design of Cold-Formed Steel Structural Members.
- C. Wall Panels:
 - 1. Steel-faced, shop-assembled, factory-foamed, insulated panel units.
 - 2. Double tongue-and-groove, side-joint design, with fasteners concealed within side joint.
 - 3. Nominal: 2 inches or Manufacturers required thickness to meet minimum continuous insulation requirement of R-14ci per 2021 International Energy Code (IEC).
 - 4. One piece from base to top of wall.
 - 5. Maximum: 40 feet.
 - 6. Exterior Face:
 - a. Nominal Width: 42 inches.
 - b. Architectural Corrugations: 3/8 inch deep on nominal 8-1/2-inch centers.
 - c. Finish: Non-directional embossed finish.
 - 7. Interior Roll-formed from pre-painted steel with 1/16-inch-deep corrugations on 6-inch centers.
- D. Panel Material and Finish:
 - 1. Corrugated Exterior-Faced Panels: 26-gauge, AZ50 aluminum-zinc coated steel.
 - 2. Interior Face: 26-gauge, AZ50 aluminum-zinc coated steel.
 - 3. Core: Poured-in-place polyurethane foam with a minimum 93 percent closed-cell structure.
 - 4. Exterior Panel Finish: Pre-finished with "Butler-Cote™" finish system, full-strength, 70 percent "Kynar 500" or "Hylar 5000" fluoropolymer (PVDF) coating in metal building system manufacturer's standard colors.
 - 5. PVDF Coating Warranty: Metal building system manufacturer shall warrant coating for 25 years for the following:
 - a. Not to peel, crack, or chip.
 - b. Chalking: Not to exceed ASTM D 4214, #8 rating.
 - c. Fading: Not more than 5 color-difference units, ASTM D 2244.
 - 6. Interior Panel Finish: Paint with USDA-approved interior white polyester paint.

E. Panel

1. R-Value: Based on actual test results from ASTM C 518 of panel core material.
 - a. 2-Inch-Thick Panels: 14.16 or Manufacturers required thickness to meet 2021 International Energy Code (IEC) minimum R value of R-13 + R-14ci.
2. Insulated Carry the following listings:
 - a. Factory Mutual Class 1 Rating for wall and ceiling construction FM 4880.
 - b. Guide NYWR, Insulated Wall Construction Subject 1040.
 - c. Surface Burning Characteristics: Panel core (6-inch unfaced) tested in accordance with ASTM E 84.
 - 1) Flame Spread: 35
 - 2) Smoke Developed: 450
 - d. 2-Hour Fire-Resistance Ratings: Achieve by incorporating 4 layers of 5/8-inch Type X gypsum wallboard on interior side of insulated panels.
 - 1) Rated Wall Assembly: UL listing U652

F. Fasteners:

1. Base, Top, and Girt Connections and Panel Joint Clip Attachments: #14 self-drilling screws.
 - a. Install additional "Lockrivet" fasteners, if necessary due to wind load.
2. Panel-to-Panel Fasteners: Not required.
 - a. Connections: Hidden, eliminating exposed fasteners.

G. Accessories:

1. Accessories (i.e., doors, windows): Design to fit wall panel system or framed openings and furnish as standard by metal building system manufacturer, unless otherwise noted.
2. Location of Standard Accessories: Indicated on erection drawings furnished by metal building system manufacturer.

2.8 INSULATION

- A. Laminated Fiberglass: Owens-Corning Fiberglas, NAIMA 202, "Certified R" metal building insulation.
 1. TIMA Insignia and Insulation Thickness: Ink-jet printed on fiberglass.
- B. Back-Fill Insulation: Owens-Corning Fiberglas unfaced "Pink Metal Building Insulation Plus".
- C. Roof Insulation:
 1. Certified R-Value: R-19 + R-11LS.
- D. Wall Insulation:
 1. Certified R-Value: R-13 + R14ci.
 - a. Facing Perm Rating: 0.02.
- E. Roof and Wall Insulation Facing: PSK Light Duty (WMP-VR).
 1. 0.0015-inch-thick, UV-stabilized, white polypropylene laminated to 11-pound Kraft paper, reinforced with glass-fiber scrim, in white.

2. Adhere facing to Owens-Corning Fiberglas "Certified R", NAIMA 202, fiberglass blanket.
3. Assembly of Insulation Blanket and Facing:
 - a. Flame Spread Rating: Less than 25.
 - b. UL Label: Submit as specified in Submittals article of this section.
 - c. Perm Rating: 0.09.
 - d. Perm Rating: 0.02.

2.9 INSULATION SUPPORT SYSTEM

- A. Insulation Support System: Butler Manufacturing™ "Sky-Web®" insulation support system.
- B. Description:
 1. 1,000 denier polyester yarn interwoven on nominal 1/2-inch-square grid coated with fire-retardant, UV-stabilized, PVC-based binder.
 2. Polypropylene tape bindings on all 4 edges.
 - a. Two Edges that Attach to Building Eave Members: Reinforce with 1/4-inch-diameter polypropylene rope.
 3. Furnish in building bay lengths by building widths.
 - a. Cover 1 bay of building length.
 - b. Extend eave-to-eave across building.
- C. Physical Properties:
 1. Tensile Strength (pounds/yarn):
 - a. Machine Direction: 15 pounds.
 - b. Cross Direction: 15 pounds.
 2. Ends per Inch:
 - a. Machine Direction: 2.5.
 - b. Cross Direction: 2.0.
 3. Weight: 0.28 to 0.32 ounces per sq ft.
- D. Fasteners and Attachment Hardware:
 1. Connections to Eave Members: Steel strapping and self-drilling screws.
 2. Mesh- to-Insulation Support System Edge Connections: Plastic cable ties.
- E. Fire-Hazard Classification:
 1. UL Fire-Hazard Classification Ratings, UL 723:
 - a. Flame Spread: 15.
 - b. Smoke Developed: 400.

2.10 ROOF INSULATION SYSTEM

- A. Roof Insulation System: Butler Manufacturing™ "TBS™" roof insulation system.

B. System Components:

1. Metal Roof System: Butler Manufacturing™ “CMR-24®” metal roof system.
2. Roof Panel Supports:
 - a. Pre-assembled 5-inch high ‘insulation bridge’ members, with
 - 1) 4- foot long by 2-1/2” wide bridge channel to support flat of roof panels.
 - 2) 5- inch high zee clips fastened to bridge channel at 1’o.c.
 - a) Factory punched ‘tubulated holes’ provide for roof clip attachment.
 - b) Provide space for various thicknesses of insulation.
 - 3) Attach insulation bridges to roof purlins with scrubolt™ fasteners.
3. Insulation:
 - a. Faced Bottom Layer of Blanket Insulation
 - 1) Insulation facing.

C. Roof and Wall Insulation Facing: PSK Light Duty (WMP-VR).

1. 0.0015-inch-thick, UV-stabilized, white polypropylene laminated to 11-pound Kraft paper, reinforced with glass-fiber scrim, in white.
2. Adhere facing to Owens-Corning Fiberglas “Certified R”, NAIMA 202, fiberglass blanket.
3. Assembly of Insulation Blanket and Facing:
 - a. Flame Spread Rating: Less than 25.
 - b. UL Label: Submit as specified in Submittals article of this section.
 - c. Perm Rating: 0.09.

D. Fasteners:

1. Roof Supports (Insulation Bridges): Install with scrubolt™ fasteners for attachment.
2. Roof Attachment Fasteners: As specified under Roof System in this specification section.

E. Provisions for Expansion and Contraction:

1. Provisions for Thermal Expansion and Contraction Movement: Accomplish in roof system.
2. As specified under Roof System in this specification section.

F. Performance Testing: As specified under Roof System in this specification section.**2.11 METAL COATING SYSTEM****A. Metal Coating System: Butler Manufacturing™ “Butler-Cote™” finish system a factory-applied, exterior metal coating system.****B. Substrate Preparation:**

1. G90 Hot-Dipped Galvanized Steel or AZ50 Galvalume: Factory-controlled chemical-conversion treatment.

C. Coating:

1. Material: Full-strength, 70 percent, “Kynar 500” or “Hylar 5000” fluoropolymer (PVDF) color coating.
2. After steel preparation, coat exterior exposed surface with primer and PVDF.
 - a. Nominal Total Dry Film Thickness: 1.0 mil.

3. Interior Exposed Surfaces: Coat with polyester color coat.
4. Apply coatings to entire material dimensions of steel sheets before forming of panels.

D. Physical Characteristics of Exterior Coating:

1. Resistance to failure through cracking, checking, peeling, and loss of adhesion.
2. Measure by the following laboratory weather-simulating tests to obtain test results justifying metal building system manufacturer's 25-year warranty:
 - a. Humidity resistance at 100 degrees F and 100 percent relative humidity, ASTM D 2247.
 - b. Salt-spray resistance at 5 percent salt fog, ASTM B 117.
 - c. Reverse impact resistance, ASTM D 2794.
 - d. Resistance to accelerated weathering, Atlas Model XW-R Dew Cycle Weather-O-Meter, ASTM D 3361.
 - e. Resistance to dry heat.
 - f. Abrasion resistance, ASTM D 968.
 - g. Chemical/acid/pollution resistance, ASTM D 1308 and G 87.
 - h. Maintain gloss of finish evenly over entire surface, ASTM D 523.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine area to receive metal building system
- B. Notify Architect of conditions that would adversely affect installation or subsequent use.
- C. Do not begin installation until unacceptable conditions are corrected.

3.2 ERECTION-STRUCTURAL STEEL FRAMING SYSTEM

- A. Erect structural steel framing system in accordance with the Drawings and metal building system manufacturer's erection drawings.
- B. Field Modifications:
 1. Require approval of metal building system manufacturer.
 2. Responsibility of building erector.
 3. Field Modifications to Truss Purlins: Not allowed, unless indicated on erection drawings furnished by metal building system manufacturer.
- C. Fixed Column Bases: Grout flush with floor line after structural steel erection is complete.

3.3 INSTALLATION-METAL ROOF SYSTEM

- A. Metal Roof System Installation: Butler Manufacturing™ "CMR-24®" roof system.
 1. Install roof system in accordance with metal building system manufacturer's instructions at locations indicated on the Drawings.
 2. Install roof system weathertight.

3. Position and align liner panels and insulation board by installing starting panels against endwall trim clips and sidewall eave structural.
4. Place liner panels with edges up and corrugations perpendicular to secondary structural members and with end laps over secondary structural members.
5. Attach liner panels to roof secondary structural members with self-drilling screws in accordance with erection drawings furnished by metal building system manufacturer.
6. Install vapor retarder over liner panels with 6-inch minimum side laps and end laps.
7. Position panel clips and bearing plates by matching hole in clip with factory-punched or field-drilled holes in secondary structural members.
8. Position and properly align panels by matching factory-punched holes in panel end with factory-punched holes in eave structural member and by aligning panel with panel clip.
9. Field seam panel side laps by self-propelled and portable electrical lock-seaming machine.
 - a. Machine field forms the final 180 degrees of a 360-degree Pittsburgh double-lock standing seam.
 - b. Factory apply side lap sealant.
10. Panel End Laps: Minimum of 6 inches, sealed with "Butler Panlastic" sealant, and fastened together by clamping plates.
 - a. Sealants: Contain hard nylon beads, which prevent mastic from flowing out due to clamping actions.
 - b. Join panel laps by 2-piece clamped connection consisting of a bottom reinforcing plate and a top panel strap.
 - c. Locate panel end laps directly over, but not fastened to, supporting secondary roof structural member and stagger, to avoid 4-panel lap-splice condition.

3.4 INSTALLATION-METAL WALL SYSTEM

- A. Metal Wall System Installation: Butler Manufacturing™ "Butler Thermawall™" wall system.
1. Install wall system in accordance with metal building system manufacturer's instructions at locations indicated on the Drawings.
 2. Install wall system weathertight.
 3. Verify structural system for wall panel installation is plumb, level, and aligned as indicated on erection drawings of metal building system manufacturer.
 - a. Variation of Intermediate Girts Within Tolerance: Outward direction.
 4. Seal wall panels with concealed, factory-applied butyl sealant at side laps and between building structural members and panel interior face at ends of panels.
 5. Exterior Trim: Smooth finish and match exterior color of wall panel system, except the following:
 - a. Gutters, Downspouts, Eave Trim, Gable Trim, Door-Side Flashings, and Header Flashings: Galvanized steel factory painted with "Butler-Cote™" finish system, full-strength, 70 percent "Kynar 500" or "Hylar 5000" fluoropolymer (PVDF) coating.

- b. Base Angle and Trim: Extruded plain anodized aluminum with optional trim cap to match wall color.
- c. Windows: Aluminum extrusions (thermally broken) with bronze anodized finish.
- d. Horizontal Panel Joint Trim: Extruded aluminum factory painted to match panel exterior face color.
- e. Interior Trim: Painted.
- f. Flashings, Trim, Closures, and Similar Items: Install as indicated on erection drawings furnished by metal building system manufacturer.

3.5 INSTALLATION-INSULATION

- A. Insulation Installation: Install insulation in accordance with metal building system manufacturer's instructions at locations indicated on the Drawings.

3.6 INSTALLATION-INSULATION SUPPORT SYSTEM

- A. Insulation Support System Installation: Butler Manufacturing™ "Sky-Web®" insulation support system.
 - 1. Install insulation support system in accordance with metal building system manufacturer's instructions at locations indicated on the Drawings.
 - 2. Verify roof structural system is in place before installation of insulation support system.
 - 3. Keep insulation support system in place after metal roof system is installed.

3.7 PROTECTION

- A. Protect installed metal building system to ensure that, except for normal weathering, metal building system will be without damage or deterioration at time of Substantial Completion.

END OF SECTION 13-3419

**SECTION 32-1313
CONCRETE PAVING**

PART 1 GENERAL

1.1 WORK INCLUDED

- A. Furnish and install Portland cement concrete paving as shown on the drawings, as specified herein, and as needed for a complete and proper installation.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Division 31 Section "Earthwork".

1.3 REFERENCES

- A. ACI 301 - Specifications for Structural Concrete for Buildings.
- B. ACI 304 - Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete.
- C. ANSI/ASTM A185 - Welded Steel Wire Fabric for Concrete Reinforcement.
- D. ANSI/ASTM D1751 - Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction.
- E. ASTM C33 - Concrete Aggregates.
- F. ASTM C94 - Ready Mix Concrete.
- G. ASTM C150 - Portland Cement
- H. ASTM C260 - Air Entraining Admixtures for Concrete.

1.4 QUALITY ASSURANCE

- A. Perform work in accordance with ACI 301.
- B. Obtain cementitious materials from same source throughout.

1.5 SUBMITTALS

- A. As specified in the General Conditions and pertinent provisions of Section 01300.

1.6 REGULATORY REQUIREMENTS

- A. Conform to applicable standards for paving work on public property.

1.7 ENVIRONMENTAL REQUIREMENTS

- A. Do not place concrete when base surface temperature is less than 40 degrees F, or surface is wet or frozen, unless appropriate admixtures have been previously approved.

PART 2 PRODUCTS

2.1 FORM MATERIALS

- A. Form Materials: Conform to ACI 301.

2.2 REINFORCEMENT

- A. Reinforcing Steel and Wire Fabric: Type specified in Section 03200.

2.3 CONCRETE MATERIALS

- A. Concrete Materials: As specified in Section 03300.

2.4 CONCRETE MIX

- A. Mix concrete in accordance with ACI 304. Deliver concrete in accordance with ASTM C94.
- B. Select proportions for normal weight concrete in accordance with ACI 301 Method 1.
- C. Provide concrete to the following criteria:
 - 1. Compressive Strength: 4000 psi @ 28 days.
 - 2. Slump: 3 to 5 inches.
 - 3. Maximum Aggregate Size: 1 inch.
 - 4. Air Content Range: 4 to 6 percent.
 - 5. Minimum Cement Content: 520 lb./cu. yd. of concrete.
- D. Use accelerating admixtures in cold weather only when approved by Architect/Engineer. Use of admixtures will not relax cold weather placement requirements.
- E. Use calcium chloride only when approved by Architect/Engineer.
- F. Use set retarding admixtures during hot weather only when approved by Architect/Engineer.

2.5 SOURCE QUALITY CONTROL

- A. Provide mix design under provisions of Section 01300.
- B. Submit proposed mix design of each class of concrete to appointed firm for review prior to commencement of work.
- C. Test samples in accordance with ACI 301.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify compacted subgrade is acceptable and ready to support paving and imposed loads.
- B. Verify gradients and elevations of base are correct.

3.2 PREPARATION

- A. Moisten base to minimize absorption of water from fresh concrete.
- B. Coat surfaces of catch basin frames with oil to prevent bond with concrete pavement.
- C. Notify Architect minimum 24 hours prior to commencement of concreting operations.

3.3 FORMING

- A. Place and secure forms to correct location, dimension, and profile.
- B. Assemble formwork to permit easy stripping and dismantling without damaging concrete.
- C. Place joint filler vertical in position, in straight lines. Secure to formwork during concrete placement.

3.4 REINFORCEMENT

- A. Place reinforcement at mid-height of slabs-on-grade.
- B. Interrupt reinforcement at expansion joints.
- C. Place reinforcement to achieve pavement and curb alignment as detailed.
- D. Provide dowelled joints 18 inches o.c. at interruptions of concrete with one end of dowel set in capped sleeve to allow longitudinal movement.

3.5 JOINTS

- A. Place expansion joints at 24 foot intervals. Align curb, gutter, and sidewalk joints.
- B. Place joint filler between paving components and building or other appurtenances. Recess top of filler 1/4 inch for sealant placement by Section 02550.
- C. Provide scored joints at 6 foot intervals along sidewalks, between sidewalks and curbs and between curbs and pavement, or as indicated on plans.

3.6 PLACING CONCRETE

- A. Place concrete in accordance with ACI 301.
- B. Place concrete continuously between predetermined construction joints. Do not break or interrupt successive pours such that cold joints occur.
- C. Place concrete to pattern indicated. Score contraction joints 3/16 inch wide at an optimum time after finishing.

3.7 FINISHING

- A. Area Paving: Medium broom.
- B. Sidewalk Paving: Medium broom, radiused to 1/2 inch radius, and trowel joint edges.
- C. Curbs and Gutters: Medium broom.
- D. Inclined Pedestrian Ramps: Heavy Broom perpendicular to slope.

3.8 FIELD QUALITY CONTROL

- A. Field testing will be performed under provisions of Section 01410.
- B. Notify testing representative 48 hours prior to placement of any materials and for required testing of paving sub-grade for compaction.
- C. Three concrete test cylinders will be taken for every 75 or less cu yds of each class of concrete placed each day.
- D. One additional test cylinder will be taken during cold weather and cured on site under same conditions as concrete it represents.
- E. One slump test will be taken for each set of test cylinders taken.
- F. Maintain records of placed concrete items. Record date, location of pour, quantity, air temperature, and test samples taken.

3.9 PROTECTION

- A. Immediately after placement, protect pavement from premature drying, excessive hot or cold temperatures, and mechanical injury.

3.10 SCHEDULES

- A. Concrete Sidewalks: 4,000 psi 28 day concrete, 4 inches thick, medium broom finish.
- B. Parking Area Pavement and Curbs: 4,000 psi 28 day concrete, 5-1/2 inches thick, medium broom finish.
- C. Concrete drive aprons: 4,000 psi 28 day concrete, 6 inches thick, medium broom finish.

END OF SECTION 321313 – CONCRETE PAVING

SECTION 32-3113 CHAIN LINK 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. Chain-link fences.
 - 2. Chain-link swing gates.

1.3 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Chain-link fence and gate framework shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated according to ASCE/SEI 7:
 - 1. Minimum Post Size: Determine according to ASTM F 1043 for framework up to 12 feet high, and post spacing not to exceed 10 feet.
 - 2. Minimum Post Size and Maximum Spacing: Determine according to CLFMI WLG 2445, based on mesh size and pattern specified and on the following:
 - a. Wind Loads: As indicated in Drawings.
 - b. Exposure Category: As indicated in the Drawings
 - c. Fence Height: As indicated in the Drawings.
 - d. Material Group: IA, ASTM F 1043, Schedule 40 steel pipe.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
 - 1. Fence and gate posts, rails, and fittings.
 - 2. Chain-link fabric, reinforcements, and attachments.
 - 3. Gates and hardware.
- B. Product Certificates: For each type of chain-link fence and gate, from manufacturer.
- C. Product Test Reports: For framing strength according to ASTM F 1043.
- D. Field quality-control reports.
- E. Warranty: Sample of special warranty.

1.5 PROJECT CONDITIONS

- A. Field Measurements: Verify layout information for chain-link fences and gates shown on Drawings in relation to property survey and existing structures. Verify dimensions by field measurements.

1.6 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which Installer agrees to repair or replace components of chain-link fences and gates that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 - 2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 CHAIN-LINK FENCE FABRIC

- A. General: Provide fabric in one-piece heights measured between top and bottom of outer edge of selvage knuckle or twist. Comply with CLFMI Product Manual and with requirements indicated below:
 - 1. Fabric Height: As indicated on Drawings.
 - 2. Steel Wire Fabric: Wire with a diameter of 0.148 inch.
 - a. Mesh Size: 2 inches.
 - b. Zinc-Coated Fabric: ASTM A 392, Type II, Class 2, 2.0 oz./sq. ft. with zinc coating applied before weaving.
 - c. Coat selvage ends of fabric that is metallic coated before the weaving process with manufacturer's standard clear protective coating.
 - 3. Selvage: Knuckled at both selvages.

2.2 FENCE FRAMING

- A. Posts and Rails: Comply with ASTM F 1043 for framing, including rails, braces, and line; terminal; and corner posts. Provide members with minimum dimensions and wall thickness according to ASTM F 1043 or ASTM F 1083 based on the following:
 - 1. Fence Height: As indicated on Drawings.
 - 2. Heavy Industrial Strength: Material Group IA, round steel pipe, Schedule 40.
 - a. Line Post: 2.0 inches in diameter.
 - b. End, Corner and Pull Post: 2.0 inches in diameter.

3. Horizontal Framework Members: Intermediate, top and bottom rails complying with ASTM F 1043.
 - a. Top Rail: 1.25 by 1.63 inches.
4. Brace Rails: Comply with ASTM F 1043.
5. Metallic Coating for Steel Framing:
 - a. Type A, consisting of not less than minimum 2.0-oz./sq. ft. average zinc coating per ASTM A 123/A 123M or 4.0-oz./sq. ft. zinc coating per ASTM A 653/A 653M.
 - b. Type B, zinc with organic overcoat, consisting of a minimum of 0.9 oz./sq. ft. of zinc after welding, a chromate conversion coating, and a clear, verifiable polymer film.
 - c. External, Type B, zinc with organic overcoat, consisting of a minimum of 0.9 oz./sq. ft. of zinc after welding, a chromate conversion coating, and a clear, verifiable polymer film. Internal, Type D, consisting of 81 percent, not less than 0.3-mil- thick, zinc-pigmented coating.
 - d. Type C, Zn-5-Al-MM alloy, consisting of not less than 1.8-oz./sq. ft. coating.
 - e. Coatings: Any coating above.

2.3 TENSION WIRE

- A. Metallic-Coated Steel Wire: 0.177-inch- diameter, marcelled tension wire complying with ASTM A 817 and ASTM A 824, with the following metallic coating:
 1. Type II, zinc coated (galvanized) by hot-dip process, with the following minimum coating weight:

2.4 SWING GATES

- A. General: Comply with ASTM F 900 for gate posts and single and double swing gate types.
 1. Gate Leaf Width: As indicated on Drawings
 2. Gate Fabric Height: As indicated on Drawings
- B. Pipe and Tubing:
 1. Zinc-Coated Steel: Comply with ASTM F 1043 and ASTM F 1083; protective coating and finish to match fence framing.
- C. Frame Corner Construction: Welded.
- D. Hardware:
 1. Hinges: 360-degree inward and outward swing.
 2. Latches permitting operation from both sides of gate with provision for padlocking accessible from both sides of gate.
 3. Closer: Manufacturer's standard.

2.5 FITTINGS

- A. General: Comply with ASTM F 626.
- B. Post Caps: Provide for each post.
 - 1. Provide line post caps with loop to receive tension wire or top rail.
- C. Rail and Brace Ends: For each gate, corner, pull, and end post.
- D. Rail Fittings: Provide the following:
 - 1. Top Rail Sleeves: Pressed-steel or round-steel tubing not less than 6 inches long.
 - 2. Rail Clamps: Line and corner boulevard clamps for connecting intermediate and bottom rails in the fence line-to-line posts.
- E. Tension and Brace Bands: Pressed steel.
- F. Tension Bars: Steel, length not less than 2 inches shorter than full height of chain-link fabric. Provide one bar for each gate and end post, and two for each corner and pull post, unless fabric is integrally woven into post.
- G. Truss Rod Assemblies: Steel, hot-dip galvanized after threading rod and turnbuckle or other means of adjustment.
- H. Tie Wires, Clips, and Fasteners: According to ASTM F 626.
 - 1. Standard Round Wire Ties: For attaching chain-link fabric to posts, rails, and frames, complying with the following:
 - a. Hot-Dip Galvanized Steel: 0.148-inch diameter wire; galvanized coating thickness matching coating thickness of chain-link fence fabric.

2.6 GROUT AND ANCHORING CEMENT

- A. Nonshrink, Nonmetallic Grout: Premixed, factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout, recommended in writing by manufacturer, for exterior applications.
- B. Erosion-Resistant Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with potable water at Project site to create pourable anchoring, patching, and grouting compound. Provide formulation that is resistant to erosion from water exposure without needing protection by a sealer or waterproof coating and that is recommended in writing by manufacturer, for exterior applications.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions, with Installer present, for compliance with requirements for site clearing, earthwork, pavement work, and other conditions affecting performance of the Work.

1. Do not begin installation before final grading is completed.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Stake locations of fence lines, gates, and terminal posts. Do not exceed intervals of 500 feet or line of sight between stakes. Indicate locations of utilities, lawn sprinkler system, underground structures, benchmarks, and property monuments.

3.3 INSTALLATION, GENERAL

- A. Install chain-link fencing to comply with ASTM F 567 and more stringent requirements indicated.
 1. Install fencing on established boundary lines inside property line.

3.4 CHAIN-LINK FENCE INSTALLATION

- A. Post Excavation: Drill or hand-excavate holes for posts to diameters and spacings indicated, in firm, undisturbed soil.
- B. Post Setting: Set posts in concrete at indicated spacing into firm, undisturbed soil.
 1. Verify that posts are set plumb, aligned, and at correct height and spacing, and hold in position during setting with concrete or mechanical devices.
 2. Concrete Fill: Place concrete around posts to dimensions indicated and vibrate or tamp for consolidation. Protect aboveground portion of posts from concrete splatter.
 - a. Exposed Concrete: Extend 2 inches above grade; shape and smooth to shed water.
- C. Terminal Posts: Locate terminal end, corner, and gate posts per ASTM F 567.
- D. Line Posts: Space line posts uniformly at 96 inches o.c.
- E. Post Bracing and Intermediate Rails: Install according to ASTM F 567, maintaining plumb position and alignment of fencing. Diagonally brace terminal posts to adjacent line posts with truss rods and turnbuckles. Install braces at end and gate posts and at both sides of corner and pull posts.
 1. Locate horizontal braces at midheight of fabric 72 inches or higher, on fences with top rail and at two-third fabric height on fences without top rail. Install so posts are plumb when diagonal rod is under proper tension.
- F. Tension Wire: Install according to ASTM F 567, maintaining plumb position and alignment of fencing. Pull wire taut, without sags. Fasten fabric to tension wire with 0.120-inch- diameter hog rings of same material and finish as fabric wire, spaced a maximum of 24 inches o.c. Install tension wire in locations indicated before stretching fabric. Provide horizontal tension wire at the following locations:
- G. Top Rail: Install according to ASTM F 567, maintaining plumb position and alignment of fencing. Run rail continuously through line post caps, bending to radius for curved runs and

terminating into rail end attached to posts or post caps fabricated to receive rail at terminal posts. Provide expansion couplings as recommended in writing by fencing manufacturer.

- H. Intermediate and Bottom Rails: Install and secure to posts with fittings.
- I. Chain-Link Fabric: Apply fabric to inside of enclosing framework. Leave 1 inch between finish grade or surface and bottom selvage unless otherwise indicated. Pull fabric taut and tie to posts, rails, and tension wires. Anchor to framework so fabric remains under tension after pulling force is released.
- J. Tension or Stretcher Bars: Thread through fabric and secure to end, corner, pull, and gate posts with tension bands spaced not more than 15 inches o.c.
- K. Tie Wires: Use wire of proper length to firmly secure fabric to line posts and rails. Attach wire at one end to chain-link fabric, wrap wire around post a minimum of 180 degrees, and attach other end to chain-link fabric per ASTM F 626. Bend ends of wire to minimize hazard to individuals and clothing.
 - 1. Maximum Spacing: Tie fabric to line posts at 12 inches o.c. and to braces at 24 inches o.c.
- L. Fasteners: Install nuts for tension bands and carriage bolts on the side of the fence opposite the fabric side.

3.5 GATE INSTALLATION

- A. Install gates according to manufacturer's written instructions, level, plumb, and secure for full opening without interference. Attach fabric as for fencing. Attach hardware using tamper-resistant or concealed means. Install ground-set items in concrete for anchorage. Adjust hardware for smooth operation and lubricate where necessary.

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. Lubricate hardware and other moving parts.

3.7 DEMONSTRATION

- A. Train Owner's personnel to adjust, operate, and maintain chain-link fences and gates.

END OF SECTION 32-3113

SECTION 22 05 13**COMMON MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT****PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

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

1.2 SUMMARY

- A. Section includes general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on ac power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

1.3 COORDINATION

- A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:
 - 1. Motor controllers.
 - 2. Torque, speed, and horsepower requirements of the load.
 - 3. Ratings and characteristics of supply circuit and required control sequence.
 - 4. Ambient and environmental conditions of installation location.

PART 2 - PRODUCTS**2.1 GENERAL MOTOR REQUIREMENTS**

- A. Comply with requirements in this Section except when stricter requirements are specified in plumbing equipment schedules or Sections.
- B. Comply with NEMA MG 1 unless otherwise indicated.
- C. Comply with IEEE 841 for severe-duty motors.

2.2 MOTOR CHARACTERISTICS

- A. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 7000 feet above sea level.
- B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

2.3 POLYPHASE MOTORS

- A. Description: NEMA MG 1, Design B, medium induction motor.
- B. Efficiency: Energy efficient, as defined in NEMA MG 1.
- C. Service Factor: 1.15.
- D. Multispeed Motors: Variable torque.
 - 1. For motors with 2:1 speed ratio, consequent pole, single winding.
 - 2. For motors with other than 2:1 speed ratio, separate winding for each speed.
- E. Multispeed Motors: Separate winding for each speed.
- F. Rotor: Random-wound, squirrel cage.
- G. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.
- H. Temperature Rise: Match insulation rating.
- I. Insulation: Class F.
- J. Code Letter Designation:
 - 1. Motors 15 HP and Larger: NEMA starting Code F or Code G.
 - 2. Motors Smaller than 15 HP: Manufacturer's standard starting characteristic.
- K. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

2.4 POLYPHASE MOTORS WITH ADDITIONAL REQUIREMENTS

- A. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.
- B. Motors Used with Variable Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.
 - 1. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width modulated inverters.
 - 2. Energy- and Premium-Efficient Motors: Class B temperature rise; Class F insulation.
 - 3. Inverter-Duty Motors: Class F temperature rise; Class H insulation.
 - 4. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.
- C. Severe-Duty Motors: Comply with IEEE 841, with 1.15 minimum service factor.

2.5 SINGLE-PHASE MOTORS

- A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:
 - 1. Permanent-split capacitor.
 - 2. Split phase.
 - 3. Capacitor start, inductor run.
 - 4. Capacitor start, capacitor run.
- B. Multispeed Motors: Variable-torque, permanent-split-capacitor type.
- C. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.
- D. Motors 1/20 HP and Smaller: Shaded-pole type.
- E. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

PART 3 - EXECUTION (Not Applicable)

END OF SECTION

SECTION 22 0519
METERS AND GAUGES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Bimetallic-actuated thermometers.
 - 2. Thermowells.
 - 3. Dial-type pressure gages.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Product certificates.
- C. Operation and maintenance data.

PART 2 - PRODUCTS

2.1 BIMETALLIC-ACTUATED THERMOMETERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following but are not limited to, the following:
- B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - 1. Ashcroft Inc.
 - 2. Ernst Flow Industries.
 - 3. Marsh Bellofram.
 - 4. Miljoco Corporation.
 - 5. Nanmac Corporation.
 - 6. Noshok.
 - 7. Palmer Wahl Instrumentation Group.
 - 8. REOTEMP Instrument Corporation.
 - 9. Tel-Tru Manufacturing Company.
 - 10. Trerice, H. O. Co.
 - 11. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.
 - 12. Weiss Instruments, Inc.
 - 13. WIKA Instrument Corporation - USA.
 - 14. Winters Instruments - U.S.
- C. Standard: ASME B40.200.

- D. Case: type(s); stainless steel with 3-inch (76-mm) nominal diameter.
- E. Dial: Nonreflective aluminum with permanently etched scale markings and scales in deg F and deg C.
- F. Connector Type(s): Union joint, rigid, back , with unified-inch screw threads.
- G. Connector Size: 1/2 inch (13 mm), with ASME B1.1 screw threads.
- H. Stem: 0.25 or 0.375 inch (6.4 or 9.4 mm) in diameter; stainless steel.
- I. Window: Plain glass.
- J. Ring: Stainless steel.
- K. Element: Bimetal coil.
- L. Pointer: Dark-colored metal.
- M. Accuracy: Plus or minus 1 percent of scale range.

2.2 THERMOWELLS

- A. Thermowells:
 - 1. Standard: ASME B40.200.
 - 2. Description: Pressure-tight, socket-type fitting made for insertion into piping tee fitting.
 - 3. Material for Use with Copper Tubing: CNR or CUNI.
 - 4. Material for Use with Steel Piping: CRES.
 - 5. Type: Stepped shank unless straight or tapered shank is indicated.
 - 6. External Threads: NPS 1/2, NPS 3/4, or NPS 1, (DN 15, DN 20, or NPS 25,) ASME B1.20.1 pipe threads.
 - 7. Internal Threads: 1/2, 3/4, and 1 inch (13, 19, and 25 mm), with ASME B1.1 screw threads.
 - 8. Bore: Diameter required to match thermometer bulb or stem.
 - 9. Insertion Length: Length required to match thermometer bulb or stem.
 - 10. Lagging Extension: Include on thermowells for insulated piping and tubing.
 - 11. Bushings: For converting size of thermowell's internal screw thread to size of thermometer connection.
- B. Heat-Transfer Medium: Mixture of graphite and glycerin.

2.3 PRESSURE GAGES

- A. Direct-Mounted, Metal-Case, Dial-Type Pressure Gages:
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - a. AMETEK, Inc.; U.S. Gauge.

- b. Ashcroft Inc.
 - c. Ernst Flow Industries.
 - d. Flo Fab Inc.
 - e. Marsh Bellofram.
 - f. Miljoco Corporation.
 - g. Noshok.
 - h. Palmer Wahl Instrumentation Group.
 - i. REOTEMP Instrument Corporation.
 - j. Tel-Tru Manufacturing Company.
 - k. Trerice, H. O. Co.
 - l. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.
 - m. Weiss Instruments, Inc.
 - n. WIKA Instrument Corporation - USA.
 - o. Winters Instruments - U.S.
- 3. Standard: ASME B40.100.
 - 4. Case: Sealed, type(s); cast aluminum or drawn steel; 4-1/2-inch nominal diameter.
 - 5. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
 - 6. Pressure Connection: Brass, with NPS 1/2 (DN 15), ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
 - 7. Movement: Mechanical, with link to pressure element and connection to pointer.
 - 8. Dial: Nonreflective aluminum with permanently etched scale markings graduated in psi and kPa.
 - 9. Pointer: Dark-colored metal.
 - 10. Window: Glass
 - 11. Ring: Metal
 - 12. Accuracy: Grade A, plus or minus 1 percent of middle half of scale range.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install thermowells with socket extending one-third of pipe diameter and in vertical position in piping tees.
- B. Install thermowells of sizes required to match thermometer connectors. Include bushings if required to match sizes.
- C. Install thermowells with extension on insulated piping.
- D. Fill thermowells with heat-transfer medium.
- E. Install direct-mounted thermometers in thermowells and adjust vertical and tilted positions.
- F. Install remote-mounted thermometer bulbs in thermowells and install cases on panels; connect cases with tubing and support tubing to prevent kinks. Use minimum tubing length.
- G. Install direct-mounted pressure gages in piping tees with pressure gage located on pipe at the most readable position.
- H. Install remote-mounted pressure gages on panel.
- I. Install valve and snubber in piping for each pressure gage for fluids.

- J. Install thermometers in the following locations:
 - 1. Inlet and outlet of each water heater.
 - 2. Inlets and outlets of each domestic water heat exchanger.
 - 3. Inlet and outlet of each domestic hot-water storage tank.
 - 4. Inlet and outlet of each remote domestic water chiller.
- K. Install pressure gages in the following locations:
 - 1. Building water service entrance into building.
 - 2. Inlet and outlet of each pressure-reducing valve.
 - 3. Suction and discharge of each domestic water pump.
- L. Install meters and gages adjacent to machines and equipment to allow service and maintenance of meters, gages, machines, and equipment.
- M. Adjust faces of meters and gages to proper angle for best visibility.

3.2 THERMOMETER SCHEDULE

- A. Thermometers at inlet and outlet of each domestic water heater shall be the following:
 - 1. Liquid-filled, bimetallic-actuated type.
- B. Thermometers at inlets and outlets of each domestic water heat exchanger shall be the following:
 - 1. Liquid-filled, bimetallic-actuated type.
- C. Thermometers at inlet and outlet of each domestic hot-water storage tank shall be the following:
 - 1. Liquid-filled, bimetallic-actuated type.
- D. Thermometers at inlet and outlet of each remote domestic water chiller shall be the following:
 - 1. Liquid-filled, bimetallic-actuated type.
- E. Thermometer stems shall be of length to match thermowell insertion length.

3.3 THERMOMETER SCALE-RANGE SCHEDULE

- A. Scale Range for Domestic Cold-Water Piping: 0 to 100 deg F (Minus 20 to plus 50 deg C).
- B. Scale Range for Domestic Cold-Water Piping: 0 to 150 deg F (Minus 20 to plus 70 deg C).
- C. Scale Range for Domestic Cold-Water Piping: 30 to 240 deg F (0 to plus 115 deg C).
- D. Scale Range for Domestic Hot-Water Piping: 0 to 250 deg F (0 to 150 deg C).
- E. Scale Range for Domestic Hot-Water Piping: 20 to 240 deg F (0 to 150 deg C).
- F. Scale Range for Domestic Cooled-Water Piping: 0 to 100 deg F (Minus 20 to plus 50 deg C).

- G. Scale Range for Domestic Cooled-Water Piping: 0 to 150 deg F (Minus 20 to plus 70 deg C).

3.4 PRESSURE-GAGE SCHEDULE

- A. Pressure gages at discharge of each water service into building shall be the following:
 - 1. Liquid-filled direct-mounted, metal case.
- B. Pressure gages at inlet and outlet of each water pressure-reducing valve shall be the following:
 - 1. Liquid-filled direct-mounted, metal case.
- C. Pressure gages at suction and discharge of each domestic water pump shall be the following:
 - 1. Liquid-filled direct-mounted, metal case.

3.5 PRESSURE-GAGE SCALE-RANGE SCHEDULE

- A. Scale Range for Water Service Piping: 0 to 100 psi and 0 to 600 kPa.
- B. Scale Range for Water Service Piping: 0 to 160 psi and 0 to 1100 kPa.
- C. Scale Range for Water Service Piping: 0 to 200 psi and 0 to 1400 kPa.
- D. Scale Range for Domestic Water Piping: 0 to 100 psi and 0 to 600 kPa.
- E. Scale Range for Domestic Water Piping: 0 to 160 psi and 0 to 1100 kPa.
- F. Scale Range for Domestic Water Piping: 0 to 200 psi and 0 to 1400 kPa.

END OF SECTION 22 0519

SECTION 22 05 23**GENERAL-DUTY VALVES FOR PLUMBING PIPING****PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

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

1.2 SUMMARY

- A. Section Includes:

- 1. Bronze angle valves.
 - 2. Brass ball valves.
 - 3. Bronze ball valves.
 - 4. Iron ball valves.
 - 5. Iron, single-flange butterfly valves.
 - 6. Iron, grooved-end butterfly valves.
 - 7. Bronze lift check valves.
 - 8. Bronze swing check valves.
 - 9. Iron swing check valves.
 - 10. Iron swing check valves with closure control.
 - 11. Iron, grooved-end swing check valves.
 - 12. Iron, center-guided check valves.
 - 13. Iron, plate-type check valves.
 - 14. Bronze gate valves.
 - 15. Iron gate valves.
 - 16. Bronze globe valves.
 - 17. Iron globe valves.

- B. Related Sections:

- 1. Division 22 plumbing piping Sections for specialty valves applicable to those Sections only.
 - 2. Division 22 Section "Identification for Plumbing Piping and Equipment" for valve tags and schedules.
 - 3. Division 33 water distribution piping Sections for general-duty and specialty valves for site construction piping.

1.3 DEFINITIONS

- A. CWP: Cold working pressure.
- B. EPDM: Ethylene propylene copolymer rubber.
- C. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.

- D. NRS: Nonrising stem.
- E. OS&Y: Outside screw and yoke.
- F. RS: Rising stem.
- G. SWP: Steam working pressure.

1.4 SUBMITTALS

- A. Product Data: For each type of valve indicated.

1.5 QUALITY ASSURANCE

- A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.
- B. ASME Compliance:
 - 1. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
 - 2. ASME B31.1 for power piping valves.
 - 3. ASME B31.9 for building services piping valves.
- C. NSF Compliance: NSF 61 for valve materials for potable-water service.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Prepare valves for shipping as follows:
 - 1. Protect internal parts against rust and corrosion.
 - 2. Protect threads, flange faces, grooves, and weld ends.
 - 3. Set angle, gate, and globe valves closed to prevent rattling.
 - 4. Set ball and plug valves open to minimize exposure of functional surfaces.
 - 5. Set butterfly valves closed or slightly open.
 - 6. Block check valves in either closed or open position.
- B. Use the following precautions during storage:
 - 1. Maintain valve end protection.
 - 2. Store valves indoors and maintain at higher than ambient dew point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.
- C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

- A. Refer to valve schedule articles for applications of valves.

- B. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.
- C. Valve Sizes: Same as upstream piping unless otherwise indicated.
- D. Valve Actuator Types:
 - 1. Gear Actuator: For quarter-turn valves NPS 8 and larger.
 - 2. Handwheel: For valves other than quarter-turn types.
 - 3. Handlever: For quarter-turn valves NPS 6 and smaller except plug valves.
 - 4. Wrench: For plug valves with square heads. Furnish Owner with 1 wrench for every 10 plug valves, for each size square plug-valve head.
 - 5. Chainwheel: Device for attachment to valve handwheel, stem, or other actuator; of size and with chain for mounting height, as indicated in the "Valve Installation" Article.
- E. Valves in Insulated Piping: With 2-inch stem extensions and the following features:
 - 1. Gate Valves: With rising stem.
 - 2. Ball Valves: With extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.
 - 3. Butterfly Valves: With extended neck.
- F. Valve-End Connections:
 - 1. Flanged: With flanges according to ASME B16.1 for iron valves.
 - 2. Grooved: With grooves according to AWWA C606.
 - 3. Solder Joint: With sockets according to ASME B16.18.
 - 4. Threaded: With threads according to ASME B1.20.1.
- G. Valve Bypass and Drain Connections: MSS SP-45.

2.2 BRONZE ANGLE VALVES

- A. Class 125, Bronze Angle Valves with Bronze Disc:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Hammond Valve.
 - b. Milwaukee Valve Company.
 - 2. Description:
 - a. Standard: MSS SP-80, Type 1.
 - b. CWP Rating: 200 psig.
 - c. Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.
 - d. Ends: Threaded.
 - e. Stem and Disc: Bronze.
 - f. Packing: Asbestos free.
 - g. Handwheel: Malleable iron bronze, or aluminum.
- B. Class 125, Bronze Angle Valves with Nonmetallic Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American Valve, Inc.
 - b. NIBCO INC.
 2. Description:
 - a. Standard: MSS SP-80, Type 2.
 - b. CWP Rating: 200 psig.
 - c. Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.
 - d. Ends: Threaded.
 - e. Stem: Bronze.
 - f. Disc: PTFE or TFE.
 - g. Packing: Asbestos free.
 - h. Handwheel: Malleable iron, bronze, or aluminum.
- C. Class 150, Bronze Angle Valves with Bronze Disc:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Crane Co.; Crane Valve Group; Stockham Division.
 - b. Kitz Corporation.
 2. Description:
 - a. Standard: MSS SP-80, Type 1.
 - b. CWP Rating: 300 psig.
 - c. Body Material: ASTM B 62, bronze with integral seat and union-ring bonnet.
 - d. Ends: Threaded.
 - e. Stem and Disc: Bronze.
 - f. Packing: Asbestos free.
 - g. Handwheel: Malleable iron, bronze, or aluminum.
- D. Class 150, Bronze Angle Valves with Nonmetallic Disc:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Crane Co.; Crane Valve Group; Crane Valves.
 - b. Crane Co.; Crane Valve Group; Jenkins Valves.
 - c. Crane Co.; Crane Valve Group; Stockham Division.
 - d. Hammond Valve.
 - e. Milwaukee Valve Company.
 - f. NIBCO INC.
 - g. Powell Valves.
 2. Description:
 - a. Standard: MSS SP-80, Type 2.
 - b. CWP Rating: 300 psig.
 - c. Body Material: ASTM B 62, bronze with integral seat and union-ring bonnet.
 - d. Ends: Threaded.
 - e. Stem: Bronze.

- f. Disc: PTFE or TFE.
- g. Packing: Asbestos free.
- h. Handwheel: Malleable iron, bronze, or aluminum.

2.3 BRASS BALL VALVES

A. One-Piece, Reduced-Port, Brass Ball Valves with Brass Trim:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Kitz Corporation.
- 2. Description:
 - a. Standard: MSS SP-110.
 - b. CWP Rating: 400 psig.
 - c. Body Design: One piece.
 - d. Body Material: Forged brass.
 - e. Ends: Threaded.
 - f. Seats: PTFE or TFE.
 - g. Stem: Brass.
 - h. Ball: Chrome-plated brass.
 - i. Port: Reduced.

B. Two-Piece, Full-Port, Brass Ball Valves with Brass Trim:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Crane Co.; Crane Valve Group; Crane Valves.
 - b. Crane Co.; Crane Valve Group; Jenkins Valves.
 - c. DynaQuip Controls.
 - d. Flow-Tek, Inc.; a subsidiary of Bray International, Inc.
 - e. Hammond Valve.
 - f. Jamesbury; a subsidiary of Metso Automation.
 - g. Jomar International, LTD.
 - h. Kitz Corporation.
 - i. Legend Valve.
 - j. Marwin Valve; a division of Richards Industries.
 - k. Milwaukee Valve Company.
 - l. NIBCO INC.
 - m. Red-White Valve Corporation.
 - n. RuB Inc.
- 2. Description:
 - a. Standard: MSS SP-110.
 - b. SWP Rating: 150 psig.
 - c. CWP Rating: 600 psig.
 - d. Body Design: Two piece.
 - e. Body Material: Forged brass.
 - f. Ends: Threaded.
 - g. Seats: PTFE or TFE.

- h. Stem: Brass.
- i. Ball: Chrome-plated brass.
- j. Port: Full.

C. Two-Piece, Full-Port, Brass Ball Valves with Stainless-Steel Trim:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Crane Co.; Crane Valve Group; Crane Valves.
 - b. Crane Co.; Crane Valve Group; Jenkins Valves.
 - c. Flow-Tek, Inc.; a subsidiary of Bray International, Inc.
 - d. Hammond Valve.
 - e. Jamesbury; a subsidiary of Metso Automation.
 - f. Kitz Corporation.
 - g. Marwin Valve; a division of Richards Industries.
 - h. Milwaukee Valve Company.
 - i. RuB Inc.
2. Description:
 - a. Standard: MSS SP-110.
 - b. SWP Rating: 150 psig.
 - c. CWP Rating: 600 psig.
 - d. Body Design: Two piece.
 - e. Body Material: Forged brass.
 - f. Ends: Threaded.
 - g. Seats: PTFE or TFE.
 - h. Stem: Stainless steel.
 - i. Ball: Stainless steel, vented.
 - j. Port: Full.

D. Two-Piece, Regular-Port, Brass Ball Valves with Brass Trim:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Hammond Valve.
 - b. Jamesbury; a subsidiary of Metso Automation.
 - c. Legend Valve.
 - d. Marwin Valve; a division of Richards Industries.
 - e. Milwaukee Valve Company.
2. Description:
 - a. Standard: MSS SP-110.
 - b. SWP Rating: 150 psig.
 - c. CWP Rating: 600 psig.
 - d. Body Design: Two piece.
 - e. Body Material: Forged brass.
 - f. Ends: Threaded.
 - g. Seats: PTFE or TFE.
 - h. Stem: Brass.
 - i. Ball: Chrome-plated brass.
 - j. Port: Regular.

E. Two-Piece, Regular-Port, Brass Ball Valves with Stainless-Steel Trim:

1. requirements, provide products by one of the following:
 - a. Jamesbury; a subsidiary of Metso Automation.
 - b. Marwin Valve; a division of Richards Industries.
2. Description:
 - a. Standard: MSS SP-110.
 - b. SWP Rating: 150 psig.
 - c. CWP Rating: 600 psig.
 - d. Body Design: Two piece.
 - e. Body Material: Brass or bronze.
 - f. Ends: Threaded.
 - g. Seats: PTFE or TFE.
 - h. Stem: Stainless steel.
 - i. Ball: Stainless steel, vented.
 - j. Port: Regular.

F. Three-Piece, Full-Port, Brass Ball Valves with Brass Trim:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Jomar International, LTD.
 - b. Kitz Corporation.
 - c. Red-White Valve Corporation.
 - d. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
2. Description:
 - a. Standard: MSS SP-110.
 - b. SWP Rating: 150 psig.
 - c. CWP Rating: 600 psig.
 - d. Body Design: Three piece.
 - e. Body Material: Forged brass.
 - f. Ends: Threaded.
 - g. Seats: PTFE or TFE.
 - h. Stem: Brass.
 - i. Ball: Chrome-plated brass.
 - j. Port: Full.

G. Three-Piece, Full-Port, Brass Ball Valves with Stainless-Steel Trim:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Jomar International, LTD.
 - b. Kitz Corporation.
 - c. Marwin Valve; a division of Richards Industries.
 - d. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
2. Description:

- a. Standard: MSS SP-110.
- b. SWP Rating: 150 psig.
- c. CWP Rating: 600 psig.
- d. Body Design: Three piece.
- e. Body Material: Forged brass.
- f. Ends: Threaded.
- g. Seats: PTFE or TFE.
- h. Stem: Stainless steel.
- i. Ball: Stainless steel, vented.
- j. Port: Full.

2.4 BRONZE BALL VALVES

A. One-Piece, Reduced-Port, Bronze Ball Valves with Bronze Trim:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American Valve, Inc.
 - b. Conbraco Industries, Inc.; Apollo Valves.
 - c. NIBCO INC.
- 2. Description:
 - a. Standard: MSS SP-110.
 - b. CWP Rating: 400 psig.
 - c. Body Design: One piece.
 - d. Body Material: Bronze.
 - e. Ends: Threaded.
 - f. Seats: PTFE or TFE.
 - g. Stem: Bronze.
 - h. Ball: Chrome-plated brass.
 - i. Port: Reduced.

B. One-Piece, Reduced-Port, Bronze Ball Valves with Stainless-Steel Trim:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Conbraco Industries, Inc.; Apollo Valves.
 - b. NIBCO INC.
- 2. Description:
 - a. Standard: MSS SP-110.
 - b. CWP Rating: 600 psig.
 - c. Body Design: One piece.
 - d. Body Material: Bronze.
 - e. Ends: Threaded.
 - f. Seats: PTFE or TFE.
 - g. Stem: Stainless steel.
 - h. Ball: Stainless steel, vented.
 - i. Port: Reduced.

C. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American Valve, Inc.
 - b. Conbraco Industries, Inc.; Apollo Valves.
 - c. Crane Co.; Crane Valve Group; Crane Valves.
 - d. Hammond Valve.
 - e. Lance Valves; a division of Advanced Thermal Systems, Inc.
 - f. Legend Valve.
 - g. Milwaukee Valve Company.
 - h. NIBCO INC.
 - i. Red-White Valve Corporation.
 - j. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
2. Description:
 - a. Standard: MSS SP-110.
 - b. SWP Rating: 150 psig.
 - c. CWP Rating: 600 psig.
 - d. Body Design: Two piece.
 - e. Body Material: Bronze.
 - f. Ends: Threaded.
 - g. Seats: PTFE or TFE.
 - h. Stem: Bronze.
 - i. Ball: Chrome-plated brass.
 - j. Port: Full.

D. Two-Piece, Full-Port, Bronze Ball Valves with Stainless-Steel Trim:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Conbraco Industries, Inc.; Apollo Valves.
 - b. Crane Co.; Crane Valve Group; Crane Valves.
 - c. Hammond Valve.
 - d. Lance Valves; a division of Advanced Thermal Systems, Inc.
 - e. Milwaukee Valve Company.
 - f. NIBCO INC.
 - g. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
2. Description:
 - a. Standard: MSS SP-110.
 - b. SWP Rating: 150 psig.
 - c. CWP Rating: 600 psig.
 - d. Body Design: Two piece.
 - e. Body Material: Bronze.
 - f. Ends: Threaded.
 - g. Seats: PTFE or TFE.
 - h. Stem: Stainless steel.
 - i. Ball: Stainless steel, vented.
 - j. Port: Full.

E. Two-Piece, Regular-Port, Bronze Ball Valves with Bronze Trim:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American Valve, Inc.
 - b. Conbraco Industries, Inc.; Apollo Valves.
 - c. Crane Co.; Crane Valve Group; Jenkins Valves.
 - d. Crane Co.; Crane Valve Group; Stockham Division.
 - e. DynaQuip Controls.
 - f. Hammond Valve.
 - g. Lance Valves; a division of Advanced Thermal Systems, Inc.
 - h. Milwaukee Valve Company.
 - i. NIBCO INC.
2. Description:
 - a. Standard: MSS SP-110.
 - b. SWP Rating: 150 psig.
 - c. CWP Rating: 600 psig.
 - d. Body Design: Two piece.
 - e. Body Material: Bronze.
 - f. Ends: Threaded.
 - g. Seats: PTFE or TFE.
 - h. Stem: Bronze.
 - i. Ball: Chrome-plated brass.
 - j. Port: Regular.

F. Two-Piece, Regular-Port, Bronze Ball Valves with Stainless-Steel Trim:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Conbraco Industries, Inc.; Apollo Valves.
 - b. Crane Co.; Crane Valve Group; Jenkins Valves.
 - c. Hammond Valve.
 - d. Milwaukee Valve Company.
2. Description:
 - a. Standard: MSS SP-110.
 - b. SWP Rating: 150 psig.
 - c. CWP Rating: 600 psig.
 - d. Body Design: Two piece.
 - e. Body Material: Bronze.
 - f. Ends: Threaded.
 - g. Seats: PTFE or TFE.
 - h. Stem: Stainless steel.
 - i. Ball: Stainless steel, vented.
 - j. Port: Regular.

G. Three-Piece, Full-Port, Bronze Ball Valves with Bronze Trim:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. Conbraco Industries, Inc.; Apollo Valves.
- b. DynaQuip Controls.
- c. Hammond Valve.
- d. Milwaukee Valve Company.
- e. NIBCO INC.
- f. Red-White Valve Corporation.

2. Description:

- a. Standard: MSS SP-110.
- b. SWP Rating: 150 psig.
- c. CWP Rating: 600 psig.
- d. Body Design: Three piece.
- e. Body Material: Bronze.
- f. Ends: Threaded.
- g. Seats: PTFE or TFE.
- h. Stem: Bronze.
- i. Ball: Chrome-plated brass.
- j. Port: Full.

H. Three-Piece, Full-Port, Bronze Ball Valves with Stainless-Steel Trim:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. Conbraco Industries, Inc.; Apollo Valves.
- b. Hammond Valve.
- c. Milwaukee Valve Company.
- d. NIBCO INC.

2. Description:

- a. Standard: MSS SP-110.
- b. SWP Rating: 150 psig.
- c. CWP Rating: 600 psig.
- d. Body Design: Three piece.
- e. Body Material: Bronze.
- f. Ends: Threaded.
- g. Seats: PTFE or TFE.
- h. Stem: Stainless steel.
- i. Ball: Stainless steel, vented.
- j. Port: Full.

2.5 IRON BALL VALVES

A. Class 125, Iron Ball Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. American Valve, Inc.
- b. Conbraco Industries, Inc.; Apollo Valves.
- c. Kitz Corporation.
- d. Sure Flow Equipment Inc.

- e. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

- a. Standard: MSS SP-72.
- b. CWP Rating: 200 psig.
- c. Body Design: Split body.
- d. Body Material: ASTM A 126, gray iron.
- e. Ends: Flanged.
- f. Seats: PTFE or TFE.
- g. Stem: Stainless steel.
- h. Ball: Stainless steel.
- i. Port: Full.

2.6 IRON, SINGLE-FLANGE BUTTERFLY VALVES

A. 200 CWP, Iron, Single-Flange Butterfly Valves with EPDM Seat and Aluminum-Bronze Disc:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ABZ Valve and Controls; a division of ABZ Manufacturing, Inc.
 - b. Conbraco Industries, Inc.; Apollo Valves.
 - c. Cooper Cameron Valves; a division of Cooper Cameron Corporation.
 - d. Crane Co.; Crane Valve Group; Jenkins Valves.
 - e. Crane Co.; Crane Valve Group; Stockham Division.
 - f. DeZurik Water Controls.
 - g. Flo Fab Inc.
 - h. Hammond Valve.
 - i. Kitz Corporation.
 - j. Legend Valve.
 - k. Milwaukee Valve Company.
 - l. NIBCO INC.
 - m. Norriseal; a Dover Corporation company.
 - n. Red-White Valve Corporation.
 - o. Spence Strainers International; a division of CIRCOR International, Inc.
 - p. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
- 2. Description:
 - a. Standard: MSS SP-67, Type I.
 - b. CWP Rating: 200 psig.
 - c. Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
 - d. Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.
 - e. Seat: EPDM.
 - f. Stem: One- or two-piece stainless steel.
 - g. Disc: Aluminum bronze.

B. 200 CWP, Iron, Single-Flange Butterfly Valves with NBR Seat and Aluminum-Bronze Disc:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. ABZ Valve and Controls; a division of ABZ Manufacturing, Inc.
- b. Conbraco Industries, Inc.; Apollo Valves.
- c. Cooper Cameron Valves; a division of Cooper Cameron Corporation.
- d. Crane Co.; Crane Valve Group; Jenkins Valves.
- e. Crane Co.; Crane Valve Group; Stockham Division.
- f. DeZurik Water Controls.
- g. Flo Fab Inc.
- h. Hammond Valve.
- i. Kitz Corporation.
- j. Legend Valve.
- k. Milwaukee Valve Company.
- l. NIBCO INC.
- m. Norriseal; a Dover Corporation company.
- n. Red-White Valve Corporation.
- o. Spence Strainers International; a division of CIRCOR International, Inc.
- p. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

- a. Standard: MSS SP-67, Type I.
- b. CWP Rating: 200 psig.
- c. Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
- d. Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.
- e. Seat: NBR.
- f. Stem: One- or two-piece stainless steel.
- g. Disc: Aluminum bronze.

C. 200 CWP, Iron, Single-Flange Butterfly Valves with EPDM Seat and Ductile-Iron Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. ABZ Valve and Controls; a division of ABZ Manufacturing, Inc.
- b. American Valve, Inc.
- c. Conbraco Industries, Inc.; Apollo Valves.
- d. Cooper Cameron Valves; a division of Cooper Cameron Corporation.
- e. Crane Co.; Crane Valve Group; Center Line.
- f. Crane Co.; Crane Valve Group; Stockham Division.
- g. DeZurik Water Controls.
- h. Flo Fab Inc.
- i. Hammond Valve.
- j. Kitz Corporation.
- k. Legend Valve.
- l. Milwaukee Valve Company.
- m. Mueller Steam Specialty; a division of SPX Corporation.
- n. NIBCO INC.
- o. Norriseal; a Dover Corporation company.
- p. Spence Strainers International; a division of CIRCOR International, Inc.
- q. Sure Flow Equipment Inc.
- r. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

- a. Standard: MSS SP-67, Type I.
- b. CWP Rating: 200 psig.

- c. Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
- d. Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.
- e. Seat: EPDM.
- f. Stem: One- or two-piece stainless steel.
- g. Disc: Nickel-plated ductile iron.

D. 200 CWP, Iron, Single-Flange Butterfly Valves with NBR Seat and Ductile-Iron Disc:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ABZ Valve and Controls; a division of ABZ Manufacturing, Inc.
 - b. American Valve, Inc.
 - c. Conbraco Industries, Inc.; Apollo Valves.
 - d. Cooper Cameron Valves; a division of Cooper Cameron Corporation.
 - e. Crane Co.; Crane Valve Group; Center Line.
 - f. Crane Co.; Crane Valve Group; Stockham Division.
 - g. DeZurik Water Controls.
 - h. Flo Fab Inc.
 - i. Hammond Valve.
 - j. Kitz Corporation.
 - k. Legend Valve.
 - l. Milwaukee Valve Company.
 - m. Mueller Steam Specialty; a division of SPX Corporation.
 - n. NIBCO INC.
 - o. Norriseal; a Dover Corporation company.
 - p. Spence Strainers International; a division of CIRCOR International, Inc.
 - q. Sure Flow Equipment Inc.
 - r. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
- 2. Description:
 - a. Standard: MSS SP-67, Type I.
 - b. CWP Rating: 200 psig.
 - c. Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
 - d. Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.
 - e. Seat: NBR.
 - f. Stem: One- or two-piece stainless steel.
 - g. Disc: Nickel-plated ductile iron.

E. 200 CWP, Iron, Single-Flange Butterfly Valves with EPDM Seat and Stainless-Steel Disc:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ABZ Valve and Controls; a division of ABZ Manufacturing, Inc.
 - b. American Valve, Inc.
 - c. Conbraco Industries, Inc.; Apollo Valves.
 - d. Cooper Cameron Valves; a division of Cooper Cameron Corporation.
 - e. Crane Co.; Crane Valve Group; Jenkins Valves.
 - f. Crane Co.; Crane Valve Group; Stockham Division.
 - g. DeZurik Water Controls.
 - h. Flo Fab Inc.
 - i. Hammond Valve.

- j. Kitz Corporation.
- k. Legend Valve.
- l. Milwaukee Valve Company.
- m. Mueller Steam Specialty; a division of SPX Corporation.
- n. NIBCO INC.
- o. Norriseal; a Dover Corporation company.
- p. Red-White Valve Corporation.
- q. Spence Strainers International; a division of CIRCOR International, Inc.
- r. Sure Flow Equipment Inc.
- s. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

- a. Standard: MSS SP-67, Type I.
- b. CWP Rating: 200 psig.
- c. Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
- d. Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.
- e. Seat: EPDM.
- f. Stem: One- or two-piece stainless steel.
- g. Disc: Stainless steel.

F. 200 CWP, Iron, Single-Flange Butterfly Valves with NBR Seat and Stainless-Steel Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. ABZ Valves and Controls; A div. of ABZ Manufacturing, Inc.
- b. American Valve, Inc.
- c. Conbraco Industries, Inc.; Apollo Valves.
- d. Cooper Cameron Valves; A div. of Cooper Cameron Corp.
- e. Crane Co.; Crane Valve Group; Jenkins Valves.
- f. Crane Co.; Crane Valve Group; Stockham Div.
- g. DeZurik Water Controls.
- h. Flo Fab Inc.
- i. Hammond Valve.
- j. Kitz Corporation.
- k. Legend Valve.
- l. Milwaukee Valve Company.
- m. Mueller Steam Specialty; a division of SPX Corporation.
- n. NIBCO INC.
- o. Norriseal; a Dover Corporation company.
- p. Red-White Valve Corporation.
- q. Spence Strainers International; a division of CIRCOR International, Inc.
- r. Sure Flow Equipment Inc.
- s. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

- a. Standard: MSS SP-67, Type I.
- b. CWP Rating: 200 psig.
- c. Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
- d. Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.
- e. Seat: NBR.
- f. Stem: One- or two-piece stainless steel.

- g. Disc: Stainless steel.

2.7 IRON, GROOVED-END BUTTERFLY VALVES

A. 175 CWP, Iron, Grooved-End Butterfly Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Kennedy Valve; a division of McWane, Inc.
 - b. Shurjoint Piping Products.
 - c. Tyco Fire Products LP; Grinnell Mechanical Products.
 - d. Victaulic Company.
2. Description:
 - a. Standard: MSS SP-67, Type I.
 - b. CWP Rating: 175 psig.
 - c. Body Material: Coated, ductile iron.
 - d. Stem: Two-piece stainless steel.
 - e. Disc: Coated, ductile iron.
 - f. Seal: EPDM.

B. 300 CWP, Iron, Grooved-End Butterfly Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Anvil International, Inc.
 - b. Kennedy Valve; a division of McWane, Inc.
 - c. Mueller Steam Specialty; a division of SPX Corporation.
 - d. NIBCO INC.
 - e. Shurjoint Piping Products.
 - f. Tyco Fire Products LP; Grinnell Mechanical Products.
 - g. Victaulic Company.
2. Description:
 - a. Standard: MSS SP-67, Type I.
 - b. NPS 8 and Smaller CWP Rating: 300 psig.
 - c. NPS 10 and Larger CWP Rating: 200 psig.
 - d. Body Material: Coated, ductile iron.
 - e. Stem: Two-piece stainless steel.
 - f. Disc: Coated, ductile iron.
 - g. Seal: EPDM.

2.8 BRONZE LIFT CHECK VALVES

A. Class 125, Lift Check Valves with Bronze Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. Crane Co.; Crane Valve Group; Crane Valves.
- b. Crane Co.; Crane Valve Group; Jenkins Valves.
- c. Crane Co.; Crane Valve Group; Stockham Division.

2. Description:

- a. Standard: MSS SP-80, Type 1.
- b. CWP Rating: 200 psig.
- c. Body Design: Vertical flow.
- d. Body Material: ASTM B 61 or ASTM B 62, bronze.
- e. Ends: Threaded.
- f. Disc: Bronze.

B. Class 125, Lift Check Valves with Nonmetallic Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. Flo Fab Inc.
- b. Hammond Valve.
- c. Kitz Corporation.
- d. Milwaukee Valve Company.
- e. Mueller Steam Specialty; a division of SPX Corporation.
- f. NIBCO INC.
- g. Red-White Valve Corporation.
- h. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

- a. Standard: MSS SP-80, Type 2.
- b. CWP Rating: 200 psig.
- c. Body Design: Vertical flow.
- d. Body Material: ASTM B 61 or ASTM B 62, bronze.
- e. Ends: Threaded.
- f. Disc: NBR, PTFE, or TFE.

2.9 BRONZE SWING CHECK VALVES

A. Class 125, Bronze Swing Check Valves with Bronze Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. American Valve, Inc.
- b. Crane Co.; Crane Valve Group; Crane Valves.
- c. Crane Co.; Crane Valve Group; Jenkins Valves.
- d. Crane Co.; Crane Valve Group; Stockham Division.
- e. Hammond Valve.
- f. Kitz Corporation.
- g. Milwaukee Valve Company.
- h. NIBCO INC.
- i. Powell Valves.
- j. Red-White Valve Corporation.
- k. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

- I. Zy-Tech Global Industries, Inc.
2. Description:
 - a. Standard: MSS SP-80, Type 3.
 - b. CWP Rating: 200 psig.
 - c. Body Design: Horizontal flow.
 - d. Body Material: ASTM B 62, bronze.
 - e. Ends: Threaded.
 - f. Disc: Bronze.
- B. Class 125, Bronze Swing Check Valves with Nonmetallic Disc:
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Crane Co.; Crane Valve Group; Crane Valves.
 - b. Crane Co.; Crane Valve Group; Jenkins Valves.
 - c. Crane Co.; Crane Valve Group; Stockham Division.
 - d. Hammond Valve.
 - e. Kitz Corporation.
 - f. Milwaukee Valve Company.
 - g. NIBCO INC.
 - h. Red-White Valve Corporation.
 - i. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
 2. Description:
 - a. Standard: MSS SP-80, Type 4.
 - b. CWP Rating: 200 psig.
 - c. Body Design: Horizontal flow.
 - d. Body Material: ASTM B 62, bronze.
 - e. Ends: Threaded.
 - f. Disc: PTFE or TFE.
- C. Class 150, Bronze Swing Check Valves with Bronze Disc:
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American Valve, Inc.
 - b. Crane Co.; Crane Valve Group; Crane Valves.
 - c. Crane Co.; Crane Valve Group; Jenkins Valves.
 - d. Crane Co.; Crane Valve Group; Stockham Division.
 - e. Kitz Corporation.
 - f. Milwaukee Valve Company.
 - g. NIBCO INC.
 - h. Red-White Valve Corporation.
 - i. Zy-Tech Global Industries, Inc.
 2. Description:
 - a. Standard: MSS SP-80, Type 3.
 - b. CWP Rating: 300 psig.
 - c. Body Design: Horizontal flow.

- d. Body Material: ASTM B 62, bronze.
- e. Ends: Threaded.
- f. Disc: Bronze.

D. Class 150, Bronze Swing Check Valves with Nonmetallic Disc:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Crane Co.; Crane Valve Group; Crane Valves.
 - b. Crane Co.; Crane Valve Group; Jenkins Valves.
 - c. Hammond Valve.
 - d. Milwaukee Valve Company.
 - e. NIBCO INC.
 - f. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
- 2. Description:
 - a. Standard: MSS SP-80, Type 4.
 - b. CWP Rating: 300 psig.
 - c. Body Design: Horizontal flow.
 - d. Body Material: ASTM B 62, bronze.
 - e. Ends: Threaded.
 - f. Disc: PTFE or TFE.

2.10 IRON SWING CHECK VALVES

A. Class 125, Iron Swing Check Valves with Metal Seats:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Crane Co.; Crane Valve Group; Crane Valves.
 - b. Crane Co.; Crane Valve Group; Jenkins Valves.
 - c. Crane Co.; Crane Valve Group; Stockham Division.
 - d. Hammond Valve.
 - e. Kitz Corporation.
 - f. Legend Valve.
 - g. Milwaukee Valve Company.
 - h. NIBCO INC.
 - i. Powell Valves.
 - j. Red-White Valve Corporation.
 - k. Sure Flow Equipment Inc.
 - l. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
 - m. Zy-Tech Global Industries, Inc.
- 2. Description:
 - a. Standard: MSS SP-71, Type I.
 - b. CWP Rating: 200 psig.
 - c. Body Design: Clear or full waterway.
 - d. Body Material: ASTM A 126, gray iron with bolted bonnet.
 - e. Ends: Flanged.
 - f. Trim: Bronze.

- g. Gasket: Asbestos free.

B. Class 125, Iron Swing Check Valves with Nonmetallic-to-Metal Seats:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Crane Co.; Crane Valve Group; Crane Valves.
 - b. Crane Co.; Crane Valve Group; Stockham Division.
2. Description:
 - a. Standard: MSS SP-71, Type I.
 - b. CWP Rating: 200 psig.
 - c. Body Design: Clear or full waterway.
 - d. Body Material: ASTM A 126, gray iron with bolted bonnet.
 - e. Ends: Flanged.
 - f. Trim: Composition.
 - g. Seat Ring: Bronze.
 - h. Disc Holder: Bronze.
 - i. Disc: PTFE or TFE.
 - j. Gasket: Asbestos free.

C. Class 250, Iron Swing Check Valves with Metal Seats:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
2. Crane Co.; Crane Valve Group; Crane Valves.
 - a. Crane Co.; Crane Valve Group; Jenkins Valves.
 - b. Crane Co.; Crane Valve Group; Stockham Division.
 - c. Hammond Valve.
 - d. Milwaukee Valve Company.
 - e. NIBCO INC.
 - f. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
3. Description:
 - a. Standard: MSS SP-71, Type I.
 - b. CWP Rating: 500 psig.
 - c. Body Design: Clear or full waterway.
 - d. Body Material: ASTM A 126, gray iron with bolted bonnet.
 - e. Ends: Flanged.
 - f. Trim: Bronze.
 - g. Gasket: Asbestos free.

2.11 IRON SWING CHECK VALVES WITH CLOSURE CONTROL

A. Class 125, Iron Swing Check Valves with Lever- and Spring-Closure Control:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. NIBCO INC.

2. Description:

- a. Standard: MSS SP-71, Type I.
- b. CWP Rating: 200 psig.
- c. Body Design: Clear or full waterway.
- d. Body Material: ASTM A 126, gray iron with bolted bonnet.
- e. Ends: Flanged.
- f. Trim: Bronze.
- g. Gasket: Asbestos free.
- h. Closure Control: Factory-installed, exterior lever and spring.

B. Class 125, Iron Swing Check Valves with Lever- and Weight-Closure Control:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. Crane Co.; Crane Valve Group; Crane Valves.
- b. Crane Co.; Crane Valve Group; Jenkins Valves.
- c. Crane Co.; Crane Valve Group; Stockham Division.
- d. Hammond Valve.
- e. Milwaukee Valve Company.
- f. NIBCO INC.
- g. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
- h. Description:
 - i. Standard: MSS SP-71, Type I.
 - j. CWP Rating: 200 psig.
 - k. Body Design: Clear or full waterway.
 - l. Body Material: ASTM A 126, gray iron with bolted bonnet.
 - m. Ends: Flanged.
 - n. Trim: Bronze.
 - o. Gasket: Asbestos free.
 - p. Closure Control: Factory-installed, exterior lever and weight.

2.12 IRON, GROOVED-END SWING CHECK VALVES

A. 300 CWP, Iron, Grooved-End Swing Check Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. Anvil International, Inc.
- b. Shurjoint Piping Products.
- c. Tyco Fire Products LP; Grinnell Mechanical Products.
- d. Victaulic Company.

2. Description:

- a. CWP Rating: 300 psig (2070 kPa).
- b. Body Material: ASTM A 536, ductile iron.
- c. Seal: EPDM.
- d. Disc: Spring-operated, ductile iron or stainless steel.

2.13 IRON, CENTER-GUIDED CHECK VALVES

A. Class 125, Iron, Compact-Wafer, Center-Guided Check Valves with Metal Seat:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Anvil International, Inc.
 - b. APCO Willamette Valve and Primer Corporation.
 - c. Crispin Valve.
 - d. DFT Inc.
 - e. Flo Fab Inc.
 - f. GA Industries, Inc.
 - g. Hammond Valve.
 - h. Metraflex, Inc.
 - i. Milwaukee Valve Company.
 - j. Mueller Steam Specialty; a division of SPX Corporation.
 - k. NIBCO INC.
 - l. Spence Strainers International; a division of CIRCOR International, Inc.
 - m. Sure Flow Equipment Inc.
 - n. Val-Matic Valve & Manufacturing Corp.
 - o. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
2. Description:
 - a. Standard: MSS SP-125.
 - b. CWP Rating: 200 psig.
 - c. Body Material: ASTM A 126, gray iron.
 - d. Style: Compact wafer.
 - e. Seat: Bronze.

B. Class 125, Iron, Globe, Center-Guided Check Valves with Metal Seat:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. APCO Willamette Valve and Primer Corporation.
 - b. Crispin Valve.
 - c. DFT Inc.
 - d. Flomatic Corporation.
 - e. Hammond Valve.
 - f. Metraflex, Inc.
 - g. Milwaukee Valve Company.
 - h. Mueller Steam Specialty; a division of SPX Corporation.
 - i. NIBCO INC.
 - j. Spence Strainers International; a division of CIRCOR International, Inc.
 - k. Sure Flow Equipment Inc.
 - l. Val-Matic Valve & Manufacturing Corp.
 - m. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
2. Description:
 - a. Standard: MSS SP-125.
 - b. CWP Rating: 200 psig.
 - c. Body Material: ASTM A 126, gray iron.

- d. Style: Globe, spring loaded.
- e. Ends: Flanged.
- f. Seat: Bronze.

C. Class 150, Iron, Compact-Wafer, Center-Guided Check Valves with Metal Seat:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. APCO Willamette Valve and Primer Corporation.
 - b. Crispin Valve.
 - c. Val-Matic Valve & Manufacturing Corp.
- 2. Description:
 - a. Standard: MSS SP-125.
 - b. CWP Rating: 300 psig.
 - c. Body Material: ASTM A 395/A 395M or ASTM A 536, ductile iron.
 - d. Style: Compact wafer.
 - e. Seat: Bronze.

D. Class 150, Iron, Globe, Center-Guided Check Valves with Metal Seat:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. APCO Willamette Valve and Primer Corporation.
 - b. Crispin Valve.
 - c. Val-Matic Valve & Manufacturing Corp.
- 2. Description:
 - a. Standard: MSS SP-125.
 - b. CWP Rating: 300 psig.
 - c. Body Material: ASTM A 395/A 395M or ASTM A 536, ductile iron.
 - d. Style: Globe, spring loaded.
 - e. Ends: Flanged.
 - f. Seat: Bronze.

E. Class 250, Iron, Compact-Wafer, Center-Guided Check Valves with Metal Seat:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. APCO Willamette Valve and Primer Corporation.
 - b. Crispin Valve.
 - c. DFT Inc.
 - d. Flo Fab Inc.
 - e. Hammond Valve.
 - f. Metraflex, Inc.
 - g. Milwaukee Valve Company.
 - h. NIBCO INC.
 - i. Sure Flow Equipment Inc.
 - j. Val-Matic Valve & Manufacturing Corp.

2. Description:

- a. Standard: MSS SP-125.
- b. CWP Rating: 400 psig.
- c. Body Material: ASTM A 126, gray iron.
- d. Style: Compact wafer, spring loaded.
- e. Seat: Bronze.

F. Class 250, Iron, Globe, Center-Guided Check Valves with Metal Seat:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. APCO Willamette Valve and Primer Corporation.
- b. Crispin Valve.
- c. DFT Inc.
- d. Flomatic Corporation.
- e. Hammond Valve.
- f. Metraflex, Inc.
- g. Milwaukee Valve Company.
- h. Mueller Steam Specialty; a division of SPX Corporation.
- i. NIBCO INC.
- j. Val-Matic Valve & Manufacturing Corp.

2. Description:

- a. Standard: MSS SP-125.
- b. CWP Rating: 400 psig.
- c. Body Material: ASTM A 126, gray iron.
- d. Style: Globe, spring loaded.
- e. Ends: Flanged.
- f. Seat: Bronze.

G. Class 300, Iron, Compact-Wafer, Center-Guided Check Valves with Metal Seat:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. APCO Willamette Valve and Primer Corporation.
- b. Crispin Valve.
- c. Val-Matic Valve & Manufacturing Corp.

2. Description:

- a. Standard: MSS SP-125.
- b. CWP Rating: 500 psig.
- c. Body Material: ASTM A 395/A 395M or ASTM A 536, ductile iron.
- d. Style: Compact wafer, spring loaded.
- e. Seat: Bronze.

H. Class 300, Iron, Globe, Center-Guided Check Valves with Metal Seat:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. APCO Willamette Valve and Primer Corporation.
 - b. Crispin Valve.
 - c. Val-Matic Valve & Manufacturing Corp.
 - 2. Description:
 - a. Standard: MSS SP-125.
 - b. CWP Rating: 500 psig.
 - c. Body Material: ASTM A 395/A 395M or ASTM A 536, ductile iron.
 - d. Style: Globe, spring loaded.
 - e. Ends: Flanged.
 - f. Seat: Bronze.
- I. Class 125, Iron, Compact-Wafer, Center-Guided Check Valves with Resilient Seat:
- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. APCO Willamette Valve and Primer Corporation.
 - b. Crispin Valve.
 - c. DFT Inc.
 - d. Flo Fab Inc.
 - e. Hammond Valve.
 - f. Milwaukee Valve Company.
 - g. NIBCO INC.
 - h. Spence Strainers International; a division of CIRCOR International, Inc.
 - i. Sure Flow Equipment Inc.
 - j. Val-Matic Valve & Manufacturing Corp.
 - 2. Description:
 - a. Standard: MSS SP-125.
 - b. CWP Rating: 200 psig.
 - c. Body Material: ASTM A 126, gray iron.
 - d. Style: Compact wafer.
 - e. Seat: EPDM.
- J. Class 125, Iron, Globe, Center-Guided Check Valves with Resilient Seat:
- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Anvil International, Inc.
 - b. APCO Willamette Valve and Primer Corporation.
 - c. Crispin Valve.
 - d. DFT Inc.
 - e. GA Industries, Inc.
 - f. Hammond Valve.
 - g. Milwaukee Valve Company.
 - h. NIBCO INC.
 - i. Sure Flow Equipment Inc.
 - j. Val-Matic Valve & Manufacturing Corp.
 - 2. Description:

- a. Standard: MSS SP-125.
- b. CWP Rating: 200 psig.
- c. Body Material: ASTM A 126, gray iron.
- d. Style: Globe, spring loaded.
- e. Ends: Flanged.
- f. Seat: EPDM.

K. Class 150, Iron, Compact-Wafer, Center-Guided Check Valves with Resilient Seat:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. APCO Willamette Valve and Primer Corporation.
 - b. Crispin Valve.
 - c. Val-Matic Valve & Manufacturing Corp.
- 2. Description:
 - a. Standard: MSS SP-125.
 - b. CWP Rating: 300 psig.
 - c. Body Material: ASTM A 395/A 395M or ASTM A 536, ductile iron.
 - d. Style: Compact wafer.
 - e. Seat: **EPDM**.

L. Class 150, Iron, Globe, Center-Guided Check Valves with Resilient Seat:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. APCO Willamette Valve and Primer Corporation.
 - b. Crispin Valve.
 - c. DFT Inc.
 - d. Val-Matic Valve & Manufacturing Corp.
- 2. Description:
 - a. Standard: MSS SP-125.
 - b. CWP Rating: 300 psig.
 - c. Body Material: ASTM A 395/A 395M or ASTM A 536, ductile iron.
 - d. Style: Globe, spring loaded.
 - e. Ends: Flanged.
 - f. Seat: EPDM.

M. Class 250, Iron, Compact-Wafer, Center-Guided Check Valves with Resilient Seat:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. APCO Willamette Valve and Primer Corporation.
 - b. Crispin Valve.
 - c. DFT Inc.
 - d. Flo Fab Inc.
 - e. Hammond Valve.
 - f. Milwaukee Valve Company.
 - g. NIBCO INC.

- h. Sure Flow Equipment Inc.
- i. Val-Matic Valve & Manufacturing Corp.

2. Description:

- a. Standard: MSS SP-125.
- b. CWP Rating: 400 psig.
- c. Body Material: ASTM A 126, gray iron.
- d. Style: Compact wafer, spring loaded.
- e. Seat: EPDM.

N. Class 250, Iron, Globe, Center-Guided Check Valves with Resilient Seat:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. APCO Willamette Valve and Primer Corporation.
- b. Crispin Valve.
- c. DFT Inc.
- d. Hammond Valve.
- e. Milwaukee Valve Company.
- f. NIBCO INC.
- g. Val-Matic Valve & Manufacturing Corp.

2. Description:

- a. Standard: MSS SP-125.
- b. CWP Rating: 400 psig.
- c. Body Material: ASTM A 126, gray iron.
- d. Style: Globe, spring loaded.
- e. Ends: Flanged.
- f. Seat: EPDM.

O. Class 300, Iron, Compact-Wafer, Center-Guided Check Valves with Resilient Seat:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. APCO Willamette Valve and Primer Corporation.
- b. Crispin Valve.
- c. Val-Matic Valve & Manufacturing Corp.

2. Description:

- a. Standard: MSS SP-125.
- b. CWP Rating: 500 psig.
- c. Body Material: ASTM A 395/A 395M or ASTM A 536, ductile iron.
- d. Style: Compact wafer, spring loaded.
- e. Seat: EPDM.

P. Class 300, Iron, Globe, Center-Guided Check Valves with Resilient Seat:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. APCO Willamette Valve and Primer Corporation.
- b. Crispin Valve.
- c. Val-Matic Valve & Manufacturing Corp.

2. Description:

- a. Standard: MSS SP-125.
- b. CWP Rating: 500 psig.
- c. Body Material: ASTM A 395/A 395M or ASTM A 536, ductile iron.
- d. Style: Globe, spring loaded.
- e. Ends: Flanged.
- f. Seat: EPDM.

2.14 IRON, PLATE-TYPE CHECK VALVES

A. Class 125, Iron, Dual-Plate Check Valves with Metal Seat:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. APCO Willamette Valve and Primer Corporation.
- b. Crane Co.; Crane Valve Group; Crane Valves.
- c. Flomatic Corporation.
- d. Mueller Steam Specialty; a division of SPX Corporation.

2. Description:

- a. Standard: API 594.
- b. CWP Rating: 200 psig.
- c. Body Design: Wafer, spring-loaded plates.
- d. Body Material: ASTM A 126, gray iron.
- e. Seat: Bronze.

B. Class 150, Iron, Dual-Plate Check Valves with Metal Seat:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. APCO Willamette Valve and Primer Corporation.
- b. Crane Co.; Crane Valve Group; Crane Valves.
- c. Mueller Steam Specialty; a division of SPX Corporation.
- d. Val-Matic Valve & Manufacturing Corp.

2. Description:

- a. Standard: API 594.
- b. CWP Rating: 300 psig.
- c. Body Design: Wafer, spring-loaded plates.
- d. Body Material: ASTM A 395/A 395M or ASTM A 536, ductile iron.
- e. Seat: Bronze.

C. Class 250, Iron, Dual-Plate Check Valves with Metal Seat:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. APCO Willamette Valve and Primer Corporation.
 - b. Crane Co.; Crane Valve Group; Crane Valves.
 2. Description:
 - a. Standard: API 594.
 - b. CWP Rating: 400 psig.
 - c. Body Design: Wafer, spring-loaded plates.
 - d. Body Material: ASTM A 126, gray iron.
 - e. Seat: Bronze.
- D. Class 300, Iron, Dual-Plate Check Valves with Metal Seat:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. APCO Willamette Valve and Primer Corporation.
 - b. Crane Co.; Crane Valve Group; Crane Valves.
 - c. Mueller Steam Specialty; a division of SPX Corporation.
 - d. Val-Matic Valve & Manufacturing Corp.
 2. Description:
 - a. Standard: API 594.
 - b. CWP Rating: 500 psig.
 - c. Body Design: Wafer, spring-loaded plates.
 - d. Body Material: ASTM A 395/A 395M or ASTM A 536, ductile iron.
 - e. Seat: Bronze.
- E. Class 125, Iron, Single-Plate Check Valves with Resilient Seat:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Flo Fab Inc.
 - b. Sure Flow Equipment Inc.
 2. Description:
 - a. Standard: API 594.
 - b. CWP Rating: 200 psig.
 - c. Body Design: Wafer, spring-loaded plate.
 - d. Body Material: ASTM A 126, gray iron.
 - e. Seat: EPDM.
- F. Class 125, Iron, Dual-Plate Check Valves with Resilient Seat:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. APCO Willamette Valve and Primer Corporation.
 - b. Cooper Cameron Valves TVB Techno.

- c. Crane Co.; Crane Valve Group; Crane Valves.
- d. Crane Co.; Crane Valve Group; Stockham Division.
- e. NIBCO INC.
- f. Spence Strainers International; a division of CIRCOR International, Inc.
- g. Sure Flow Equipment Inc.
- h. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

- a. Standard: API 594.
- b. CWP Rating: 200 psig.
- c. Body Design: Wafer, spring-loaded plates.
- d. Body Material: ASTM A 126, gray iron.
- e. Seat: EPDM.

G. Class 150, Iron, Dual-Plate Check Valves with Resilient Seat:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. APCO Willamette Valve and Primer Corporation.
- b. Crane Co.; Crane Valve Group; Crane Valves.
- c. Crane Co.; Crane Valve Group; Jenkins Valves.
- d. Val-Matic Valve & Manufacturing Corp.

2. Description:

- a. Standard: API 594.
- b. CWP Rating: 300 psig.
- c. Body Design: Wafer, spring-loaded plates.
- d. Body Material: ASTM A 395/A 395M or ASTM A 536, ductile iron.
- e. Seat: EPDM.

H. Class 250, Iron, Wafer, Single-Plate Check Valves with Resilient Seat:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. Sure Flow Equipment Inc.

2. Description:

- a. Standard: API 594.
- b. CWP Rating: 400 psig.
- c. Body Design: Wafer, spring-loaded plate.
- d. Body Material: ASTM A 126, gray iron.
- e. Seat: EPDM.

I. Class 250, Iron, Dual-Plate Check Valves with Resilient Seat:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. APCO Willamette Valve and Primer Corporation.
- b. Crane Co.; Crane Valve Group; Crane Valves.

- c. Sure Flow Equipment Inc.

2. Description:

- a. Standard: API 594.
- b. CWP Rating: 400 psig.
- c. Body Design: Wafer, spring-loaded plates.
- d. Body Material: ASTM A 126, gray iron.
- e. Seat: EPDM.

J. Class 300, Iron, Dual-Plate Check Valves with Resilient Seat:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. APCO Willamette Valve and Primer Corporation.
- b. Val-Matic Valve & Manufacturing Corp.

2. Description:

- a. Standard: API 594.
- b. CWP Rating: 500 psig.
- c. Body Design: Wafer, spring-loaded plates.
- d. Body Material: ASTM A 395/A 395M or ASTM A 536, ductile iron.
- e. Seat: EPDM.

2.15 BRONZE GATE VALVES

A. Class 125, NRS Bronze Gate Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. American Valve, Inc.
- b. Crane Co.; Crane Valve Group; Crane Valves.
- c. Crane Co.; Crane Valve Group; Jenkins Valves.
- d. Crane Co.; Crane Valve Group; Stockham Division.
- e. Hammond Valve.
- f. Kitz Corporation.
- g. Milwaukee Valve Company.
- h. NIBCO INC.
- i. Powell Valves.
- j. Red-White Valve Corporation.
- k. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
- l. Zy-Tech Global Industries, Inc.

2. Description:

- a. Standard: MSS SP-80, Type 1.
- b. CWP Rating: 200 psig.
- c. Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.
- d. Ends: Threaded or solder joint.
- e. Stem: Bronze.
- f. Disc: Solid wedge; bronze.

- g. Packing: Asbestos free.
- h. Handwheel: Malleable iron, bronze, or aluminum.

B. Class 125, RS Bronze Gate Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American Valve, Inc.
 - b. Crane Co.; Crane Valve Group; Crane Valves.
 - c. Crane Co.; Crane Valve Group; Jenkins Valves.
 - d. Crane Co.; Crane Valve Group; Stockham Division.
 - e. Hammond Valve.
 - f. Kitz Corporation.
 - g. Milwaukee Valve Company.
 - h. NIBCO INC.
 - i. Powell Valves.
 - j. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
 - k. Zy-Tech Global Industries, Inc.
2. Description:
 - a. Standard: MSS SP-80, Type 2.
 - b. CWP Rating: 200 psig.
 - c. Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.
 - d. Ends: Threaded or solder joint.
 - e. Stem: Bronze.
 - f. Disc: Solid wedge; bronze.
 - g. Packing: Asbestos free.
 - h. Handwheel: Malleable iron, bronze, or aluminum.

C. Class 150, NRS Bronze Gate Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Hammond Valve.
 - b. Kitz Corporation.
 - c. Milwaukee Valve Company.
 - d. NIBCO INC.
 - e. Powell Valves.
 - f. Red-White Valve Corporation.
 - g. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
2. Description:
 - a. Standard: MSS SP-80, Type 1.
 - b. CWP Rating: 300 psig.
 - c. Body Material: ASTM B 62, bronze with integral seat and union-ring bonnet.
 - d. Ends: Threaded.
 - e. Stem: Bronze.
 - f. Disc: Solid wedge; bronze.
 - g. Packing: Asbestos free.
 - h. Handwheel: Malleable iron, bronze, or aluminum.

D. Class 150, RS Bronze Gate Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Crane Co.; Crane Valve Group; Crane Valves.
 - b. Crane Co.; Crane Valve Group; Stockham Division.
 - c. Hammond Valve.
 - d. Kitz Corporation.
 - e. Milwaukee Valve Company.
 - f. NIBCO INC.
 - g. Powell Valves.
 - h. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
 - i. Zy-Tech Global Industries, Inc.
2. Description:
 - a. Standard: MSS SP-80, Type 2.
 - b. CWP Rating: 300 psig.
 - c. Body Material: ASTM B 62, bronze with integral seat and union-ring bonnet.
 - d. Ends: Threaded.
 - e. Stem: Bronze.
 - f. Disc: Solid wedge; bronze.
 - g. Packing: Asbestos free.
 - h. Handwheel: Malleable iron, bronze, or aluminum.

2.16 IRON GATE VALVES

A. Class 125, NRS, Iron Gate Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Crane Co.; Crane Valve Group; Crane Valves.
 - b. Crane Co.; Crane Valve Group; Jenkins Valves.
 - c. Crane Co.; Crane Valve Group; Stockham Division.
 - d. Flo Fab Inc.
 - e. Hammond Valve.
 - f. Kitz Corporation.
 - g. Legend Valve.
 - h. Milwaukee Valve Company.
 - i. NIBCO INC.
 - j. Powell Valves.
 - k. Red-White Valve Corporation.
 - l. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
 - m. Zy-Tech Global Industries, Inc.
2. Description:
 - a. Standard: MSS SP-70, Type I.
 - b. CWP Rating: 200 psig.
 - c. Body Material: ASTM A 126, gray iron with bolted bonnet.
 - d. Ends: Flanged.
 - e. Trim: Bronze.

- f. Disc: Solid wedge.
- g. Packing and Gasket: Asbestos free.

B. Class 125, OS&Y, Iron Gate Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Crane Co.; Crane Valve Group; Crane Valves.
 - b. Crane Co.; Crane Valve Group; Jenkins Valves.
 - c. Crane Co.; Crane Valve Group; Stockham Division.
 - d. Flo Fab Inc.
 - e. Hammond Valve.
 - f. Kitz Corporation.
 - g. Legend Valve.
 - h. Milwaukee Valve Company.
 - i. NIBCO INC.
 - j. Powell Valves.
 - k. Red-White Valve Corporation.
 - l. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
 - m. Zy-Tech Global Industries, Inc.
2. Description:
 - a. Standard: MSS SP-70, Type I.
 - b. CWP Rating: 200 psig.
 - c. Body Material: ASTM A 126, gray iron with bolted bonnet.
 - d. Ends: Flanged.
 - e. Trim: Bronze.
 - f. Disc: Solid wedge.
 - g. Packing and Gasket: Asbestos free.

C. Class 250, NRS, Iron Gate Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Crane Co.; Crane Valve Group; Crane Valves.
 - b. Crane Co.; Crane Valve Group; Stockham Division.
 - c. NIBCO INC.
2. Description:
 - a. Standard: MSS SP-70, Type I.
 - b. CWP Rating: 500 psig.
 - c. Body Material: ASTM A 126, gray iron with bolted bonnet.
 - d. Ends: Flanged.
 - e. Trim: Bronze.
 - f. Disc: Solid wedge.
 - g. Packing and Gasket: Asbestos free.

D. Class 250, OS&Y, Iron Gate Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. Crane Co.; Crane Valve Group; Crane Valves.
- b. Crane Co.; Crane Valve Group; Stockham Division.
- c. Hammond Valve.
- d. Milwaukee Valve Company.
- e. NIBCO INC.
- f. Powell Valves.
- g. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

- a. Standard: MSS SP-70, Type I.
- b. CWP Rating: 500 psig.
- c. Body Material: ASTM A 126, gray iron with bolted bonnet.
- d. Ends: Flanged.
- e. Trim: Bronze.
- f. Disc: Solid wedge.
- g. Packing and Gasket: Asbestos free.

2.17 BRONZE GLOBE VALVES

A. Class 125, Bronze Globe Valves with Bronze Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. Crane Co.; Crane Valve Group; Crane Valves.
- b. Crane Co.; Crane Valve Group; Stockham Division.
- c. Hammond Valve.
- d. Kitz Corporation.
- e. Milwaukee Valve Company.
- f. NIBCO INC.
- g. Powell Valves.
- h. Red-White Valve Corporation.
- i. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
- j. Zy-Tech Global Industries, Inc.

2. Description:

- a. Standard: MSS SP-80, Type 1.
- b. CWP Rating: 200 psig.
- c. Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.
- d. Ends: Threaded or solder joint.
- e. Stem and Disc: Bronze.
- f. Packing: Asbestos free.
- g. Handwheel: Malleable iron, bronze, or aluminum.

B. Class 125, Bronze Globe Valves with Nonmetallic Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. Crane Co.; Crane Valve Group; Crane Valves.
- b. Crane Co.; Crane Valve Group; Stockham Division.
- c. NIBCO INC.

d. Red-White Valve Corporation.

2. Description:

- a. Standard: MSS SP-80, Type 2.
- b. CWP Rating: 200 psig.
- c. Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.
- d. Ends: Threaded or solder joint.
- e. Stem: Bronze.
- f. Disc: PTFE or TFE.
- g. Packing: Asbestos free.
- h. Handwheel: Malleable iron, bronze, or aluminum.

C. Class 150, Bronze Globe Valves with Nonmetallic Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. Crane Co.; Crane Valve Group; Crane Valves.
- b. Hammond Valve.
- c. Kitz Corporation.
- d. Milwaukee Valve Company.
- e. NIBCO INC.
- f. Powell Valves.
- g. Red-White Valve Corporation.
- h. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
- i. Zy-Tech Global Industries, Inc.

2. Description:

- a. Standard: MSS SP-80, Type 2.
- b. CWP Rating: 300 psig.
- c. Body Material: ASTM B 62, bronze with integral seat and union-ring bonnet.
- d. Ends: Threaded.
- e. Stem: Bronze.
- f. Disc: PTFE or TFE.
- g. Packing: Asbestos free.
- h. Handwheel: Malleable iron, bronze, or aluminum.

2.18 IRON GLOBE VALVES

A. Class 125, Iron Globe Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. Crane Co.; Crane Valve Group; Crane Valves.
- b. Crane Co.; Crane Valve Group; Jenkins Valves.
- c. Crane Co.; Crane Valve Group; Stockham Division.
- d. Hammond Valve.
- e. Kitz Corporation.
- f. Milwaukee Valve Company.
- g. NIBCO INC.
- h. Powell Valves.

- i. Red-White Valve Corporation.
- j. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
- k. Zy-Tech Global Industries, Inc.

2. Description:

- a. Standard: MSS SP-85, Type I.
- b. CWP Rating: 200 psig.
- c. Body Material: ASTM A 126, gray iron with bolted bonnet.
- d. Ends: Flanged.
- e. Trim: Bronze.
- f. Packing and Gasket: Asbestos free.

B. Class 250, Iron Globe Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. Crane Co.; Crane Valve Group; Crane Valves.
- b. Crane Co.; Crane Valve Group; Jenkins Valves.
- c. Crane Co.; Crane Valve Group; Stockham Division.
- d. Hammond Valve.
- e. Milwaukee Valve Company.
- f. NIBCO INC.
- g. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

- a. Standard: MSS SP-85, Type I.
- b. CWP Rating: 500 psig.
- c. Body Material: ASTM A 126, gray iron with bolted bonnet.
- d. Ends: Flanged.
- e. Trim: Bronze.
- f. Packing and Gasket: Asbestos free.

2.19 LUBRICATED PLUG VALVES

A. Class 125, Regular-Gland, Lubricated Plug Valves with Threaded Ends:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. Nordstrom Valves, Inc.

2. Description:

- a. Standard: MSS SP-78, Type II.
- b. CWP Rating: 200 psig.
- c. Body Material: ASTM A 48/A 48M or ASTM A 126, cast iron with lubrication-sealing system.
- d. Pattern: Regular or short.
- e. Plug: Cast iron or bronze with sealant groove.

B. Class 125, Regular-Gland, Lubricated Plug Valves with Flanged Ends:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Nordstrom Valves, Inc.
 2. Description:
 - a. Standard: MSS SP-78, Type II.
 - b. CWP Rating: 200 psig.
 - c. Body Material: ASTM A 48/A 48M or ASTM A 126, cast iron with lubrication-sealing system.
 - d. Pattern: Regular or short.
 - e. Plug: Cast iron or bronze with sealant groove.
- C. Class 125, Cylindrical, Lubricated Plug Valves with Threaded Ends:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Homestead Valve; a division of Olson Technologies, Inc.
 - b. Milliken Valve Company.
 - c. R & M Energy Systems; a unit of Robbins & Myers, Inc.
 2. Description:
 - a. Standard: MSS SP-78, Type IV.
 - b. CWP Rating: 200 psig.
 - c. Body Material: ASTM A 48/A 48M or ASTM A 126, cast iron with lubrication-sealing system.
 - d. Pattern: **Regular or short.**
 - e. Plug: Cast iron or bronze with sealant groove.
- D. Class 125, Cylindrical, Lubricated Plug Valves with Flanged Ends:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Homestead Valve; a division of Olson Technologies, Inc.
 - b. Milliken Valve Company.
 - c. R & M Energy Systems; a unit of Robbins & Myers, Inc.
 2. Description:
 - a. Standard: MSS SP-78, Type IV.
 - b. CWP Rating: 200 psig.
 - c. Body Material: ASTM A 48/A 48M or ASTM A 126, cast iron with lubrication-sealing system.
 - d. Pattern: Regular or short.
 - e. Plug: Cast iron or bronze with sealant groove.
- E. Class 250, Regular-Gland, Lubricated Plug Valves with Threaded Ends:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. Nordstrom Valves, Inc.
2. Description:
- a. Standard: MSS SP-78, Type II.
 - b. CWP Rating: 400 psig.
 - c. Body Material: ASTM A 48/A 48M or ASTM A 126, cast iron with lubrication-sealing system.
 - d. Pattern: Regular or short.
 - e. Plug: Cast iron or bronze with sealant groove.
- F. Class 250, Regular-Gland, Lubricated Plug Valves with Flanged Ends:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- a. Nordstrom Valves, Inc.
2. Description:
- a. Standard: MSS SP-78, Type II.
 - b. CWP Rating: 400 psig.
 - c. Body Material: ASTM A 48/A 48M or ASTM A 126, cast iron with lubrication-sealing system.
 - d. Pattern: Regular or short.
 - e. Plug: Cast iron or bronze with sealant groove.
- G. Class 250, Cylindrical, Lubricated Plug Valves with Threaded Ends:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- a. Homestead Valve; a division of Olson Technologies, Inc.
 - b. Milliken Valve Company.
 - c. R & M Energy Systems; a unit of Robbins & Myers, Inc.
2. Description:
- a. Standard: MSS SP-78, Type IV.
 - b. CWP Rating: 400 psig.
 - c. Body Material: ASTM A 48/A 48M or ASTM A 126, cast iron with lubrication-sealing system.
 - d. Pattern: Regular or short.
 - e. Plug: Cast iron or bronze with sealant groove.
- H. Class 250, Cylindrical, Lubricated Plug Valves with Flanged Ends:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- a. Homestead Valve; a division of Olson Technologies, Inc.
 - b. Milliken Valve Company.
 - c. R & M Energy Systems; a unit of Robbins & Myers, Inc.
2. Description:

- a. Standard: MSS SP-78, Type IV.
- b. CWP Rating: 400 psig.
- c. Body Material: ASTM A 48/A 48M or ASTM A 126, Grade 40 cast iron with lubrication-sealing system.
- d. Pattern Regular or short.
- e. Plug: Cast iron or bronze with sealant groove.

2.20 NOT USED

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.
- B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.
- C. Examine threads on valve and mating pipe for form and cleanliness.
- D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.
- E. Do not attempt to repair defective valves; replace with new valves.

3.2 VALVE INSTALLATION

- A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
- B. Locate valves for easy access and provide separate support where necessary.
- C. Install valves in horizontal piping with stem at or above center of pipe.
- D. Install valves in position to allow full stem movement.
- E. NOT USED
- F. Install check valves for proper direction of flow and as follows:
 - 1. Swing Check Valves: In horizontal position with hinge pin level.
 - 2. Center-Guided Check Valves: In horizontal or vertical position, between flanges.
 - 3. Lift Check Valves: With stem upright and plumb.

3.3 ADJUSTING

- A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

3.4 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

- A. If valve applications are not indicated, use the following:
 - 1. Shutoff Service: Ball and butterfly valves.
 - 2. Butterfly Valve Dead-End Service: Single-flange (lug) type.
 - 3. Throttling Service: Globe or butterfly valves.
 - 4. Pump-Discharge Check Valves:
 - a. NPS 2 and Smaller: Bronze swing check valves with bronze disc.
 - b. NPS 2-1/2 and Larger for Domestic Water: Iron swing check valves with lever and weight or with spring or iron, center-guided, metal-seat check valves.
 - c. NPS 2-1/2 and Larger for Sanitary Waste and Storm Drainage: Iron swing check valves with lever and weight or spring.
- B. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP classes or CWP ratings may be substituted.
- C. Select valves, except wafer types, with the following end connections:
 - 1. For Copper Tubing, NPS 2 and Smaller: Threaded ends except where solder-joint valve-end option is indicated in valve schedules below.
 - 2. For Copper Tubing, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve-end option is indicated in valve schedules below.
 - 3. For Copper Tubing, NPS 5 and Larger: Flanged ends.
 - 4. For Steel Piping, NPS 2 and Smaller: Threaded ends.
 - 5. For Steel Piping, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve-end option is indicated in valve schedules below.
 - 6. For Steel Piping, NPS 5 and Larger: Flanged ends.
 - 7. For Grooved-End Copper Tubing and Steel Piping: Valve ends may be grooved.

3.5 NOT USED

3.6 NOT USED

3.7 DOMESTIC, HOT- AND COLD-WATER VALVE SCHEDULE

- A. Pipe NPS 2 and Smaller:
 - 1. Bronze and Brass Valves: May be provided with solder-joint ends instead of threaded ends.
 - 2. Bronze Angle Valves: Class 125 bronze disc.
 - 3. Ball Valves: One Piece, full Port, brass with brass trim.
 - 4. Bronze Swing Check Valves: Class 125 bronze disc.
 - 5. Bronze Gate Valves: Class 125 NRS.
 - 6. Bronze Globe Valves: Class 125, bronze disc.

B. Pipe NPS 2-1/2 and Larger:

1. Iron Valves, NPS 2-1/2: May be provided with threaded ends instead of flanged ends.
2. Iron Ball Valves: Class 150.
3. Iron, Single-Flange Butterfly Valves: 200 CWP, EPDM seat, aluminum-bronze disc.
4. Iron, Grooved-End Butterfly Valves: 175 CWP.
5. Iron Swing Check Valves: Class 125 metal seats.
6. Iron Swing Check Valves with Closure Control: Class 125, lever and spring weight.
7. Iron, Grooved-End Swing Check Valves: 300 CWP.
8. Iron, Center-Guided Check Valves: Class 125, metal seat.
9. Iron, Plate-Type Check Valves: Class 125; single plate; metal seat.
10. Iron Gate Valves: Class 125, NRS.
11. Iron Globe Valves: Class 125.

3.8 **Not Used**

END OF SECTION 22-0523

SECTION 22 05 29**HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT****PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

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

1.2 SUMMARY

- A. This Section includes the following hangers and supports for plumbing system piping and equipment:
 - 1. Steel pipe hangers and supports.
 - 2. Trapeze pipe hangers.
 - 3. Fiberglass pipe hangers.
 - 4. Metal framing systems.
 - 5. Fiberglass strut systems.
 - 6. Thermal-hanger shield inserts.
 - 7. Fastener systems.
 - 8. Pipe stands.
 - 9. Pipe positioning systems.
 - 10. Equipment supports.
- B. Related Sections include the following:
 - 1. Division 05 Section "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.
 - 2. Division 21 Section "Water-Based Fire-Suppression Systems" for pipe hangers for fire-suppression piping.
 - 3. Division 22 Section "Expansion Fittings and Loops for Plumbing Piping" for pipe guides and anchors.
 - 4. Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment" for vibration isolation devices.

1.3 DEFINITIONS

- A. MSS: Manufacturers Standardization Society for The Valve and Fittings Industry Inc.
- B. Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."

1.4 PERFORMANCE REQUIREMENTS

- A. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.

- B. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
- C. Design seismic-restraint hangers and supports for piping and equipment and obtain approval from authorities having jurisdiction.

1.5 SUBMITTALS

- A. Product Data: For the following:
 - 1. Steel pipe hangers and supports.
 - 2. Fiberglass pipe hangers.
 - 3. Thermal-hanger shield inserts.
 - 4. Powder-actuated fastener systems.
 - 5. Pipe positioning systems.
- B. Shop Drawings: Show fabrication and installation details and include calculations for the following:
 - 1. Trapeze pipe hangers. Include Product Data for components.
 - 2. Metal framing systems. Include Product Data for components.
 - 3. Fiberglass strut systems. Include Product Data for components.
 - 4. Pipe stands. Include Product Data for components.
 - 5. Equipment supports.
- C. Welding certificates.

1.6 QUALITY ASSURANCE

- A. Welding: Not Used
- B. Welding: Not Used

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
 - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 STEEL PIPE HANGERS AND SUPPORTS

- A. Description: MSS SP-58, Types 1 through 58, factory-fabricated components. Refer to Part 3 "Hanger and Support Applications" Article for where to use specific hanger and support types.

B. Manufacturers:

1. AAA Technology & Specialties Co., Inc.
2. Bergen-Power Pipe Supports.
3. B-Line Systems, Inc.; a division of Cooper Industries.
4. Carpenter & Paterson, Inc.
5. Empire Industries, Inc.
6. ERICO/Michigan Hanger Co.
7. Globe Pipe Hanger Products, Inc.
8. Grinnell Corp.
9. GS Metals Corp.
10. National Pipe Hanger Corporation.
11. PHD Manufacturing, Inc.
12. PHS Industries, Inc.
13. Piping Technology & Products, Inc.
14. Tolco Inc.

C. Galvanized, Metallic Coatings: Pregalvanized or hot dipped.

D. Nonmetallic Coatings: Plastic coating, jacket, or liner.

E. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion for support of bearing surface of piping.

2.3 TRAPEZE PIPE HANGERS

A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural-steel shapes with MSS SP-58 hanger rods, nuts, saddles, and U-bolts.

2.4 FIBERGLASS PIPE HANGERS

A. Clevis-Type, Fiberglass Pipe Hangers: Similar to MSS Type 1, steel pipe hanger except hanger is made of fiberglass and continuous-thread rod and nuts are made of polyurethane.

1. Manufacturers:

- a. B-Line Systems, Inc.; a division of Cooper Industries.
- b. Champion Fiberglass, Inc.
- c. Cope, T. J., Inc.; Tyco International, Ltd.
- d. Seasafe, Inc.
- e. Unistrut Corp.; Tyco International, Ltd.
- f. Wesanco, Inc.

B. Strap-Type, Fiberglass Pipe Hangers: Made of fiberglass loop with stainless-steel continuous-thread rod, nuts, and support hook.

1. Manufacturers:

- a. Plasti-Fab, Inc.

2.5 METAL FRAMING SYSTEMS

- A. Description: MFMA-3, shop- or field-fabricated pipe-support assembly made of steel channels and other components.
- B. Manufacturers:
 - 1. B-Line Systems, Inc.; a division of Cooper Industries.
 - 2. ERICO/Michigan Hanger Co.; ERISTRUT Div.
 - 3. GS Metals Corp.
 - 4. Power-Strut Div.; Tyco International, Ltd.
 - 5. Thomas & Betts Corporation.
 - 6. Tolco Inc.
 - 7. Unistrut Corp.; Tyco International, Ltd.
- C. Coatings: Manufacturer's standard finish unless bare metal surfaces are indicated.
- D. Nonmetallic Coatings: Plastic coating, jacket, or liner.

2.6 FIBERGLASS STRUT SYSTEMS

- A. Description: Shop- or field-fabricated pipe-support assembly, similar to MFMA-3, made of fiberglass channels and other components.
- B. Manufacturers:
 - 1. B-Line Systems, Inc.; a division of Cooper Industries.
 - 2. Champion Fiberglass, Inc.
 - 3. Cope, T. J., Inc.; Tyco International Ltd.
 - 4. Seasafe, Inc.

2.7 Not Used

2.8 FASTENER SYSTEMS

- A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
 - 1. Manufacturers:
 - a. Hilti, Inc.
 - b. ITW Ramset/Red Head.
 - c. Masterset Fastening Systems, Inc.
 - d. MKT Fastening, LLC.
 - e. Powers Fasteners.
- B. Mechanical-Expansion Anchors: Insert-wedge-type zinc-coated steel, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

1. Manufacturers:
 - a. B-Line Systems, Inc.; a division of Cooper Industries.
 - b. Empire Industries, Inc.
 - c. Hilti, Inc.
 - d. ITW Ramset/Red Head.
 - e. MKT Fastening, LLC.
 - f. Powers Fasteners.

2.9 PIPE STAND FABRICATION

- A. Pipe Stands, General: Shop or field-fabricated assemblies made of manufactured corrosion-resistant components to support roof-mounted piping.
- B. Compact Pipe Stand: One-piece plastic unit with integral-rod-roller, pipe clamps, or V-shaped cradle to support pipe, for roof installation without membrane penetration.

1. Manufacturers:
 - a. ERICO/Michigan Hanger Co.
 - b. MIRO Industries.

- C. Low-Type, Single-Pipe Stand: One-piece plastic base unit with plastic roller, for roof installation without membrane penetration.

1. Manufacturers:
 - a. MIRO Industries.

- D. High-Type, Single-Pipe Stand: Assembly of base, vertical and horizontal members, and pipe support, for roof installation without membrane penetration.

1. Manufacturers:
 - a. ERICO/Michigan Hanger Co.
 - b. MIRO Industries.
 - c. Portable Pipe Hangers.
2. Base: Plastic.
3. Vertical Members: Two or more cadmium-plated-steel or stainless-steel, continuous-thread rods.
4. Horizontal Member: Cadmium-plated-steel or stainless-steel rod with plastic or stainless-steel, roller-type pipe support.

- E. High-Type, Multiple-Pipe Stand: Assembly of bases, vertical and horizontal members, and pipe supports, for roof installation without membrane penetration.

1. Manufacturers:
 - a. Portable Pipe Hangers.
2. Bases: One or more plastic.
3. Vertical Members: Two or more protective-coated-steel channels.
4. Horizontal Member: Protective-coated-steel channel.

5. Pipe Supports: Galvanized-steel, clevis-type pipe hangers.

- F. Curb-Mounting-Type Pipe Stands: Shop- or field-fabricated pipe support made from structural-steel shape, continuous-thread rods, and rollers for mounting on permanent stationary roof curb.

2.10 PIPE POSITIONING SYSTEMS

- A. Description: IAPMO PS 42, system of metal brackets, clips, and straps for positioning piping in pipe spaces for plumbing fixtures for commercial applications.
- B. Manufacturers:
1. C & S Mfg. Corp.
 2. HOLDRITE Corp.; Hubbard Enterprises.
 3. Samco Stamping, Inc.

2.11 EQUIPMENT SUPPORTS

- A. Description: Welded, shop- or field-fabricated equipment support made from structural-steel shapes.

2.12 MISCELLANEOUS MATERIALS

- A. Structural Steel: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
- B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.
1. Properties: Nonstaining, noncorrosive, and nongaseous.
 2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT APPLICATIONS

- A. Specific hanger and support requirements are specified in Sections specifying piping systems and equipment.
- B. Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in piping system Sections.
- C. Use hangers and supports with galvanized, metallic coatings for piping and equipment that will not have field-applied finish.
- D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- E. Use padded hangers for piping that is subject to scratching.

- F. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated stationary pipes, NPS 1/2 to NPS 30.
 2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of 120 to 450 deg F pipes, NPS 4 to NPS 16, requiring up to 4 inches of insulation.
 3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes, NPS 3/4 to NPS 24, requiring clamp flexibility and up to 4 inches of insulation.
 4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes, NPS 1/2 to NPS 24, if little or no insulation is required.
 5. Pipe Hangers (MSS Type 5): For suspension of pipes, NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.
 6. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated stationary pipes, NPS 3/4 to NPS 8.
 7. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8.
 8. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8.
 9. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 2.
 10. Split Pipe-Ring with or without Turnbuckle-Adjustment Hangers (MSS Type 11): For suspension of noninsulated stationary pipes, NPS 3/8 to NPS 8.
 11. Extension Hinged or 2-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated stationary pipes, NPS 3/8 to NPS 3.
 12. U-Bolts (MSS Type 24): For support of heavy pipes, NPS 1/2 to NPS 30.
 13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
 14. Pipe Saddle Supports (MSS Type 36): For support of pipes, NPS 4 to NPS 36, with steel pipe base stanchion support and cast-iron floor flange.
 15. Pipe Stanchion Saddles (MSS Type 37): For support of pipes, NPS 4 to NPS 36, with steel pipe base stanchion support and cast-iron floor flange and with U-bolt to retain pipe.
 16. Adjustable, Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes, NPS 2-1/2 to NPS 36, if vertical adjustment is required, with steel pipe base stanchion support and cast-iron floor flange.
 17. Single Pipe Rolls (MSS Type 41): For suspension of pipes, NPS 1 to NPS 30, from 2 rods if longitudinal movement caused by expansion and contraction might occur.
 18. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes, NPS 2-1/2 to NPS 20, from single rod if horizontal movement caused by expansion and contraction might occur.
 19. Complete Pipe Rolls (MSS Type 44): For support of pipes, NPS 2 to NPS 42, if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.
 20. Pipe Roll and Plate Units (MSS Type 45): For support of pipes, NPS 2 to NPS 24, if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is not necessary.
 21. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes, NPS 2 to NPS 30, if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.
- G. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers, NPS 3/4 to NPS 20.

2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers, NPS 3/4 to NPS 20, if longer ends are required for riser clamps.
- H. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
 2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
 3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
 4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
 5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.
- I. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
 2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction to attach to top flange of structural shape.
 3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
 4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
 5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
 6. C-Clamps (MSS Type 23): For structural shapes.
 7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
 8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
 9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
 10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
 11. Malleable Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
 12. Welded-Steel Brackets: For support of pipes from below, or for suspending from above by using clip and rod. Use one of the following for indicated loads:
 - a. Light (MSS Type 31): 750 lb.
 - b. Medium (MSS Type 32): 1500 lb.
 - c. Heavy (MSS Type 33): 3000 lb.
 13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
 14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
 15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.
- J. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
 2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
 3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.

- K. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
 2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
 3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41 roll hanger with springs.
 4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
 5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from hanger.
 6. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from base support.
 7. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from trapeze support.
 8. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:
 - a. Horizontal (MSS Type 54): Mounted horizontally.
 - b. Vertical (MSS Type 55): Mounted vertically.
 - c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.
- L. Comply with MSS SP-69 for trapeze pipe hanger selections and applications that are not specified in piping system Sections.
- M. Comply with MFMA-102 for metal framing system selections and applications that are not specified in piping system Sections.
- N. Use **[powder-actuated fasteners]** [or] **[mechanical-expansion anchors]** instead of building attachments where required in concrete construction.
- O. Use pipe positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

3.2 HANGER AND SUPPORT INSTALLATION

- A. Steel Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.
- B. Trapeze Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping and support together on field-fabricated trapeze pipe hangers.
1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified above for individual pipe hangers.
 2. Field fabricate from ASTM A 36/A 36M, steel shapes selected for loads being supported. Weld steel according to AWS D1.1.

- C. Fiberglass Pipe Hanger Installation: Comply with applicable portions of MSS SP-69 and MSS SP-89. Install hangers and attachments as required to properly support piping from building structure.
- D. Metal Framing System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled metal framing systems.
- E. Fiberglass Strut System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled fiberglass struts.
- F. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.
- G. Fastener System Installation:
 - 1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
 - 2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
- H. Pipe Stand Installation:
 - 1. Pipe Stand Types except Curb-Mounting Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.
 - 2. Curb-Mounting-Type Pipe Stands: Assemble components or fabricate pipe stand and mount on permanent, stationary roof curb. Refer to Division 07 Section "Roof Accessories" for curbs.
- I. Pipe Positioning System Installation: Install support devices to make rigid supply and waste piping connections to each plumbing fixture. Refer to Division 22 Section "Plumbing Fixtures" for plumbing fixtures.
- J. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.
- K. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
- L. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
- M. Install lateral bracing with pipe hangers and supports to prevent swaying.
- N. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, **[NPS 2-1/2 (DN 65)]** <Insert other> and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.
- O. Load Distribution: Install hangers and supports so piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- P. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.9 (for building services piping) are not exceeded.

Q. Insulated Piping: Comply with the following:

1. Attach clamps and spacers to piping.
 - a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
 - b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
 - c. Do not exceed pipe stress limits according to ASME B31.9 for building services piping.
2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
 - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
 - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
4. Shield Dimensions for Pipe: Not less than the following:
 - a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
 - b. NPS 4: 12 inches long and 0.06 inch thick.
 - c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.
 - d. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.
 - e. NPS 16 to NPS 24: 24 inches long and 0.105 inch thick.
5. Pipes NPS 8 and Larger: Include wood inserts.
6. Insert Material: Length at least as long as protective shield.
7. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.3 EQUIPMENT SUPPORTS

- A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.
- B. Grouting: Place grout under supports for equipment and make smooth bearing surface.
- C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.4 METAL FABRICATIONS

- A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers.
- 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 procedures for shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work, and with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. Finish welds at exposed connections so no roughness shows after finishing and contours of welded surfaces match adjacent contours.

3.5 ADJUSTING

- A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
- B. Trim excess length of continuous-thread hanger and support rods **to 1-1/2 inches**.

3.6 PAINTING

- A. Touch Up: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
 1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.
- B. Touch Up: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Division 09 painting Sections.
- C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION

SECTION 22 05 53**IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT****PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Equipment labels.
 - 2. Warning signs and labels.
 - 3. Pipe labels.
 - 4. Stencils.
 - 5. Valve tags.
 - 6. Warning tags.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples: For color, letter style, and graphic representation required for each identification material and device.
- C. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.
- D. Valve numbering scheme.
- E. Valve Schedules: For each piping system to include in maintenance manuals.

1.4 COORDINATION

- A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- B. Coordinate installation of identifying devices with locations of access panels and doors.
- C. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Metal Labels for Equipment:

1. Material and Thickness: Brass, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
2. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
3. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
4. Fasteners: Stainless-steel rivets.
5. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Plastic Labels for Equipment:

1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware.
2. Letter Color: Black.
3. Background Color: White.
4. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
6. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
7. Fasteners: Stainless-steel rivets.
8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

C. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified.

D. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.2 WARNING SIGNS AND LABELS

- A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, **1/16 inch** thick, and having predrilled holes for attachment hardware.
- B. Letter Color: Black.
- C. Background Color: Black.
- D. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

- E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
- F. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
- G. Fasteners: Stainless-steel rivets.
- H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- I. Label Content: Include caution and warning information, plus emergency notification instructions.

2.3 PIPE LABELS

- A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.
- B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to partially cover circumference of pipe and to attach to pipe without fasteners or adhesive.
- C. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.
- D. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.
 - 1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.
 - 2. Lettering Size: At least 1-1/2 inches high.

2.4 STENCILS

- A. Stencils: Prepared with letter sizes according to ASME A13.1 for piping; and minimum letter height of 3/4 inch for access panel and door labels, equipment labels, and similar operational instructions.
 - 1. Stencil Material: Aluminum.
 - 2. Stencil Paint: Exterior, gloss, alkyd enamel black unless otherwise indicated. Paint may be in pressurized spray-can form.
 - 3. Identification Paint: Exterior, alkyd enamel in colors according to ASME A13.1 unless otherwise indicated.

2.5 VALVE TAGS

- A. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers.
 - 1. Tag Material: Brass, **0.032-inch** minimum thickness, and having predrilled or stamped holes for attachment hardware.
 - 2. Fasteners: Brass wire-link or beaded chain; or S-hook.

- B. Valve Schedules: For each piping system, on 8-1/2-by-11-inch bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.

1. Valve-tag schedule shall be included in operation and maintenance data.

2.6 WARNING TAGS

- A. Warning Tags: Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with matte finish suitable for writing.
1. Size: **3 by 5-1/4 inches.**
 2. Fasteners: **Brass grommet and wire.**
 3. Nomenclature: Large-size primary caption such as "DANGER," "CAUTION," or "DO NOT OPERATE."
 4. Color: Yellow background with black lettering.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 EQUIPMENT LABEL INSTALLATION

- A. Install or permanently fasten labels on each major item of mechanical equipment.
- B. Locate equipment labels where accessible and visible.

3.3 PIPE LABEL INSTALLATION

- A. Piping Color-Coding: Painting of piping is specified in Division 09 Section "**Interior Painting.**"
- B. Stenciled Pipe Label Option: Stenciled labels may be provided instead of manufactured pipe labels, at Installer's option. Install stenciled pipe labels with painted, color-coded bands or rectangles on each piping system.
1. Identification Paint: Use for contrasting background.
 2. Stencil Paint: Use for pipe marking.
- C. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
1. Near each valve and control device.
 2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.

3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
4. At access doors, manholes, and similar access points that permit view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced at maximum intervals of **50** along each run. Reduce intervals to **25 feet** in areas of congested piping and equipment.
7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

D. Pipe Label Color Schedule:

1. Low-Pressure, Compressed-Air Piping:
 - a. Background Color: Black.
 - b. Letter Color: Black.
2. Medium-Pressure, Compressed-Air Piping:
 - a. Background Color: Black.
 - b. Letter Color: Black
3. Domestic Water Piping:
 - a. Background Color: Black
 - b. Letter Color: Black
4. Sanitary Waste Piping:
 - a. Background Color: Black.
 - b. Letter Color: **[Black] [Blue] [Red] [White] [Yellow] <Insert color>**.

3.4 VALVE-TAG INSTALLATION

- A. Install tags on valves and control devices in piping systems, except check valves; valves within factory-fabricated equipment units; shutoff valves; faucets; convenience and lawn-watering hose connections; and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.
- B. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following subparagraphs:
 1. Valve-Tag Size and Shape:
 - a. Cold Water: 1-1/2 inches round.
 - b. Hot Water: 1-1/2 inches round.
 2. Valve-Tag Color:
 - a. Cold Water: Green.
 - b. Hot Water: Red.
 3. Letter Color:
 - a. Cold Water: White.
 - b. Hot Water: White.

3.5 WARNING-TAG INSTALLATION

- A. Write required message on, and attach warning tags to, equipment and other items where required.

END OF SECTION

SECTION 22 07 00
PLUMBING 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. Insulation Materials:
 - a. Calcium silicate.
 - b. Cellular glass.
 - c. Flexible elastomeric.
 - d. Mineral fiber.
 - e. Phenolic.
 - f. Polyisocyanurate.
 - g. Polyolefin.
 - h. Polystyrene.
2. Insulating cements.
3. Adhesives.
4. Mastics.
5. Lagging adhesives.
6. Sealants.
7. Factory-applied jackets.
8. Field-applied fabric-reinforcing mesh.
9. Field-applied cloths.
10. Field-applied jackets.
11. Tapes.
12. Securements.
13. Corner angles.

- B. Related Sections include the following:

1. Division 21 Section "Fire-Suppression Systems Insulation."
2. Division 23 Section "HVAC Insulation."

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated. Include thermal conductivity, thickness, and jackets (both factory and field applied, if any).
- B. Shop Drawings:

1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
 2. Detail attachment and covering of heat tracing inside insulation.
 3. Detail insulation application at pipe expansion joints for each type of insulation.
 4. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
 5. Detail removable insulation at piping specialties, equipment connections, and access panels.
 6. Detail application of field-applied jackets.
 7. Detail application at linkages of control devices.
 8. Detail field application for each equipment type.
- C. Samples: For each type of insulation and jacket indicated. Identify each Sample, describing product and intended use. Sample sizes are as follows:
1. Sample Sizes:
 - a. Preformed Pipe Insulation Materials: 12 inches long by NPS 2.
 - b. Sheet Form Insulation Materials: 12 inches square.
 - c. Jacket Materials for Pipe: 12 inches long by NPS 2.
 - d. Sheet Jacket Materials: 12 inches square.
 - e. Manufacturer's Color Charts: For products where color is specified, show the full range of colors available for each type of finish material.
- D. Qualification Data: For qualified Installer.
- E. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.
- B. Fire-Test-Response Characteristics: Insulation and related materials shall have fire-test-response characteristics indicated, as determined by testing identical products per ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing and inspecting agency.
1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
 2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.
- C. Mockups: Before installing insulation, build mockups for each type of insulation and finish listed below to demonstrate quality of insulation application and finishes. Build mockups in the location indicated or, if not indicated, as directed by Architect. Use materials indicated for the completed Work.
1. Piping Mockups:

- a. One 10-foot section of NPS 2 straight pipe.
 - b. One each of a 90-degree threaded, welded, and flanged elbow.
 - c. One each of a threaded, welded, and flanged tee fitting.
 - d. One NPS 2 or smaller valve, and one NPS 2-1/2 or larger valve.
 - e. Four support hangers including hanger shield and insert.
 - f. One threaded strainer and one flanged strainer with removable portion of insulation.
 - g. One threaded reducer and one welded reducer.
 - h. One pressure temperature tap.
 - i. One mechanical coupling.
2. Equipment Mockups: One tank or vessel.
 3. For each mockup, fabricate cutaway sections to allow observation of application details for insulation materials, adhesives, mastics, attachments, and jackets.
 4. Notify Architect seven days in advance of dates and times when mockups will be constructed.
 5. Obtain Architect's approval of mockups before starting insulation application.
 6. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 7. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
 8. Demolish and remove mockups when directed.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.6 COORDINATION

- A. Coordinate size and location of supports, hangers, and insulation shields specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."
- B. Coordinate clearance requirements with piping Installer for piping insulation application and equipment Installer for equipment insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.
- C. Coordinate installation and testing of heat tracing.

1.7 SCHEDULING

- A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.
- B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

- A. Comply with requirements in Part 3 schedule articles for where insulating materials shall be applied.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.
- D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.
- E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
- F. Calcium Silicate:
 - 1. Products: Subject to compliance with requirements, provide the following:
 - a. Industrial Insulation Group (The); Thermo-12 Gold.
 - 2. Preformed Pipe Sections: Flat-, curved-, and grooved-block sections of noncombustible, inorganic, hydrous calcium silicate with a non-asbestos fibrous reinforcement. Comply with ASTM C 533, Type I.
 - 3. Flat-, curved-, and grooved-block sections of noncombustible, inorganic, hydrous calcium silicate with a non-asbestos fibrous reinforcement. Comply with ASTM C 533, Type I.
 - 4. Prefabricated Fitting Covers: Comply with ASTM C 450 and ASTM C 585 for dimensions used in preforming insulation to cover valves, elbows, tees, and flanges.
- G. Cellular Glass: Inorganic, incombustible, foamed or cellulated glass with annealed, rigid, hermetically sealed cells. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
 - 1. Products: Subject to compliance with requirements, provide the following:
 - a. Cell-U-Foam Corporation; Ultra-CUF.
 - b. Pittsburgh Corning Corporation; Foamglas Super K.
 - 2. Block Insulation: ASTM C 552, Type I.
 - 3. Special-Shaped Insulation: ASTM C 552, Type III.
 - 4. Board Insulation: ASTM C 552, Type IV.
 - 5. Preformed Pipe Insulation without Jacket: Comply with ASTM C 552, Type II, Class 1.
 - 6. Preformed Pipe Insulation with Factory-Applied ASJ: Comply with ASTM C 552, Type II, Class 2.
 - 7. Factory fabricate shapes according to ASTM C 450 and ASTM C 585.
- H. Flexible Elastomeric: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials and Type II for sheet materials.
 - 1. Products: Subject to compliance with requirements, provide the following:

- a. Aeroflex USA Inc.; Aerocel.
 - b. Armacell LLC; AP Armaflex.
 - c. RBX Corporation; Insul-Sheet 1800 and Insul-Tube 180.
- I. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type I. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
 - 1. Products: Subject to compliance with requirements, provide the following:
 - a. CertainTeed Corp.; Duct Wrap.
 - b. Johns Manville; Microlite.
 - c. Knauf Insulation; Duct Wrap.
 - d. Manson Insulation Inc.; Alley Wrap.
 - e. Owens Corning; All-Service Duct Wrap.
- J. Mineral-Fiber, Preformed Pipe Insulation:
 - 1. Products: Subject to compliance with requirements, provide the following:
 - a. Fibrex Insulations Inc.; Coreplus 1200.
 - b. Johns Manville; Micro-Lok.
 - c. Knauf Insulation; 1000(Pipe Insulation.
 - d. Manson Insulation Inc.; Alley-K.
 - e. Owens Corning; Fiberglas Pipe Insulation. ASJ requires field-applied adhesive and staples. ASJ with SSL does not require field-applied adhesive and staples, resulting in reduced installation labor.

2.2 INSULATING CEMENTS

- A. Mineral-Fiber Insulating Cement: Comply with ASTM C 195.
 - 1. Products: Subject to compliance with requirements, provide the following:
 - a. Insulco, Division of MFS, Inc.; Triple I.
 - b. P. K. Insulation Mfg. Co., Inc.; Super-Stik.
- B. Expanded or Exfoliated Vermiculite Insulating Cement: Comply with ASTM C 196.
 - 1. Products: Subject to compliance with requirements, provide the following:
 - a. P. K. Insulation Mfg. Co., Inc.; Thermal-V-Kote.
- C. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449/C 449M.
 - 1. Products: Subject to compliance with requirements, provide the following:
 - a. Insulco, Division of MFS, Inc.; SmoothKote.
 - b. P. K. Insulation Mfg. Co., Inc.; PK No. 127, and Quik-Cote.
 - c. Rock Wool Manufacturing Company; Delta One Shot.

2.3 ADHESIVES

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.
- B. Calcium Silicate Adhesive: Fibrous, sodium-silicate-based adhesive with a service temperature range of 50 to 800 deg F.
 - 1. Products: Subject to compliance with requirements, provide the following:
 - a. Childers Products, Division of ITW; CP-97.
 - b. Foster Products Corporation, H. B. Fuller Company; 81-27/81-93.
 - c. Marathon Industries, Inc.; 290.
 - d. Mon-Eco Industries, Inc.; 22-30.
 - 2. For indoor applications, use adhesive that has a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- C. Cellular-Glass, Phenolic, Polyisocyanurate, and Polystyrene Adhesive: Solvent-based resin adhesive, with a service temperature range of minus 75 to plus 300 deg F.
 - 1. Products: Subject to compliance with requirements, provide the following:
 - a. Childers Products, Division of ITW; CP-96.
 - b. Foster Products Corporation, H. B. Fuller Company; 81-33.
- D. Flexible Elastomeric and Polyolefin Adhesive: Comply with MIL-A-24179A, Type II, Class I.
 - 1. Products: Subject to compliance with requirements, provide the following:
 - a. Aeroflex USA Inc.; Aero seal.
 - b. Armacell LCC; 520 Adhesive.
 - c. Foster Products Corporation, H. B. Fuller Company; 85-75.
 - d. RBX Corporation; Rubatex Contact Adhesive. Retain subparagraph below if low-emitting materials are required for LEED-NC Credit EQ 4.1.
 - 2. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- E. PVC Jacket Adhesive: Compatible with PVC jacket.
 - 1. Products: Subject to compliance with requirements, provide the following:
 - a. Dow Chemical Company (The); 739, Dow Silicone.
 - b. Johns-Manville; Zeston Perma-Weld, CEEL-TITE Solvent Welding Adhesive.
 - c. P.I.C. Plastics, Inc.; Welding Adhesive.
 - d. Speedline Corporation; Speedline Vinyl Adhesive. Retain subparagraph below if low-emitting materials are required for LEED-NC Credit EQ 4.1.
 - 2. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.4 MASTICS

- A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-C-19565C, Type II.
- B. Vapor-Barrier Mastic: Water based; suitable for indoor and outdoor use on below ambient services.
 - 1. Products: Subject to compliance with requirements, provide the following:
 - a. Childers Products, Division of ITW; CP-35.
 - b. Foster Products Corporation, H. B. Fuller Company; 30-90.
 - c. ITW TACC, Division of Illinois Tool Works; CB-50.
 - d. Marathon Industries, Inc.; 590.
 - e. Mon-Eco Industries, Inc.; 55-40.
 - f. Vimasco Corporation; 749.
 - 2. Water-Vapor Permeance: ASTM E 96, Procedure B, 0.013 perm 43-mil dry film thickness.
 - 3. Service Temperature Range: Minus 20 to plus 180 deg F.
 - 4. Solids Content: ASTM D 1644, 59 percent by volume and 71 percent by weight.
 - 5. Color: White.

2.5 SEALANTS

- A. Joint Sealants:
 - 1. Joint Sealants for Cellular-Glass, Phenolic, and Polyisocyanurate Products: Subject to compliance with requirements, provide the following:
 - a. Childers Products, Division of ITW; CP-76.
 - b. Foster Products Corporation, H. B. Fuller Company; 30-45.
 - c. Marathon Industries, Inc.; 405.
 - d. Mon-Eco Industries, Inc.; 44-05.
 - e. Pittsburgh Corning Corporation; Pittseal 444.
 - f. Vimasco Corporation; 750.
 - 2. Joint Sealants for Polystyrene Products: Subject to compliance with requirements, provide the following:
 - a. Childers Products, Division of ITW; CP-70.
 - b. Foster Products Corporation, H. B. Fuller Company; 30-45/30-46.
 - c. Marathon Industries, Inc.; 405.
 - d. Mon-Eco Industries, Inc.; 44-05.
 - e. Vimasco Corporation; 750.
 - 3. Materials shall be compatible with insulation materials, jackets, and substrates.
 - 4. Permanently flexible, elastomeric sealant.
 - 5. Service Temperature Range: Minus 100 to plus 300 deg F.
 - 6. Color: White or gray.
- B. FSK and Metal Jacket Flashing Sealants:
 - 1. Products: Subject to compliance with requirements, provide the following:

- a. Childers Products, Division of ITW; CP-76-8.
 - b. Foster Products Corporation, H. B. Fuller Company; 95-44.
 - c. Marathon Industries, Inc.; 405.
 - d. Mon-Eco Industries, Inc.; 44-05.
 - e. Vimasco Corporation; 750.
2. Materials shall be compatible with insulation materials, jackets, and substrates.
 3. Fire- and water-resistant, flexible, elastomeric sealant.
 4. Service Temperature Range: Minus 40 to plus 250 deg F.
 5. Color: Aluminum.

2.6 FACTORY-APPLIED JACKETS

- A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.
3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.
4. PVDC Jacket for Indoor Applications: 4-mil- thick, white PVDC biaxially oriented barrier film with a permeance at 0.02 perms when tested according to ASTM E 96 and with a flame-spread index of 5 and a smoke-developed index of 20 when tested according to ASTM E 84.

- a. Products: Subject to compliance with requirements, provide the following:

- 1) Dow Chemical Company (The); Saran 540 Vapor Retarder Film and Saran 560 Vapor Retarder Film.

5. PVDC Jacket for Outdoor Applications: 6-mil- thick white PVDC biaxially oriented barrier film with a permeance at 0.01 perms when tested according to ASTM E 96 and with a flame-spread index of 5 and a smoke-developed index of 25 when tested according to ASTM E 84.

- a. Products: Subject to compliance with requirements, provide the following:

- 1) Dow Chemical Company (The); Saran 540 Vapor Retarder Film and Saran 560 Vapor Retarder Film.>

6. PVDC-SSL Jacket: PVDC jacket with a self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip.

- a. Products: Subject to compliance with requirements, provide the following:

- 1) Dow Chemical Company (The); Saran 540 Vapor Retarder Film and Saran 560 Vapor Retarder Film.

2.7 FIELD-APPLIED FABRIC-REINFORCING MESH

- A. Woven Glass-Fiber Fabric for Pipe Insulation: Approximately 2 oz./sq. yd. with a thread count of 10 strands by 10 strands/sq. inch for covering pipe and pipe fittings.
 - 1. Products: Subject to compliance with requirements, provide the following:
 - a. Vimasco Corporation; Elastafab 894.
- B. Woven Glass-Fiber Fabric for Equipment Insulation: Approximately 6 oz./sq. yd. with a thread count of 5 strands by 5 strands/sq. inch for covering equipment.
 - 1. Products: Subject to compliance with requirements, provide the following:
 - a. Childers Products, Division of ITW; Chil-Glas No. 5.
- C. Woven Polyester Fabric: Approximately 1 oz./sq. yd. with a thread count of strands/sq. inch, in a Leno weave, for equipment and pipe.
 - 1. Products: Subject to compliance with requirements, **provide the following] [provide one of the following] [available products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. Foster Products Corporation, H. B. Fuller Company; Mast-A-Fab.
 - b. Vimasco Corporation; Elastafab 894.
- D. Woven Glass-Fiber Fabric: Comply with MIL-C-20079H, Type I, plain weave, and presized a minimum of **8 oz./sq. yd.**
 - 1. Products: Subject to compliance with requirements, provide the following:
 - a. Alpha Associates, Inc.; Alpha-Maritex 84215 and 84217/9485RW, Luben 59.

2.8 FIELD-APPLIED JACKETS

- A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.
- B. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.
 - 1. Products: Subject to compliance with requirements, provide the following:
 - a. Johns Manville; Zeston.
 - b. P.I.C. Plastics, Inc.; FG Series.
 - c. Proto PVC Corporation; LoSmoke.
 - d. Speedline Corporation; SmokeSafe.
 - 2. Adhesive: As recommended by jacket material manufacturer.
 - 3. Color: White.
 - 4. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.

- a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.
5. Factory-fabricated tank heads and tank side panels.

2.9 TAPES

- A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.
 1. Products: Subject to compliance with requirements, provide the following:
 - a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0835.
 - b. Compac Corp.; 104 and 105.
 - c. Ideal Tape Co., Inc., an American Biltrite Company; 428 AWF ASJ.
 - d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.
 2. Width: 3 inches.
 3. Thickness: 11.5 mils.
 4. Adhesion: 90 ounces force/inch in width.
 5. Elongation: 2 percent.
 6. Tensile Strength: 40 lbf/inch in width.
 7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.
- B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.
 1. Products: Subject to compliance with requirements, provide the following:
 - a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0827.
 - b. Compac Corp.; 110 and 111.
 - c. Ideal Tape Co., Inc., an American Biltrite Company; 491 AWF FSK.
 - d. Venture Tape; 1525 CW, 1528 CW, and 1528 CW/SQ.
 2. Width: 3 inches.
 3. Thickness: 6.5 mils.
 4. Adhesion: 90 ounces force/inch in width.
 5. Elongation: 2 percent.
 6. Tensile Strength: 40 lbf/inch in width.
 7. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.
- C. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive. Suitable for indoor and outdoor applications.
 1. Products: Subject to compliance with requirements, provide the following:
 - a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0555.
 - b. Compac Corp.; 130.
 - c. Ideal Tape Co., Inc., an American Biltrite Company; 370 White PVC tape.
 - d. Venture Tape; 1506 CW NS.
 2. Width: 2 inches.
 3. Thickness: 6 mils.

4. Adhesion: 64 ounces force/inch in width.
5. Elongation: 500 percent.
6. Tensile Strength: 18 lbf/inch in width.

2.10 SECUREMENTS

A. Bands:

1. Products: Subject to compliance with requirements, provide the following:
 - a. Childers Products; Bands.
 - b. PABCO Metals Corporation; Bands.
 - c. RPR Products, Inc.; Bands. Wing seals are primarily used for fastening bands together. Closed seals are occasionally used for large, 84-inch- (2130-mm-) diameter applications and where used with springs. Wing seals are reusable; closed seals are not.
2. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type closed seal.

B. Insulation Pins and Hangers:

1. Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, **0.106-inch-diameter** shank, length to suit depth of insulation indicated.
 - a. Products: Subject to compliance with requirements, provide the following:
 - 1) AGM Industries, Inc.; CWP-1.
 - 2) GEMCO; CD.
 - 3) Midwest Fasteners, Inc.; CD.
 - 4) Nelson Stud Welding; TPA, TPC, and TPS.

2.11 CORNER ANGLES

- A. PVC Corner Angles: 30 mils thick, minimum 1 by 1 inch, PVC according to ASTM D 1784, Class 16354-C. White or color-coded to match adjacent surface.
- B. Aluminum Corner Angles: 0.040 inch thick, minimum 1 by 1 inch, aluminum according to ASTM B 209 Alloy 3003, 3005, 3105 or 5005; Temper H-14.
- C. Stainless-Steel Corner Angles: 0.024 inch thick, minimum 1 by 1 inch, stainless steel according to ASTM A 167 or ASTM A 240/A 240M, Type 304.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.

1. Verify that systems and equipment to be insulated have been tested and are free of defects.
2. Verify that surfaces to be insulated are clean and dry.
3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.
- B. Surface Preparation: Clean and prepare surfaces to be insulated. Before insulating, apply a corrosion coating to insulated surfaces as follows:
 1. Stainless Steel: Coat 300 series stainless steel with an epoxy primer 5 mils thick and an epoxy finish 5 mils thick if operating in a temperature range between 140 and 300 deg F. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
 2. Carbon Steel: Coat carbon steel operating at a service temperature between 32 and 300 deg F with an epoxy coating. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
- C. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.
- D. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.3 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment and piping including fittings, valves, and specialties.
- B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of equipment and pipe system as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- G. Keep insulation materials dry during application and finishing.
- H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- I. Install insulation with least number of joints practical.

- J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
 - 1. Install insulation continuously through hangers and around anchor attachments.
 - 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
 - 3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
 - 4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
- K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- L. Install insulation with factory-applied jackets as follows:
 - 1. Draw jacket tight and smooth.
 - 2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
 - 3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge .at **2 inches o.c.**
 - a. For below ambient services, apply vapor-barrier mastic over staples.
 - 4. Cover joints and seams with tape as recommended by insulation material manufacturer to maintain vapor seal.
 - 5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.
- M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.
- P. For above ambient services, do not install insulation to the following:
 - 1. Vibration-control devices.
 - 2. Testing agency labels and stamps.
 - 3. Nameplates and data plates.
 - 4. Manholes.
 - 5. Handholes.
 - 6. Cleanouts.

3.4 PENETRATIONS

- A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.
 - 1. Seal penetrations with flashing sealant.
 - 2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 - 3. Extend jacket of outdoor insulation outside roof flashing at least **2 inches (50 mm)** below top of roof flashing.
 - 4. Seal jacket to roof flashing with flashing sealant.
- B. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.
- C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
 - 1. Seal penetrations with flashing sealant.
 - 2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 - 3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
 - 4. Seal jacket to wall flashing with flashing sealant.
- D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- E. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.
 - 1. Comply with requirements in Division 07 Section "Penetration Firestopping"irestopping and fire-resistive joint sealers.
- F. Insulation Installation at Floor Penetrations:
 - 1. Pipe: Install insulation continuously through floor penetrations.
 - 2. Seal penetrations through fire-rated assemblies. Comply with requirements in Division 07 Section "Penetration Firestopping."

3.5 Not Used

3.6 GENERAL PIPE INSULATION INSTALLATION

- A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.
- B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:

1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity, unless otherwise indicated.
 2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
 3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
 4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
 5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below ambient services, provide a design that maintains vapor barrier.
 6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
 7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below ambient services and a breather mastic for above ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
 8. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
 9. Stencil or label the outside insulation jacket of each union with the word "UNION." Match size and color of pipe labels.
- C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes, vessels, and equipment. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.
- D. Install removable insulation covers at locations indicated. Installation shall conform to the following:
1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
 2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
 3. Construct removable valve insulation covers in same manner as for flanges except divide the two-part section on the vertical center line of valve body.

4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least **2 inches (50 mm)** over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.7 Not Used

3.8 Not Used

3.9 Not Used

3.10 Not Used

3.11 Not Used

3.12 Not Used

3.13 Not Used

3.14 POLYSTYRENE INSULATION INSTALLATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of insulation with tape or bands and tighten bands without deforming insulation materials. Orient longitudinal joints between half sections in 3 and 9 o'clock positions on the pipe.
2. For insulation with factory-applied jackets with vapor barriers, do not staple longitudinal tabs but secure tabs with additional adhesive or tape as recommended by insulation material manufacturer and seal with vapor-barrier mastic.
3. All insulation shall be tightly butted and free of voids and gaps at all joints. Vapor barrier must be continuous. Before installing jacket material, install vapor-barrier system.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, same thickness of adjacent pipe insulation, not to exceed 1-1/2-inch thickness.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of polystyrene block insulation of same thickness as pipe insulation.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed insulation sections of same material as straight segments of pipe insulation. Secure according to manufacturer's written instructions.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed section of polystyrene insulation to valve body.
2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.

3.15 Not Used

3.16 FINISHES

A. Equipment and Pipe Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Division 09 painting Sections.

1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.
 - a. Finish Coat Material: Interior, flat, latex-emulsion size.

B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.

C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.

D. Do not field paint aluminum or stainless-steel jackets.

3.17 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Inspect field-insulated equipment, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to one location for each type of equipment defined in the "Equipment Insulation Schedule" Article. For large equipment, remove only a portion adequate to determine compliance.
2. Inspect pipe, fittings, strainers, and valves, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to three locations of straight pipe, three locations of threaded fittings, three locations of welded fittings, two locations of threaded strainers, two locations of welded strainers, three locations of threaded valves, and three locations of flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.

B. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.18 Not Used

3.19 Not Used

3.20 PIPING INSULATION SCHEDULE, GENERAL

- A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.
- B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:
 - 1. Drainage piping located in crawl spaces.
 - 2. Underground piping.
 - 3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.21 INDOOR PIPING INSULATION SCHEDULE

- A. Domestic Cold Water:
 - 1. NPS 1" and Smaller: Insulation shall be one of the following:
 - a. Cellular Glass: 1-1/2 inches thick.
 - b. Flexible Elastomeric: 1 inch thick.
 - c. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
 - 2. NPS 1-1/4 and Larger: Insulation shall be one of the following:
 - a. Cellular Glass: 1-1/2 inches thick.
 - b. Flexible Elastomeric: 1 inch thick.
 - c. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
- B. Domestic Hot and Recirculated Hot Water:
 - 1. NPS 1-1/4 and Smaller: Insulation shall be one of the following:
 - a. Cellular Glass: 1-1/2 inches thick.
 - b. Flexible Elastomeric: 1 inch thick.
- C. Not Used
- D. Not Used
- E. Roof Drains, Overflow Drain, Piping and Bodies:
 - 1. All Pipe Sizes: Insulation shall be **one of** the following:
 - a. Cellular Glass: 1-1/2 inches thick with vapor barrier.
 - b. Flexible Elastomeric: 1 inch thick with vapor barrier.
- F. Not Used

G. Not used

H. Condensate and Equipment Drain Water below 60 Deg F:

1. All Pipe Sizes: Insulation shall be the following:

- a. Cellular Glass: 1-1/2 inches thick.
- b. Flexible Elastomeric: 3/4 inch thick.

I. Not Used

J. Not Used

K. Not Used:

3.22 Not Used

3.23 Not Used.

3.24 Not used

3.25 Not Used

3.26 Not Used.

END OF SECTION

SECTION 22 11 16

DOMESTIC WATER PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:

1. Under-building slab and aboveground domestic water pipes, tubes, fittings, and specialties inside the building.
2. Encasement for piping.
3. Specialty valves.
4. Flexible connectors.
5. Water meters furnished by utility company for installation by Contractor.
6. Water meters.
7. Escutcheons.
8. Sleeves and sleeve seals.
9. Wall penetration systems.

- B. Related Section:

1. Division 22 Section "Facility Water Distribution Piping" for water-service piping and water meters outside the building from source to the point where water-service piping enters the building.

1.3 PERFORMANCE REQUIREMENTS

- A. Not Used

1.4 SUBMITTALS

- A. Product Data: For the following products:

1. Specialty valves.
2. Transition fittings.
3. Dielectric fittings.
4. Flexible connectors.
5. Water meters.
6. Backflow preventers.
7. Escutcheons.
8. Sleeves and sleeve seals.
9. Water penetration systems.

- B. Water Samples: Specified in "Cleaning" Article.
- C. Coordination Drawings: For piping in equipment rooms and other congested areas, drawn to scale, on which the following items are shown and coordinated with each other, using input from Installers of the items involved:
 - 1. Domestic water piping.
- D. Field quality-control reports.

1.5 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with NSF 14 for plastic, potable domestic water piping and components.
- C. Comply with NSF 61 for potable domestic water piping and components.

1.6 PROJECT CONDITIONS

- A. Interruption of Existing Water Service: Do not interrupt water service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water service according to requirements indicated:
 - 1. Notify Owner no fewer than two days in advance of proposed interruption of water service.
 - 2. Do not proceed with interruption of water service without Owner's written permission.

1.7 COORDINATION

- A. Coordinate sizes and locations of concrete bases with actual equipment provided.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

- A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.2 COPPER TUBE AND FITTINGS

- A. Hard Copper Tube: ASTM B 88, Type L and ASTM B 88, Type M water tube, drawn temper.
 - 1. Cast-Copper Solder-Joint Fittings: ASME B16.18, pressure fittings.
 - 2. Wrought-Copper Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.
 - 3. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.
 - 4. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.
 - 5. Copper Pressure-Seal-Joint Fittings:

- a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) Elkhart Products Corporation; Industrial Division.
 - 2) NIBCO INC.
 - 3) Viega; Plumbing and Heating Systems.
 - b. NPS 2 and Smaller: Wrought-copper fitting with EPDM-rubber O-ring seal in each end.
 - c. NPS 2-1/2 to NPS 4: Cast-bronze or wrought-copper fitting with EPDM-rubber O-ring seal in each end.
6. Copper Push-on-Joint Fittings:
- a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) NVent LLC.
 - b. Description: Cast-copper fitting complying with ASME B16.18 or wrought-copper fitting complying with ASME B 16.22; with stainless-steel teeth and EPDM-rubber O-ring seal in each end instead of solder-joint ends.
7. Copper-Tube Extruded-Tee Connections:
- a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) T-DRILL Industries Inc.
 - b. Description: Tee formed in copper tube according to ASTM F 2014.
8. Grooved-Joint Copper-Tube Appurtenances:
- a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) Anvil International.
 - 2) Shurjoint Piping Products.
 - 3) Victaulic Company.
 - b. Copper Grooved-End Fittings: ASTM B 75 copper tube or ASTM B 584 bronze castings.
 - c. Grooved-End-Tube Couplings: Copper-tube dimensions and design similar to AWWA C606. Include ferrous housing sections, EPDM-rubber gaskets suitable for hot and cold water, and bolts and nuts.
- B. Soft Copper Tube: **ASTM B 88, Type K** **ASTM B 88, Type L** water tube, annealed temper.
- 1. Copper Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.
 - 2. Copper Pressure-Seal-Joint Fittings:
 - a. Manufacturers: Subject to compliance with requirements[provide products by one of the following:

- 1) Elkhart Products Corporation; Industrial Division.
- 2) NIBCO INC.
- 3) Viega; Plumbing and Heating Systems.

- b. NPS 2 and Smaller: Wrought-copper fitting with EPDM-rubber O-ring seal in each end.
- c. NPS 3 and NPS 4 Cast-bronze or wrought-copper fitting with EPDM-rubber O-ring seal in each end.

2.3 Not Used

2.4 GALVANIZED-STEEL PIPE AND FITTINGS

- A. Galvanized-Steel Pipe: ASTM A 53/A 53M, **Type E, Grade B grade**, Standard Weight. Include ends matching joining method.

1. Galvanized-Steel Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M or ASTM A 106/A 106M, Standard Weight, seamless steel pipe with threaded ends.
2. Galvanized, Gray-Iron Threaded Fittings: ASME B16.4, Class 125, standard pattern.
3. Malleable-Iron Unions: ASME B16.39, Class 150, hexagonal-stock body with ball-and-socket, metal-to-metal, bronze seating surface, and female threaded ends.
4. Flanges: ASME B16.1, Class 125, cast iron.
5. Grooved-Joint, Galvanized-Steel-Pipe Appurtenances:

- a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- 1) Anvil International.
- 2) Shurjoint Piping Products.
- 3) Star Pipe Products.
- 4) Victaulic Company.

- b. Galvanized, Grooved-End Fittings for Galvanized-Steel Piping: ASTM A 47/A 47M, malleable-iron casting; ASTM A 106/A 106M, steel pipe; or ASTM A 536, ductile-iron casting; with dimensions matching steel pipe.
- c. Grooved-End-Pipe Couplings for Galvanized-Steel Piping: AWWA C606 for steel-pipe dimensions. Include ferrous housing sections, EPDM-rubber gaskets suitable for hot and cold water, and bolts and nuts.

2.5 Not Used

2.6 Not Used

2.7 Not Used

2.8 PIPING JOINING MATERIALS

- A. Pipe-Flange Gasket Materials: AWWA C110, rubber, flat face, 1/8 inch thick or ASME B16.21, nonmetallic and asbestos free, unless otherwise indicated; full-face or ring type unless otherwise indicated.
- B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.
- C. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
- D. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.
- E. Solvent Cements for Joining CPVC Piping and Tubing: ASTM F 493.
 - 1. Use CPVC solvent cement that has a VOC content of 490 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 2. Use adhesive primer that has a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- F. Solvent Cements for Joining PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.
 - 1. Use PVC solvent cement that has a VOC content of 510 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 2. Use adhesive primer that has a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- G. Plastic, Pipe-Flange Gaskets, Bolts, and Nuts: Type and material recommended by piping system manufacturer unless otherwise indicated.

2.9 ENCASEMENT FOR PIPING

- A. Standard: ASTM A 674 or AWWA C105.
- B. Form: Tube.
- C. Material: **LLDPE film of 0.008-inch minimum thickness or high-density, cross-laminated PE film of 0.004-inch High-density, cross-laminated PE film of 0.004-inch thickness.**
- D. Color: **Black.**

2.10 SPECIALTY VALVES

- A. Comply with requirements in Division 22 Section "General-Duty Valves for Plumbing Piping" for general-duty metal valves.
- B. Comply with requirements in Division 22 Section "Domestic Water Piping Specialties" for balancing valves, drain valves, backflow preventers, and vacuum breakers.

Not Used

- C. Not Used:
- D. Not Used:
- E. Not used:
- F. Not Used:
- G. Not Used:
- H. Not Used:
- I. Not Used:

2.11 TRANSITION FITTINGS

- A. General Requirements:
 - 1. Same size as pipes to be joined.
 - 2. Pressure rating at least equal to pipes to be joined.
 - 3. End connections compatible with pipes to be joined.
- B. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.
- C. Sleeve-Type Transition Coupling: AWWA C219.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Cascade Waterworks Manufacturing.
 - b. Dresser, Inc.; Dresser Piping Specialties.
 - c. Ford Meter Box Company, Inc. (The).
 - d. JCM Industries.
 - e. Romac Industries, Inc.
 - f. Smith-Blair, Inc; a Sensus company.
 - g. Viking Johnson; c/o Mueller Co.
- D. Plastic-to-Metal Transition Fittings:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Charlotte Pipe and Foundry Company.

- b. Harvel Plastics, Inc.
- c. Spears Manufacturing Company.

2.12 DIELECTRIC FITTINGS

- A. General Requirements: Assembly of copper alloy and ferrous materials or ferrous material body with separating nonconductive insulating material suitable for system fluid, pressure, and temperature.
- B. Dielectric Unions:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Capitol Manufacturing Company.
 - b. Central Plastics Company.
 - c. EPCO Sales, Inc.
 - d. Hart Industries International, Inc.
 - e. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
 - f. Zurn Plumbing Products Group; Wilkins Water Control Products.
 - 2. Description:
 - a. Pressure Rating: 150 psig, minimum at 180 deg F.
 - b. End Connections: Solder-joint copper alloy and threaded ferrous.
- C. Dielectric Flanges:
 - 1. Manufacturers: Subject to compliance with requirements, **provide products by one of the following**:
 - a. Capitol Manufacturing Company.
 - b. Central Plastics Company.
 - c. EPCO Sales, Inc.
 - d. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
 - 2. Description:
 - a. Factory-fabricated, bolted, companion-flange assembly.
 - b. Pressure Rating: 150 psig minimum.
 - c. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.
- D. Dielectric-Flange Kits:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Advance Products & Systems, Inc.
 - b. Calpico, Inc.
 - c. Central Plastics Company.
 - d. Pipeline Seal and Insulator, Inc.
 - 2. Description:

- a. Nonconducting materials for field assembly of companion flanges.
- b. Pressure Rating: **150 psig**.
- c. Gasket: Neoprene or phenolic.
- d. Bolt Sleeves: Phenolic or polyethylene.
- e. Washers: Phenolic with steel backing washers.

E. Dielectric Couplings:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Calpico, Inc.
 - b. Lochinvar Corporation.
- 2. Description:
 - a. Galvanized-steel coupling.
 - b. Pressure Rating: 300 psig at 225 deg F.
 - c. End Connections: Female threaded.
 - d. Lining: Inert and noncorrosive, thermoplastic.

F. Dielectric Nipples:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Perfection Corporation; a subsidiary of American Meter Company.
 - b. Precision Plumbing Products, Inc.
 - c. Victaulic Company.
- 2. Description:
 - a. Electroplated steel nipple complying with ASTM F 1545.
 - b. Pressure Rating: **300 psig at 225 deg F**.
 - c. End Connections: Male threaded or grooved.
 - d. Lining: Inert and noncorrosive, propylene.

2.13 FLEXIBLE CONNECTORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- 1. Flex-Hose Co., Inc.
 - 2. Flexicraft Industries.
 - 3. Flex Pression, Ltd.
 - 4. Flex-Weld, Inc.
 - 5. Hyspan Precision Products, Inc.
 - 6. Mercer Rubber Co.
 - 7. Metraflex, Inc.
 - 8. Proco Products, Inc.
 - 9. Tozen Corporation.
 - 10. Unaflex, Inc.
 - 11. Universal Metal Hose; a Hyspan company

- B. Bronze-Hose Flexible Connectors: Corrugated-bronze tubing with bronze wire-braid covering and ends brazed to inner tubing.
 - 1. Working-Pressure Rating: Minimum **200 psig**].
 - 2. End Connections NPS 2 and Smaller: Threaded copper pipe or plain-end copper tube.
 - 3. End Connections NPS 2-1/2 and Larger: Flanged copper alloy.
- C. Stainless-Steel-Hose Flexible Connectors: Corrugated-stainless-steel tubing with stainless-steel wire-braid covering and ends welded to inner tubing.
 - 1. Working-Pressure Rating: Minimum **200 psig**.
 - 2. End Connections NPS 2 and Smaller: Threaded steel-pipe nipple.
 - 3. End Connections NPS 2-1/2 and Larger: Flanged steel nipple.

2.14 Not Used

2.15 ESCUTCHEONS

- A. General: Manufactured ceiling, floor, and wall escutcheons and floor plates.
- B. One Piece, Cast Brass: Polished, chrome-plated finish with setscrews.
- C. One Piece, Deep Pattern: Deep-drawn, box-shaped brass with chrome-plated finish.
- D. One Piece, Stamped Steel: Chrome-plated finish with setscrew.
- E. Split Casting, Cast Brass: Polished, chrome-plated finish with concealed hinge and setscrew.
- F. Split Plate, Stamped Steel: Chrome-plated finish with concealed hinge, setscrew.
- G. One-Piece Floor Plates: Cast-iron flange with holes for fasteners.
- H. Split-Casting Floor Plates: Cast brass with concealed hinge.

2.16 SLEEVES

- A. Cast-Iron Wall Pipes: Fabricated of cast iron, and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.
- B. Galvanized-Steel-Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.
- C. Molded-PE Sleeves: Reusable, PE, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.

2.17 SLEEVE SEALS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Advance Products & Systems, Inc.

2. Calpico, Inc.
3. Metraflex, Inc.
4. Pipeline Seal and Insulator, Inc.
5. **<Insert manufacturer's name>**.

B. Description: Modular sealing element unit, designed for field assembly, used to fill annular space between pipe and sleeve.

1. Sealing Elements: **EPDM-rubber** interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.

2.18 Not Used

2.19 GROUT

- A. Standard: ASTM C 1107, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
- B. Characteristics: Nonshrink; recommended for interior and exterior applications.
- C. Design Mix: 5000-psi, 28-day compressive strength.
- D. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 EARTHWORK

- A. Comply with requirements in Division 31 Section "Earth Moving" for excavating, trenching, and backfilling.

3.2 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- B. Install copper tubing under building slab according to CDA's "Copper Tube Handbook."
- C. Install ductile-iron piping under building slab with restrained joints according to AWWA C600 and AWWA M41.
- D. Install underground copper tube in PE encasement according to ASTM A 674 or AWWA C105.
- E. Install shutoff valve, hose-end drain valve, strainer, pressure gage, and test tee with valve, inside the building at each domestic water service entrance. Comply with requirements in Division 22 Section "Meters and Gages for Plumbing Piping" for pressure gages and Division 22 Section "Domestic Water Piping Specialties" for drain valves and strainers.

- F. Install shutoff valve immediately upstream of each dielectric fitting.
- G. Install water-pressure-reducing valves downstream from shutoff valves. Comply with requirements in Division 22 Section "Domestic Water Piping Specialties" for pressure-reducing valves.
- H. Install domestic water piping level with 0.25 percent slope downward toward drain and plumb.
- I. Rough-in domestic water piping for water-meter installation according to utility company's requirements.
- J. Install seismic restraints on piping. Comply with requirements in Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment" for seismic-restraint devices.
- K. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.
- L. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- M. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.
- N. Install piping adjacent to equipment and specialties to allow service and maintenance.
- O. Install piping to permit valve servicing.
- P. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than system pressure rating used in applications below unless otherwise indicated.
- Q. Install piping free of sags and bends.
- R. Install fittings for changes in direction and branch connections.
- S. Install PEX piping with loop at each change of direction of more than 90 degrees.
- T. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.
- U. Install pressure gages on suction and discharge piping from each plumbing pump and packaged booster pump. Comply with requirements in Division 22 Section "Meters and Gages for Plumbing Piping" for pressure gages.
- V. Not Used
- W. Install thermometers on **inlet and** outlet piping from each water heater. Comply with requirements in Division 22 Section "Meters and Gages for Plumbing Piping" for thermometers.

3.3 JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

- B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.
- C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - 1. Apply appropriate tape or thread compound to external pipe threads.
 - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.
- D. Brazed Joints: Join copper tube and fittings according to CDA's "Copper Tube Handbook," "Braze Joints" Chapter.
- E. Soldered Joints: Apply ASTM B 813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B 828 or CDA's "Copper Tube Handbook."
- F. Pressure-Sealed Joints: Join copper tube and pressure-seal fittings with tools recommended by fitting manufacturer.
- G. Copper-Tubing, Push-on Joints: Clean end of tube. Measure insertion depth with manufacturer's depth gage. Join copper tube and push-on-joint fittings by inserting tube to measured depth.
- H. Extruded-Tee Connections: Form tee in copper tube according to ASTM F 2014. Use tool designed for copper tube; drill pilot hole, form collar for outlet, dimple tube to form seating stop, and braze branch tube into collar.
- I. Copper-Tubing Grooved Joints: Roll groove end of tube. Assemble coupling with housing, gasket, lubricant, and bolts. Join copper tube and grooved-end fittings according to AWWA C606 for roll-grooved joints.
- J. Ductile-Iron-Piping Grooved Joints: Cut groove end of pipe. Assemble coupling with housing, gasket, lubricant, and bolts. Join ductile-iron pipe and grooved-end fittings according to AWWA C606 for ductile-iron-pipe, cut-grooved joints.
- K. Steel-Piping Grooved Joints: **Cut** groove end of pipe. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe grooved joints.
- L. Flanged Joints: Select appropriate asbestos-free, nonmetallic gasket material in size, type, and thickness suitable for domestic water service. Join flanges with gasket and bolts according to ASME B31.9.
- M. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
 - 1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements. Apply primer.
 - 2. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.
 - 3. PVC Piping: Join according to ASTM D 2855.
- N. PEX Piping Joints: Join according to ASTM F 1807.

- O. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.

3.4 VALVE INSTALLATION

- A. General-Duty Valves: Comply with requirements in Division 22 Section "General-Duty Valves for Plumbing Piping" for valve installations.
- B. Install shutoff valve close to water main on each branch and riser serving plumbing fixtures or equipment, on each water supply to equipment, and on each water supply to plumbing fixtures that do not have supply stops. Use ball or gate valves for piping NPS 2 and smaller. Use butterfly or gate valves for piping NPS 2-1/2 and larger.
- C. Install drain valves for equipment at base of each water riser, at low points in horizontal piping, and where required to drain water piping. Drain valves are specified in Division 22 Section "Domestic Water Piping Specialties."
 - 1. Hose-End Drain Valves: At low points in water mains, risers, and branches.
 - 2. Stop-and-Waste Drain Valves: Instead of hose-end drain valves where indicated.
- D. Install balancing valve in each hot-water circulation return branch and discharge side of each pump and circulator. Set balancing valves partly open to restrict but not stop flow. Use ball valves for piping NPS 2 and smaller and butterfly valves for piping NPS 2-1/2 and larger. Comply with requirements in Division 22 Section "Domestic Water Piping Specialties" for balancing valves.
- E. Install calibrated balancing valves in each hot-water circulation return branch and discharge side of each pump and circulator. Set calibrated balancing valves partly open to restrict but not stop flow. Comply with requirements in Division 22 Section "Domestic Water Piping Specialties" for calibrated balancing valves.

3.5 TRANSITION FITTING INSTALLATION

- A. Install transition couplings at joints of dissimilar piping.
- B. Transition Fittings in Underground Domestic Water Piping:
 - 1. NPS 1-1/2 and Smaller: Fitting-type coupling.
 - 2. NPS 2 and Larger: Sleeve-type coupling.
- C. Transition Fittings in Aboveground Domestic Water Piping NPS 2 and Smaller: Plastic-to-metal transition fittings or unions.

3.6 DIELECTRIC FITTING INSTALLATION

- A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
- B. Dielectric Fittings for NPS 2 and Smaller: Use dielectric unions.
- C. Dielectric Fittings for NPS 2-1/2 to NPS 4: Use dielectric flanges.

3.7 FLEXIBLE CONNECTOR INSTALLATION

- A. Install flexible connectors in suction and discharge piping connections to each domestic water pump
- B. Install bronze-hose flexible connectors in copper domestic water tubing.
- C. Install stainless-steel-hose flexible connectors in steel domestic water piping.

3.8 Not Used

3.9 HANGER AND SUPPORT INSTALLATION

- A. Not Used.
- B. Comply with requirements in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment" for pipe hanger and support products and installation.
 - 1. Vertical Piping: MSS Type 8 or 42, clamps.
 - 2. Individual, Straight, Horizontal Piping Runs:
 - a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
 - b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
 - c. Longer Than 100 Feet: If Indicated: MSS Type 49, spring cushion rolls.
 - 3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
 - 4. Base of Vertical Piping: MSS Type 52, spring hangers.
- C. Support vertical piping and tubing at base and at each floor.
- D. Rod diameter may be reduced one size for double-rod hangers, to a minimum of 3/8inch.
- E. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 3/4 and Smaller: 60 inches with 3/8-inch rod.
 - 2. NPS 1 and NPS 1-1/4: 72 inches with 3/8-inch rod.
 - 3. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
 - 4. NPS 2-1/2: 108 inches with 1/2-inch rod.
 - 5. NPS 3 to NPS 5: 10 feet with 1/2-inch rod.
- F. Install supports for vertical copper tubing every 10 feet.
- G. Install hangers for steel piping with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 1-1/4 and Smaller: 84 inches with 3/8-inch rod.
 - 2. NPS 1-1/2: 108 inches with 3/8-inch rod.
 - 3. NPS 2: 10 feet with 3/8-inch rod.
 - 4. NPS 2-1/2: 11 feet with 1/2-inch rod.
 - 5. NPS 3 and NPS 3-1/2: 12 feet with 1/2-inch rod.
 - 6. NPS 4 and NPS 5: 12 feet with 5/8-inch rod.

- H. Not Used
- I. Not Used
- J. Not Used
- K. Not Used
- L. Not Used
- M. Not Used
- N. Not Used
- O. Not Used.

3.10 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to equipment and machines to allow service and maintenance.
- C. Connect domestic water piping to exterior water-service piping. Use transition fitting to join dissimilar piping materials.
- D. Connect domestic water piping to water-service piping with shutoff valve; extend and connect to the following:
 - 1. Domestic Water Booster Pumps: Cold-water suction and discharge piping.
 - 2. Water Heaters: Cold-water inlet and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.
 - 3. Plumbing Fixtures: Cold- and hot-water supply piping in sizes indicated, but not smaller than required by plumbing code. Comply with requirements in Division 22 plumbing fixture Sections for connection sizes.
 - 4. Equipment: Cold- and hot-water supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection. Use flanges instead of unions for NPS 2-1/2 and larger.

3.11 ESCUTCHEON INSTALLATION

- A. Install escutcheons for penetrations of walls, ceilings, and floors.
- B. Escutcheons for New Piping:
 - 1. Piping with Fitting or Sleeve Protruding from Wall: One piece, deep pattern.
 - 2. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One piece, cast brass with polished chrome-plated finish.
 - 3. Bare Piping at Ceiling Penetrations in Finished Spaces: One piece, cast brass with polished chrome-plated finish.
 - 4. Bare Piping in Unfinished Service Spaces: One piece, cast brass with polished chrome-plated finish.
 - 5. Bare Piping at Floor Penetrations in Equipment Rooms: One-piece floor plate.

C. Not Used:

3.12 SLEEVE INSTALLATION

- A. General Requirements: Install sleeves for pipes and tubes passing through penetrations in floors, partitions, roofs, and walls.
- B. Sleeves are not required for core-drilled holes.
- C. Permanent sleeves are not required for holes formed by removable PE sleeves.
- D. Cut sleeves to length for mounting flush with both surfaces unless otherwise indicated.
- E. Install sleeves in new partitions, slabs, and walls as they are built.
- F. For interior wall penetrations, seal annular space between sleeve and pipe or pipe insulation using joint sealants appropriate for size, depth, and location of joint. Comply with requirements in Division 07 Section "Joint Sealants" for joint sealants.
- G. For exterior wall penetrations above grade, seal annular space between sleeve and pipe using joint sealants appropriate for size, depth, and location of joint. Comply with requirements in Division 07 Section "Joint Sealants" for joint sealants.
- H. For exterior wall penetrations below grade, seal annular space between sleeve and pipe using sleeve seals specified in this Section.
- I. Seal space outside of sleeves in concrete slabs and walls with grout.
- J. Install sleeve materials according to the following applications:
 - 1. Sleeves for Piping Passing through Concrete Floor Slabs: **Molded PE.**
 - 2. Sleeves for Piping Passing through Concrete Floor Slabs of Mechanical Equipment Areas or Other Wet Areas: Steel pipe.
 - a. Extend sleeves 2 inches above finished floor level.
 - b. For pipes penetrating floors with membrane waterproofing, extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level. Comply with requirements in Division 07 Section "Sheet Metal Flashing and Trim" for flashing.
 - 3. Sleeves for Piping Passing through Gypsum-Board Partitions:
 - a. Steel pipe sleeves for pipes smaller than NPS 6.
 - b. Galvanized-steel sheet sleeves for pipes NPS 6 and larger.
 - c. Exception: Sleeves are not required for water supply tubes and waste pipes for individual plumbing fixtures if escutcheons will cover openings.
 - 4. Sleeves for Piping Passing through Concrete Roof Slabs: Molded PE.
- K. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements in Division 07 Section "Penetration Firestopping" for firestop materials and installations.

3.13 SLEEVE SEAL INSTALLATION

- A. Install sleeve seals in sleeves in exterior concrete walls at water-service piping entries into building.
- B. Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble sleeve seal components and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.14 WALL PENETRATION SYSTEM INSTALLATION

- A. Install wall penetration systems in new, exterior concrete walls.
- B. Assemble wall penetration system components with sleeve pipe. Install so that end of sleeve pipe and face of housing are flush with wall. Adjust locking devices to secure sleeve pipe in housing.

3.15 IDENTIFICATION

- A. Identify system components. Comply with requirements in Division 22 Section "Identification for Plumbing Piping and Equipment" for identification materials and installation.
- B. Label pressure piping with system operating pressure.

3.16 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
 - 1. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
 - 2. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:
 - a. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
 - b. Final Inspection: Arrange final inspection for authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
 - 3. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.
 - 4. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
- B. Piping Tests:
 - 1. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
 - 2. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.

3. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
4. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
5. Repair leaks and defects with new materials and retest piping or portion thereof until satisfactory results are obtained.
6. Prepare reports for tests and for corrective action required.

C. Domestic water piping will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

3.17 ADJUSTING

A. Perform the following adjustments before operation:

1. Close drain valves, hydrants, and hose bibbs.
2. Open shutoff valves to fully open position.
3. Open throttling valves to proper setting.
4. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.
 - a. Manually adjust ball-type balancing valves in hot-water-circulation return piping to provide flow of hot water in each branch.
 - b. Adjust calibrated balancing valves to flows indicated.
5. Remove plugs used during testing of piping and for temporary sealing of piping during installation.
6. Remove and clean strainer screens. Close drain valves and replace drain plugs.
7. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.
8. Check plumbing specialties and verify proper settings, adjustments, and operation.

3.18 CLEANING

A. Clean and disinfect potable domestic water piping as follows:

1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed, use procedures described in either AWWA C651 or AWWA C652 or follow procedures described below:
 - a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
 - b. Fill and isolate system according to either of the following:
 - 1) Fill system or part thereof with water/chlorine solution with at least 50 ppm of chlorine. Isolate with valves and allow to stand for 24 hours.
 - 2) Fill system or part thereof with water/chlorine solution with at least 200 ppm of chlorine. Isolate and allow to stand for three hours.

- c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
 - d. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.
- B. Prepare and submit reports of purging and disinfecting activities.
- C. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

3.19 PIPING SCHEDULE

- A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.
- B. Flanges and unions may be used for aboveground piping joints unless otherwise indicated.
- C. Under-building-slab, domestic water, building service piping, NPS 3 and smaller pipe size, shall be one of the following:
 - 1. Soft copper tube, ASTM B 88, Type K ASTM B 88, Type L; wrought-copper solder-joint fittings; and brazed joints.
- D. Aboveground domestic water piping, NPS 2 and smaller, shall be one of the following:
 - 1. Galvanized-steel pipe and nipples; galvanized, gray-iron threaded fittings; and threaded joints.
 - 2. Hard copper tube, ASTM B 88, Type L ASTM B 88, Type M wrought copper solder-joint fittings; and soldered joints.
 - 3. Hard copper tube, ASTM B 88, Type L or ASTM B 88, Type M; copper pressure-seal-joint fittings; and pressure-sealed joints.
 - 4. Hard copper tube, ASTM B 88, Type L or ASTM B 88, Type M; copper push-on-joint fittings; and push-on joints.
- E. Aboveground domestic water piping, NPS 2-1/2 to NPS 4 , shall be one of the following:
 - 1. Hard copper tube, ASTM B 88, Type L [ASTM B 88, Type M; wrought copper solder-joint fittings; and soldered joints.
 - 2. Hard copper tube, ASTM B 88, Type L or ASTM B 88, Type M; copper pressure-seal-joint fittings; and pressure-sealed joints.
 - 3. Hard copper tube, ASTM B 88, Type L or ASTM B 88, Type M; grooved-joint copper-tube appurtenances; and grooved joints.
 - 4. Galvanized-steel pipe and nipples; galvanized, gray-iron threaded fittings; and threaded joints.
 - 5. Galvanized-steel pipe; grooved-joint, galvanized-steel-pipe appurtenances; and grooved joints.
- F. Not Used
- G. Not Used

3.20 VALVE SCHEDULE

- A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:
 - 1. Shutoff Duty: Use ball or gate valves for piping NPS 2 and smaller. Use butterfly, ball, or gate valves with flanged ends for piping NPS 2-1/2 and larger.
 - 2. Throttling Duty: Use ball or globe valves for piping NPS 2 and smaller. Use butterfly or ball valves with flanged ends for piping NPS 2-1/2 and larger.
 - 3. Hot-Water Circulation Piping, Balancing Duty: Calibrated balancing valves.
 - 4. Drain Duty: Hose-end drain valves.
- B. Use check valves to maintain correct direction of domestic water flow to and from equipment.
- C. Iron grooved-end valves may be used with grooved-end piping.
- D. Not Used.

END OF SECTION 221116

SECTION 22 11 19**DOMESTIC WATER PIPING 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. This Section includes the following domestic water piping specialties:
 - 1. Vacuum breakers.
 - 2. Backflow preventers.
 - 3. Water pressure-reducing valves.
 - 4. Balancing valves.
 - 5. Strainers.
 - 6. Wall hydrants.
 - 7. Water hammer arresters.
 - 8. Air vents.
 - 9. Trap-seal primer valves.
 - 10. Trap-seal primer systems.
- B. Related Sections include the following:
 - 1. Division 22 Section "Meters and Gages for Plumbing Piping" for thermometers, pressure gages, and flow meters in domestic water piping.
 - 2. Division 22 Section "Domestic Water Piping" for water meters.
 - 3. Division 22 Section "Drinking Fountains and Water Coolers" for water filters for water coolers.

1.3 PERFORMANCE REQUIREMENTS

- A. Minimum Working Pressure for Domestic Water Piping Specialties: 100 psi, unless otherwise indicated.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Diagram power, signal, and control wiring.
- C. Field quality-control test reports.
- D. Operation and Maintenance Data: For domestic water piping specialties to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. NSF Compliance:
 - 1. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic domestic water piping components.
 - 2. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9."

PART 2 - PRODUCTS

2.1 VACUUM BREAKERS

- A. Not Used
- B. Hose-Connection Vacuum Breakers:
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Arrowhead Brass Products, Inc.
 - b. Cash Acme.
 - c. Conbraco Industries, Inc.
 - d. Legend Valve.
 - e. MIFAB, Inc.
 - f. Prier Products, Inc.
 - g. Watts Industries, Inc.; Water Products Div.
 - h. Woodford Manufacturing Company.
 - i. Zurn Plumbing Products Group; Light Commercial Operation.
 - j. Zurn Plumbing Products Group; Wilkins Div.
 - k. **<Insert manufacturer's name.>**
 - 3. Standard: ASSE 1011.
 - 4. Body: Bronze, nonremovable, with manual drain.
 - 5. Outlet Connection: Garden-hose threaded complying with ASME B1.20.7.
 - 6. Finish: Rough bronze.
- C. Not Used:
- D. Not Used:
- E. Not Used:

2.2 BACKFLOW PREVENTERS

- A. Not Used:
- B. Reduced-Pressure-Principle Backflow Preventers:
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 3. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings.
- C. Not Used
- D. Not used
- E. Not Used
- F. Not Used
- G. Not Used
- H. Not Used
- I. Not Used
- J. Not Used

2.3 WATER PRESSURE-REDUCING VALVES

- A. Water Regulators:
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Cash Acme.
 - b. Conbraco Industries, Inc.
 - c. Honeywell Water Controls.
 - d. Watts Industries, Inc.; Water Products Div.
 - e. Zurn Plumbing Products Group; Wilkins Div.
 - 3. Standard: ASSE 1003.
 - 4. Pressure Rating: Initial working pressure of 150 psig
- B. Not Used

2.4 BALANCING VALVES

A. Copper-Alloy Calibrated Balancing Valves:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
3. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings.

B. Not Used

C. Not Used

D. Not Used

2.5 Not Used

2.6 Not Used

2.7 Not Used

2.8 Not Used

2.9 HOSE BIBBS

A. Hose Bibbs:

1. Standard: ASME A112.18.1 for sediment faucets.
2. Body Material: Bronze.
3. Seat: Bronze, replaceable.
4. Supply Connections: NPS 1/2 or NPS 3/4 threaded or solder-joint inlet.
5. Outlet Connection: Garden-hose thread complying with ASME B1.20.7.
6. Pressure Rating: 125 psig.
7. Vacuum Breaker: Integral nonremovable, drainable, hose-connection vacuum breaker complying with ASSE 1011.
8. Finish for Equipment Rooms: Rough bronze, or chrome or nickel plated.
9. Finish for Service Areas: Rough bronze.
10. Finish for Finished Rooms: Chrome or nickel plated.
11. Operation for Equipment Rooms: Wheel handle or operating key.
12. Operation for Service Areas: Wheel handle.
13. Operation for Finished Rooms: Wheel handle.
14. Include operating key with each operating-key hose bibb.
15. Include wall flange with each chrome- or nickel-plated hose bibb.

2.10 WALL HYDRANTS

A. Nonfreeze Wall Hydrants:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Josam Company.
 - b. MIFAB, Inc.
 - c. Prier Products, Inc.
 - d. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - e. Tyler Pipe; Wade Div.
 - f. Watts Drainage Products Inc.
 - g. Woodford Manufacturing Company.
 - h. Zurn Plumbing Products Group; Light Commercial Operation.
 - i. Zurn Plumbing Products Group; Specification Drainage Operation.

B. Not Used

C. Not Used:

D. Not Used

2.11 Not Used

A. Not Used

2.12 Not Used

2.13 DRAIN VALVES

A. Ball-Valve-Type, Hose-End Drain Valves:

1. Standard: MSS SP-110 for standard-port, two-piece ball valves.
2. Pressure Rating: 400-psig minimum CWP.
3. Size: NPS 3/4.
4. Body: Copper alloy.
5. Ball: Chrome-plated brass.
6. Seats and Seals: Replaceable.
7. Handle: Vinyl-covered steel.
8. Inlet: Threaded or solder joint.
9. Outlet: Threaded, short nipple with garden-hose thread complying with ASME B1.20.7 and cap with brass chain.

B. Gate-Valve-Type, Hose-End Drain Valves:

1. Standard: MSS SP-80 for gate valves.
2. Pressure Rating: Class 125.
3. Size: NPS 3/4.

4. Body: ASTM B 62 bronze.
5. Inlet: NPS 3/4 threaded or solder joint.
6. Outlet: Garden-hose thread complying with ASME B1.20.7 and cap with brass chain.

C. Stop-and-Waste Drain Valves :

1. Standard: MSS SP-110 for ball valves or MSS SP-80 for gate valves.
2. Pressure Rating: 200-psig minimum CWP or Class 125.
3. Size: NPS 3/4.
4. Body: Copper alloy or ASTM B 62 bronze.
5. Drain: NPS 1/8 side outlet with cap.

2.14 WATER HAMMER ARRESTERS

A. Water Hammer Arresters:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. AMTROL, Inc.
 - b. Josam Company.
 - c. MIFAB, Inc.
 - d. PPP Inc.
 - e. Sioux Chief Manufacturing Company, Inc.
 - f. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - g. Tyler Pipe; Wade Div.
 - h. Watts Drainage Products Inc.
 - i. Zurn Plumbing Products Group; Specification Drainage Operation.
3. Standard: ASSE 1010 or PDI-WH 201.
4. Type: Metal bellows.
5. Size: ASSE 1010, Sizes AA and A through F or PDI-WH 201, Sizes A through F.

2.15 AIR VENTS

A. Bolted-Construction Automatic Air Vents:

1. Body: Bronze.
2. Pressure Rating: 125-psig minimum pressure rating at 140 deg F.
3. Float: Replaceable, corrosion-resistant metal.
4. Mechanism and Seat: Stainless steel.
5. Size: NPS 3/8 minimum inlet.
6. Inlet and Vent Outlet End Connections: Threaded.

2.16 TRAP-SEAL PRIMER VALVES

A. Supply-Type, Trap-Seal Primer Valves:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. MIFAB, Inc.
 - b. PPP Inc.
 - c. Sioux Chief Manufacturing Company, Inc.
 - d. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - e. Watts Industries, Inc.; Water Products Div.
 - f. **<Insert manufacturer.>**
3. Standard: ASSE 1018.
4. Pressure Rating: 125 psig minimum.
5. Body: Bronze.
6. Inlet and Outlet Connections: NPS 1/2 threaded, union, or solder joint.
7. Gravity Drain Outlet Connection: NPS 1/2 threaded or solder joint.
8. Finish: Chrome plated, or rough bronze for units used with pipe or tube that is not chrome finished.

B. Drainage-Type, Trap-Seal Primer Valves:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
3. Standard: ASSE 1044, lavatory P-trap with NPS 3/8 minimum, trap makeup connection.
4. Size: NPS 1-1/4 minimum.
5. Material: Chrome-plated, cast brass.

2.17 TRAP-SEAL PRIMER SYSTEMS

A. Trap-Seal Primer Systems:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
3. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Refer to Division 22 Section "Common Work Results for Plumbing" for piping joining materials, joint construction, and basic installation requirements.
- B. Install backflow preventers in each water supply to mechanical equipment and systems and to other equipment and water systems that may be sources of contamination. Comply with authorities having jurisdiction.
 - 1. Locate backflow preventers in same room as connected equipment or system.
 - 2. Install drain for backflow preventers with atmospheric-vent drain connection with air-gap fitting, fixed air-gap fitting, or equivalent positive pipe separation of at least two pipe diameters in drain piping and pipe to floor drain. Locate air-gap device attached to or under backflow preventer. Simple air breaks are not acceptable for this application.
 - 3. Do not install bypass piping around backflow preventers.
- C. Install water regulators with inlet and outlet shutoff valves. Install pressure gages on inlet and outlet.
- D. Install water control valves with inlet and outlet shutoff valves. Install pressure gages on inlet and outlet.
- E. Install balancing valves in locations where they can easily be adjusted.
- F. Install temperature-actuated water mixing valves with check stops or shutoff valves on inlets and with shutoff valve on outlet.
 - 1. Install thermometers and water regulators if specified.
 - 2. Install cabinet-type units recessed in or surface mounted on wall as specified.
- G. Install Y-pattern strainers for water on supply side of each water pressure-reducing valve.
- H. Install water hammer arresters in water piping according to PDI-WH 201.
- I. Install air vents at high points of water piping. Install drain piping and discharge onto floor drain.
- J. Install supply-type, trap-seal primer valves with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting. Adjust valve for proper flow.
- K. Install drainage-type, trap-seal primer valves as lavatory trap with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting.
- L. Install trap-seal primer systems with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting. Adjust system for proper flow.

3.2 CONNECTIONS

- A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping and specialties.

- B. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."
- C. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.3 LABELING AND IDENTIFYING

- A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each of the following:
 - 1. Pressure vacuum breakers.
 - 2. Intermediate atmospheric-vent backflow preventers.
 - 3. Reduced-pressure-principle backflow preventers.
 - 4. Double-check backflow-prevention assemblies.
 - 5. Carbonated-beverage-machine backflow preventers.
 - 6. Dual-check-valve backflow preventers.
 - 7. Reduced-pressure-detector, fire-protection backflow-preventer assemblies.
 - 8. Double-check, detector-assembly backflow preventers.
 - 9. Water pressure-reducing valves.
 - 10. Calibrated balancing valves.
 - 11. Primary, thermostatic, water mixing valves.
 - 12. Manifold, thermostatic, water-mixing-valve assemblies.
 - 13. Photographic-process, thermostatic, water-mixing-valve assemblies.
 - 14. Primary water tempering valves.
 - 15. Outlet boxes.
 - 16. Hose stations.
 - 17. Supply-type, trap-seal primer valves.
 - 18. Trap-seal primer systems.
- B. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Division 22 Section "Identification for Plumbing Piping and Equipment."

3.4 FIELD QUALITY CONTROL

- A. Perform the following tests and prepare test reports:
 - 1. Test each reduced-pressure-principle backflow preventer according to authorities having jurisdiction and the device's reference standard.
- B. Remove and replace malfunctioning domestic water piping specialties and retest as specified above.

3.5 ADJUSTING

- A. Set field-adjustable pressure set points of water pressure-reducing valves.
- B. Set field-adjustable flow set points of balancing valves.
- C. Set field-adjustable temperature set points of temperature-actuated water mixing valves.

END OF SECTION

SECTION 22 13 13

FACILITY SANITARY SEWERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes gravity-flow, nonpressure sanitary sewerage outside the building, with the following components:
 - 1. Special fittings for expansion and deflection.
 - 2. Backwater valves.
 - 3. Cleanouts.

1.3 DEFINITIONS

- A. ABS: Acrylonitrile-butadiene-styrene plastic.
- B. EPDM: Ethylene-propylene-diene-monomer rubber.
- C. FRP: Fiberglass-reinforced plastic.
- D. LLDPE: Linear low-density, polyethylene plastic.
- E. PE: Polyethylene plastic.
- F. PP: Polypropylene plastic.
- G. PVC: Polyvinyl chloride plastic.
- H. RTRF: Glass-fiber-reinforced, thermosetting-resin fitting.
- I. RTRP: Glass-fiber-reinforced, thermosetting-resin pipe.
- J. TPE: Thermoplastic elastomer.

1.4 PERFORMANCE REQUIREMENTS

- A. Gravity-Flow, Nonpressure, Drainage-Piping Pressure Rating: **10-foot head of water.**

1.5 SUBMITTALS

- A. Product Data: For the following:
 - 1. Special pipe fittings.
 - 2. Backwater valves.
- B. Shop Drawings: For the following:
 - 1. Piping and fittings.
- C. Coordination Drawings: Show pipe sizes, locations, and elevations. Show other piping in same trench and clearances from sewerage system piping. Indicate interface and spatial relationship between manholes, piping, and proximate structures.
- D. Profile Drawings: Show system piping in elevation. Draw profiles at horizontal scale of not less than 1 inch equals 50 feet and vertical scale of not less than 1 inch equals 5 feet. Indicate manholes and piping. Show types, sizes, materials, and elevations of other utilities crossing system piping.
- E. Field quality-control test reports.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Do not store plastic manholes, pipe, and fittings in direct sunlight.
- B. Protect pipe, pipe fittings, and seals from dirt and damage.
- C. Handle manholes according to manufacturer's written rigging instructions.

1.7 PROJECT CONDITIONS

- A. Interruption of Existing Sanitary Sewerage Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:
 - 1. Notify Architect no fewer than two days in advance of proposed interruption of service.
 - 2. Do not proceed with interruption of service without Architect's written permission.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
 - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 PIPING MATERIALS

- A. Refer to Part 3 "Piping Applications" Article for applications of pipe, fitting, and joining materials.

2.3 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS

- A. Pipe and Fittings: ASTM A 74, Service class.
- B. Gaskets: ASTM C 564, rubber.
- C. Calking Materials: ASTM B 29, pure lead and oakum or hemp fiber.

2.4 HUBLESS CAST-IRON SOIL PIPE AND FITTINGS

- A. Pipe and Fittings: ASTM A 888 or CISPI 301.
- B. Shielded Couplings: ASTM C 1277 assembly of metal shield or housing, corrosion-resistant fasteners, and rubber sleeve with integral, center pipe stop.
- C. Shielded, Stainless-Steel Couplings: CISPI 310, with ASTM A 666, Type 301, stainless-steel corrugated shield; stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve.

1. Manufacturers:

- a. ANACO.
- b. Dallas Specialty & Mfg. Co.
- c. Fernco Inc.
- d. Ideal Div.; Stant Corp.
- e. Mission Rubber Company; a division of MCP Industries, Inc.
- f. Tyler Pipe; Soil Pipe Div.
- g. **<Insert manufacturer's name.>**

- 2. Couplings for NPS 1-1/2 to NPS 4: 2-1/8-inch- wide shield with 2 bands.
- 3. Couplings for NPS 5 and NPS 6: 3-inch- wide shield with 4 bands.
- 4. Couplings for NPS 8 and NPS 10: 4-inch- wide shield with 4 bands.

- D. Heavy-Duty, Shielded, Stainless-Steel Couplings, NPS 10 and Smaller: With ASTM A 666, Type 301 or Type 304, stainless-steel shield; 2 or more stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve.

1. Manufacturers:

- a. ANACO.
- b. Clamp-All Corp.
- c. Dallas Specialty & Mfg. Co.
- d. Ideal Div.; Stant Corp.
- e. Mission Rubber Company; a division of MCP Industries, Inc.
- f. Tyler Pipe; Soil Pipe Div.

- 2. Couplings for NPS 1-1/2 to NPS 4: 3 inches.
- 3. Couplings for NPS 5 to NPS 10: 4 inches.

E. Not Used

F. Unshielded Couplings: ASTM C 1461, rigid, sleeve-type, reducing- or transition-type mechanical coupling molded from ASTM C 1440, TPE material with corrosion-resistant-metal tension band and tightening mechanism on each end.

2.5 Not Used

2.6 Not Used

2.7 Not Used

2.8 Not Used

2.9 Not Used

2.10 Not Used

2.11 Not Used

2.12 Not Used

2.13 Not Used

2.14 Not Used

2.15 BACKWATER VALVES

A. Gray-Iron Backwater Valves: ASME A112.14.1, gray-iron body and bolted cover, with bronze seat.

1. Manufacturers:

- a. Josam Company.
- b. Smith, Jay R. Mfg. Co.
- c. Wade Div.; Tyler Pipe.
- d. Watts Industries, Inc.
- e. Watts Industries, Inc.; Enpoco, Inc. Div.
- f. Zurn Specification Drainage Operation; Zurn Plumbing Products Group.

2. Horizontal Type: With swing check valve and hub-and-spigot ends.

3. Combination Horizontal and Manual Gate-Valve Type: With swing check valve, integral gate valve, and hub-and-spigot ends.

4. Terminal Type: With bronze seat, swing check valve, and hub inlet.

B. Not Used

2.16 CLEANOUTS

A. Gray-Iron Cleanouts: ASME A112.36.2M, round, gray-iron housing with clamping device and round, secured, scoriated, gray-iron cover. Include gray-iron ferrule with inside calk or spigot connection and countersunk, tapered-thread, brass closure plug.

1. Manufacturers:

- a. Josam Company.
- b. MIFAB Manufacturing Inc.
- c. Smith, Jay R. Mfg. Co.
- d. Wade Div.; Tyler Pipe.
- e. Watts Industries, Inc.
- f. Watts Industries, Inc.; Enpoco, Inc. Div.
- g. Zurn Specification Drainage Operation; Zurn Plumbing Products Group.

2. Top-Loading Classification: Heavy duty.

3. Sewer Pipe Fitting and Riser to Cleanout: ASTM A 74, Service class, cast-iron soil pipe and fittings.

B. Not Used

C. Not Used

2.17 Not Used

2.18 Not Used

2.19 Not Used

PART 3 - EXECUTION

3.1 EARTHWORK

A. Excavating, trenching, and backfilling are specified in Division 31 Section "Earth Moving."

3.2 PIPING APPLICATIONS

A. Pipe couplings and special pipe fittings with pressure ratings at least equal to piping rating may be used in applications below, unless otherwise indicated.

1. Use nonpressure-type flexible couplings where required to join gravity-flow, nonpressure sewer piping, unless otherwise indicated.

- a. Unshielded flexible couplings for same or minor difference OD pipes.

- b. Unshielded, increaser/reducer-pattern, flexible couplings for pipes with different OD.
- c. Ring-type flexible couplings for piping of different sizes where annular space between smaller piping's OD and larger piping's ID permits installation.

2. Not Used

- B. Special Pipe Fittings: Use for pipe expansion and deflection. Pipe couplings and special pipe fittings with pressure ratings at least equal to piping rating may be used in applications below, unless otherwise indicated.
- C. Gravity-Flow, Nonpressure Sewer Piping: Use any of the following pipe materials for each size range:
 - 1. NPS 3: Hub-and-spigot, Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
 - 2. NPS 3: Hubless cast-iron soil pipe and fittings; heavy-duty, shielded, stainless-steel couplings; and coupled joints.
 - 3. NPS 3 or NPS 6 ductile-iron, gravity sewer pipe or NPS 3 or NPS 4 ductile-iron pressure pipe; ductile-iron standard fittings; gaskets; and gasketed joints.
 - 4. NPS 3: Stainless-steel drainage pipe and fittings, gaskets, and gasketed joints. Use EPDM-compound gaskets, unless otherwise indicated. Use nitrile-rubber-compound gaskets for wastes containing gasoline or oil.
 - 5. NPS 3: ABS, SDR 35, sewer pipe and fittings; gaskets; and gasketed joints.
 - 6. NPS 3: PVC water-service pipe; PVC Schedule 40, water-service-pipe fittings; and solvent-cemented joints.
 - 7. NPS 3 or NPS 4 PVC sewer pipe and fittings, gaskets, and gasketed joints.
 - 8. NPS 3 or NPS 4 Class 1, nonreinforced-concrete sewer pipe and fittings, gaskets, and gasketed joints.

3.3 PIPING INSTALLATION

- A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground sanitary sewerage piping. Location and arrangement of piping layout take design considerations into account. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.
- B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for using lubricants, cements, and other installation requirements.
- C. Install manholes for changes in direction, unless fittings are indicated. Use fittings for branch connections, unless direct tap into existing sewer is indicated.
- D. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.
- E. Tunneling: Install pipe under streets or other obstructions that cannot be disturbed by tunneling, jacking, or combination of both.
- F. Install gravity-flow, nonpressure, drainage piping according to the following:

1. Install piping pitched down in direction of flow, at minimum slope of **2** percent, unless otherwise indicated.
2. Install piping NPS 6 and larger with restrained joints at tee fittings and at changes in direction. Use corrosion-resistant rods, pipe or fitting manufacturer's proprietary restraint system, or cast-in-place-concrete supports or anchors.
3. Install piping with 36-inch minimum cover.
4. Install piping below frost line.
5. Install hub-and-spigot, cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook."
6. Install hubless cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook."

G. Not Used.

H. Not Used

3.4 PIPE JOINT CONSTRUCTION

- A. Basic piping joint construction is specified in Division 22 Section "Common Work Results for Plumbing" Where specific joint construction is not indicated, follow piping manufacturer's written instructions.
- B. Join gravity-flow, nonpressure, drainage piping according to the following:
1. Join hub-and-spigot, cast-iron soil piping with gasket joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.
 2. Join hub-and-spigot, cast-iron soil piping with calked joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for lead and oakum calked joints.
 3. Join hubless cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-coupling joints.

C. Not Used

3.5 Not Used

3.6 Not Used

3.7 BACKWATER VALVE INSTALLATION

- A. Install horizontal-type backwater valves in piping where indicated.
- B. Install combination horizontal and manual gate valve type in piping and in manholes where indicated.
- C. Install terminal-type backwater valves on end of piping and in manholes where indicated. Secure units to sidewalls.

3.8 CLEANOUT INSTALLATION

- A. Install cleanouts and riser extensions from sewer pipes to cleanouts at grade. Use cast-iron soil pipe fittings in sewer pipes at branches for cleanouts and cast-iron soil pipe for riser extensions to cleanouts. Install piping so cleanouts open in direction of flow in sewer pipe.
 - 1. Use light-duty, top-loading classification cleanouts in earth or unpaved foot-traffic.
 - 2. Use medium-duty, top-loading classification cleanouts in paved foot-traffic areas.
 - 3. Use heavy-duty, top-loading classification cleanouts in vehicle-traffic service areas.
 - 4. Use extra-heavy-duty, top-loading classification cleanouts in roads.
- B. Set cleanout frames and covers in earth in cast-in-place-concrete block, 18 by 18 by 6 inches deep. Set with tops 1 inch above surrounding grade.
- C. Set cleanout frames and covers in concrete pavement with tops flush with pavement surface.

3.9 CONNECTIONS

- A. Connect nonpressure, gravity-flow drainage piping to building's sanitary building drains specified in Division 22 Section "Sanitary Waste and Vent Piping."
- B. Not Used
- C. Not Used

3.10 Not Used

3.11 Not Used

3.12 Not Used

3.13 FIELD QUALITY CONTROL

- A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches of backfill is in place, and again at completion of Project.
 - 1. Submit separate report for each system inspection.
 - 2. Defects requiring correction include the following:
 - a. Alignment: Less than full diameter of inside of pipe is visible between structures.
 - b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
 - c. Crushed, broken, cracked, or otherwise damaged piping.
 - d. Infiltration: Water leakage into piping.
 - e. Exfiltration: Water leakage from or around piping.
 - 3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
 - 4. Reinspect and repeat procedure until results are satisfactory.

- B. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.
 - 1. Do not enclose, cover, or put into service before inspection and approval.
 - 2. Test completed piping systems according to requirements of authorities having jurisdiction.
 - 3. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours' advance notice.
 - 4. Submit separate report for each test.
 - 5. Hydrostatic Tests: Test sanitary sewerage according to requirements of authorities having jurisdiction and the following:
 - a. Allowable leakage is maximum of 50 gal./inch of nominal pipe size per mile of pipe, during 24-hour period.
 - b. Close openings in system and fill with water.
 - c. Purge air and refill with water.
 - d. Disconnect water supply.
 - e. Test and inspect joints for leaks.
 - 6. Air Tests: Test sanitary sewerage according to requirements of authorities having jurisdiction, UNI-B-6, and the following:
 - a. Option: Test plastic gravity sewer piping according to ASTM F 1417.
 - b. Option: Test concrete gravity sewer piping according to ASTM C 924.
- C. Leaks and loss in test pressure constitute defects that must be repaired.
- D. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

3.14 CLEANING

- A. Clean interior of piping of dirt and superfluous material.

END OF SECTION

SECTION 22 13 16

SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following for soil, waste, and vent piping inside the building:
 - 1. Pipe, tube, and fittings.
 - 2. Special pipe fittings..
- B. Not Used

1.3 DEFINITIONS

- A. ABS: Acrylonitrile-butadiene-styrene plastic.
- B. EPDM: Ethylene-propylene-diene terpolymer rubber.
- C. LLDPE: Linear, low-density polyethylene plastic.
- D. NBR: Acrylonitrile-butadiene rubber.
- E. PE: Polyethylene plastic.
- F. PVC: Polyvinyl chloride plastic.
- G. TPE: Thermoplastic elastomer.

1.4 PERFORMANCE REQUIREMENTS

- A. Components and installation shall be capable of withstanding the following minimum working pressure, unless otherwise indicated:
 - 1. Soil, Waste, and Vent Piping: 10-foot head of water.
 - 2. Not Used
- B. Not Used

1.5 SUBMITTALS

- A. Product Data: For pipe, tube, fittings, and couplings.
- B. Not Used:
- C. Shop Drawings:
 - 1. Material and fittings
- D. Field quality-control inspection and test reports.

1.6 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with NSF 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-dwv" for plastic drain, waste, and vent piping; "NSF-drain" for plastic drain piping; "NSF-tubular" for plastic continuous waste piping; and "NSF-sewer" for plastic sewer piping.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
 - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 PIPING MATERIALS

- A. Refer to Part 3 "Piping Applications" Article for applications of pipe, tube, fitting, and joining materials.

2.3 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS

- A. Pipe and Fittings: ASTM A 74, Service class.
- B. Gaskets: ASTM C 564, rubber.
- C. Calking Materials: ASTM B 29, pure lead and oakum or hemp fiber.

2.4 HUBLESS CAST-IRON SOIL PIPE AND FITTINGS

- A. Pipe and Fittings: ASTM A 888 or CISPI 301.
- B. Sovent Stack Fittings: ASME B16.45 or ASSE 1043, hubless, cast-iron aerator and deaerator drainage fittings.
- C. Shielded Couplings: ASTM C 1277 assembly of metal shield or housing, corrosion-resistant fasteners, and rubber sleeve with integral, center pipe stop.
 - 1. Standard, Shielded, Stainless-Steel Couplings: CISPI 310, with stainless-steel corrugated shield; stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve.
 - a. Manufacturers:
 - 1) ANACO.
 - 2) Fernco, Inc.
 - 3) Ideal Div.; Stant Corp.
 - 4) Mission Rubber Co.
 - 5) Tyler Pipe; Soil Pipe Div.
 - 2. Heavy-Duty, Shielded, Stainless-Steel Couplings: With stainless-steel shield, stainless-steel bands and tightening devices, and ASTM C 564, rubber sleeve.
 - a. Manufacturers:
 - 1) ANACO.
 - 2) Clamp-All Corp.
 - 3) Ideal Div.; Stant Corp.
 - 4) Mission Rubber Co.
 - 5) Tyler Pipe; Soil Pipe Div.
 - 3. Heavy-Duty, Shielded, Cast-Iron Couplings: ASTM A 48/A 48M, two-piece, cast-iron housing; stainless-steel bolts and nuts; and ASTM C 564, rubber sleeve.
 - a. Manufacturers:
 - 1) MG Piping Products Co.
- D. Rigid, Unshielded Couplings: ASTM C 1461, sleeve-type, reducing- or transition-type mechanical coupling molded from ASTM C 1440, TPE material with corrosion-resistant-metal tension band and tightening mechanism on each end.
 - 1. Manufacturers:
 - a. ANACO.

2.5 STEEL PIPE AND FITTINGS

- A. Steel Pipe: ASTM A 53/A 53M, Type E or S, Grade A or B, Standard Weight or Schedule 40, galvanized. Include ends matching joining method.
- B. Drainage Fittings: ASME B16.12 galvanized, threaded, cast-iron drainage pattern.

C. Pressure Fittings:

1. Steel Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M or ASTM A 106, Schedule 40, galvanized, seamless steel pipe. Include ends matching joining method.
2. Malleable-Iron Unions: ASME B16.39; Class 150; hexagonal-stock body with ball-and-socket, metal-to-metal, bronze seating surface; and female threaded ends.
3. Gray-Iron, Threaded Fittings: ASME B16.4, Class 125, galvanized, standard pattern.
4. Cast-Iron Flanges: ASME B16.1, Class 125.
5. Cast-Iron, Flanged Fittings: ASME B16.1, Class 125, galvanized.

D. Grooved-Joint Systems:

1. Manufacturers:
 - a. Anvil International.
 - b. Star Pipe Products; Star Fittings Div.
 - c. Victaulic Company.
 - d. Ward Manufacturing, Inc.
2. Grooved-End, Steel-Piping Fittings: ASTM A 47/A 47M, galvanized, malleable-iron casting; ASTM A 106, galvanized-steel pipe; or ASTM A 536, galvanized, ductile-iron casting; with dimensions matching steel pipe.
3. Grooved-End, Steel-Piping Couplings: AWWA C606, for steel-pipe dimensions. Include ferrous housing sections, gasket suitable for water, and bolts and nuts.

2.6 Not Used

2.7 DUCTILE-IRON PIPE AND FITTINGS

- A. Mechanical-Joint, Ductile-Iron Pipe: AWWA C151, with mechanical-joint bell and plain spigot end, unless grooved or flanged ends are indicated.
 1. Mechanical-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
 2. Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron glands, rubber gaskets, and steel bolts.
- B. Push-on-Joint, Ductile-Iron Pipe: AWWA C151, with push-on-joint bell and plain spigot end, unless grooved or flanged ends are indicated.
 1. Push-on-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
 2. Gaskets: AWWA C111, rubber.
- C. Grooved-Joint Systems:
 1. Manufacturers:
 - a. Victaulic Company.
 2. Grooved-End, Ductile-Iron Fittings: ASTM A 47/A 47M, malleable-iron castings or ASTM A 536, ductile-iron castings with dimensions matching pipe.

3. Grooved-End, Ductile-Iron-Piping Couplings: AWWA C606, for ductile-iron-pipe dimensions. Include ferrous housing sections, gasket suitable for water, and bolts and nuts.

D. Flanges: ASME 16.1, Class 125, cast iron.

2.8 COPPER TUBE AND FITTINGS

A. Copper DWV Tube: ASTM B 306, drainage tube, drawn temper.

1. Copper Drainage Fittings: ASME B16.23, cast copper or ASME B16.29, wrought copper, solder-joint fittings.

B. Hard Copper Tube: ASTM B 88, Types L and M, water tube, drawn temper.

1. Copper Pressure Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.
2. Copper Flanges: ASME B16.24, Class 150, cast copper with solder-joint end.
3. Copper Unions: MSS SP-123, copper-alloy, hexagonal-stock body with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.

C. Soft Copper Tube: ASTM B 88, Type L, water tube, annealed temper.

1. Copper Pressure Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.

2.9 Not Used

2.10 Not Used

2.11 SPECIAL PIPE FITTINGS

A. Flexible, Nonpressure Pipe Couplings: Comply with ASTM C 1173, elastomeric, sleeve-type, reducing or transition pattern. Include shear ring, ends of same sizes as piping to be joined, and corrosion-resistant-metal tension band and tightening mechanism on each end.

1. Manufacturers:

- a. Dallas Specialty & Mfg. Co.
- b. Fernco, Inc.
- c. Logan Clay Products Company (The).
- d. Mission Rubber Co.
- e. NDS, Inc.
- f. Plastic Oddities, Inc.

2. Sleeve Materials:

- a. For Cast-Iron Soil Pipes: ASTM C 564, rubber.
- b. For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
- c. For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.

- B. Shielded Nonpressure Pipe Couplings: ASTM C 1460, elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.
1. Manufacturers:
 - a. Cascade Waterworks Mfg. Co.
 - b. Mission Rubber Co.
- C. Rigid, Unshielded, Nonpressure Pipe Couplings: ASTM C 1461, sleeve-type reducing- or transition-type mechanical coupling molded from ASTM C 1440, TPE material with corrosion-resistant-metal tension band and tightening mechanism on each end.
1. Manufacturers:
 - a. ANACO.
- D. Pressure Pipe Couplings: AWWA C219 metal, sleeve-type same size as, with pressure rating at least equal to, and ends compatible with, pipes to be joined.
1. Manufacturers:
 - a. Cascade Waterworks Mfg. Co.
 - b. Dresser, Inc.; DMD Div.
 - c. EBAA Iron Sales, Inc.
 - d. Ford Meter Box Company, Inc. (The); Pipe Products Div.
 - e. JCM Industries, Inc.
 - f. Romac Industries, Inc.
 - g. Smith-Blair, Inc.
 - h. Viking Johnson.
 2. Center-Sleeve Material: Manufacturer's standard.
 3. Gasket Material: Natural or synthetic rubber.
 4. Metal Component Finish: Corrosion-resistant coating or material.
- E. Flexible Ball Joints: Ductile-iron fitting with combination of flanged and mechanical-joint ends complying with AWWA C110 or AWWA C153. Include gasketed ball-joint section and ductile-iron gland, rubber gasket, and steel bolts.
1. Manufacturers:
 - a. EBAA Iron Sales, Inc.
- F. Expansion Joints: Two or three-piece, ductile-iron assembly consisting of telescoping sleeve(s) with gaskets and restrained-type, ductile-iron, bell-and-spigot end sections complying with AWWA C110 or AWWA C153. Select and assemble components for expansion indicated. Include AWWA C111, ductile-iron glands, rubber gaskets, and steel bolts.
1. Manufacturers:
 - a. EBAA Iron Sales, Inc.
 - b. Romac Industries, Inc.
 - c. Star Pipe Products; Star Fittings Div.

- G. Wall-Penetration Fittings: Compound, ductile-iron coupling fitting with sleeve and flexing sections for up to 20-degree deflection, gaskets, and restrained-joint ends complying with AWWA C110 or AWWA C153. Include AWWA C111, ductile-iron glands, rubber gaskets, and steel bolts.

1. Manufacturers:

- a. SIGMA Corp.

2.12 Not Used

PART 3 - EXECUTION

3.1 EXCAVATION

- A. Refer to Division 31 Section "Earth Moving" for excavating, trenching, and backfilling.

3.2 PIPING APPLICATIONS

- A. Flanges and unions may be used on aboveground pressure piping, unless otherwise indicated.

- B. Aboveground, soil and waste piping NPS 4 and smaller the following:

1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
2. Hubless cast-iron soil pipe and fittings couplings; and hubless-coupling joints.
3. Steel pipe, drainage fittings, and threaded joints.
4. Stainless-steel pipe and fittings, gaskets, and gasketed joints.
5. Copper DWV tube, copper drainage fittings, and soldered joints.

- C. Aboveground, soil and waste piping NPS 5 shall be any of the following:

1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
2. Hubless cast-iron soil pipe and fittings and hubless-coupling joints.
3. Steel pipe, drainage fittings, and threaded joints.

- D. Aboveground, vent piping NPS 4 and smaller shall be any of the following:

1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
2. Hubless cast-iron soil pipe and fittings; standard, shielded, stainless-steel couplings; and hubless-coupling joints.
3. Steel pipe, drainage fittings, and threaded joints.
4. Stainless-steel pipe and fittings gaskets, and gasketed joints.
5. Copper DWV tube, copper drainage fittings, and soldered joints.

- a. Option for Vent Piping, NPS 2-1/2 and NPS 3-1/2: Hard copper tube, Type M ; copper pressure fittings; and soldered joints.

- E. Aboveground, vent piping NPS 5 and larger shall be the following:

1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.

2. Hubless cast-iron soil pipe and fittings; standard shielded, stainless-steel couplings; and hubless-coupling joints.
 3. Steel pipe, drainage fittings, and threaded joints.
- F. Underground, soil, waste, and vent piping NPS 4 and smaller shall be any of the following:
1. Extra-Heavy class, cast-iron soil piping; gaskets; and gasketed joints.
 2. Hubless cast-iron soil pipe and fittings; [standard, shielded, stainless-steel] [heavy-duty shielded, stainless-steel] [heavy-duty shielded, cast-iron] [and] [rigid, unshielded] couplings; and hubless-coupling joints.
 3. Stainless-steel pipe and fittings, gaskets, and gasketed joints.
- G. Underground, soil and waste piping NPS 5 and larger shall be any of the following:
1. **Extra-Heavy** class, cast-iron soil piping; gaskets; and gasketed joints.
 2. Hubless cast-iron soil pipe and fittings; heavy-duty shielded, stainless-steel couplings; and hubless-coupling joints.
- H. Not Used
- I. Not Used
- J. Not Used
- K. Not Used

3.3 PIPING INSTALLATION

- A. Sanitary sewer piping outside the building is specified in Division 22 Section "Facility Sanitary Sewers."
- B. Basic piping installation requirements are specified in Division 22 Section "Common Work Results for Plumbing."
- C. Not Used
- D. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers.
- E. Not Used
- F. Not Used
- G. Not Used
- H. Not Used
- I. Not Used
- J. Install cast-iron sleeve with water stop and mechanical sleeve seal at each service pipe penetration through foundation wall. Select number of interlocking rubber links required to make installation watertight. Sleeves and mechanical sleeve seals are specified in Division 22 Section "Common Work Results for Plumbing."

- K. Install wall-penetration fitting at each service pipe penetration through foundation wall. Make installation watertight.
- L. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."
 - 1. Install encasement on underground piping according to ASTM A 674 or AWWA C105.
- M. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch and 1/8-bend fittings if 2 fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.
- N. Lay buried building drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.
- O. Install soil and waste drainage and vent piping at the following minimum slopes, unless otherwise indicated:
 - 1. Building Sanitary Drain: 2 percent downward in direction of flow for piping NPS 3 and smaller; 1 percent downward in direction of flow for piping NPS 4 and larger.
 - 2. Horizontal Sanitary Drainage Piping: 2 percent downward in direction of flow.
 - 3. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.
- P. Install engineered soil and waste drainage and vent piping systems as follows:
 - 1. Combination Waste and Vent: Comply with standards of authorities having jurisdiction.
 - 2. Solvent Drainage System: Comply with ASSE 1043 and solvent fitting manufacturer's written installation instructions.
 - 3. Reduced-Size Venting: Comply with standards of authorities having jurisdiction.
- Q. Sleeves are not required for cast-iron soil piping passing through concrete slabs-on-grade if slab is without membrane waterproofing.
- R. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

3.4 JOINT CONSTRUCTION

- A. Basic piping joint construction requirements are specified in Division 22 Section "Common Work Results for Plumbing."
- B. Join hub-and-spigot, cast-iron soil piping with gasket joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.
- C. Join hub-and-spigot, cast-iron soil piping with calked joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for lead and oakum calked joints.

- D. Join hubless cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-coupling joints.
- E. Soldered Joints: Use ASTM B 813, water-flushable, lead-free flux; ASTM B 32, lead-free-alloy solder; and ASTM B 828 procedure, unless otherwise indicated.
- F. Grooved Joints: Assemble joint with keyed coupling, gasket, lubricant, and bolts according to coupling and fitting manufacturer's written instructions.
- G. PVC Nonpressure Piping Joints: Join piping according to ASTM D 2665.

3.5 VALVE INSTALLATION

- A. General valve installation requirements are specified in Division 22 Section "General-Duty Valves for Plumbing Piping."
- B. Shutoff Valves: Install shutoff valve on each sewage pump discharge.
 - 1. Install gate or full-port ball valve for piping NPS 2 and smaller.
 - 2. Install gate valve for piping NPS 2-1/2 and larger.
- C. Check Valves: Install swing check valve, between pump and shutoff valve, on each sewage pump discharge.
- D. Backwater Valves: Install backwater valves in piping subject to sewage backflow.
 - 1. Horizontal Piping: Horizontal backwater valves. Use normally closed type, unless otherwise indicated.
 - 2. Floor Drains: Drain outlet backwater valves, unless drain has integral backwater valve.
 - 3. Install backwater valves in accessible locations.
 - 4. Backwater valve are specified in Division 22 Section "Sanitary Waste Piping Specialties."

3.6 HANGER AND SUPPORT INSTALLATION

- A. Seismic-restraint devices are specified in Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment."
- B. Pipe hangers and supports are specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment." Install the following:
 - 1. Vertical Piping: MSS Type 8 or Type 42, clamps.
 - 2. Install individual, straight, horizontal piping runs according to the following:
 - a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
 - b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
 - c. Longer Than 100 Feet, if Indicated: MSS Type 49, spring cushion rolls.
 - 3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
 - 4. Base of Vertical Piping: MSS Type 52, spring hangers.
- C. Install supports according to Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."

- D. Support vertical piping and tubing at base and at each floor.
- E. Rod diameter may be reduced 1 size for double-rod hangers, with 3/8-inch minimum rods.
- F. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 1-1/2 and NPS 2: 60 inches with 3/8-inch rod.
 - 2. NPS 3: 60 inches with 1/2-inch rod.
 - 3. NPS 4 and NPS 5: 60 inches with 5/8-inch rod.
 - 4. NPS 6: 60 inches with 3/4-inch rod.
 - 5. NPS 8 to NPS 12: 60 inches with 7/8-inch rod.
- G. Install supports for vertical cast-iron soil piping every 15 feet.

3.7 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.
- C. Connect drainage and vent piping to the following:
 - 1. Plumbing Fixtures: Connect drainage piping in sizes indicated, but not smaller than required by plumbing code.
 - 2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
 - 3. Plumbing Specialties: Connect drainage and vent piping in sizes indicated, but not smaller than required by plumbing code.
 - 4. Equipment: Connect drainage piping as indicated. Provide shutoff valve, if indicated, and union for each connection. Use flanges instead of unions for connections NPS 2-1/2 and larger.
- D. Connect force-main piping to the following:
 - 1. Sanitary Sewer: To exterior force main or sanitary manhole.
 - 2. Sewage Pumps: To sewage pump discharge.

3.8 FIELD QUALITY CONTROL

- A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.
 - 1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
 - 2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
- B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
- C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

- D. Test sanitary drainage and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
 2. Leave uncovered and unconcealed new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
 3. Roughing-in Plumbing Test Procedure: Test drainage and vent piping, except outside leaders, on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water. From 15 minutes before inspection starts to completion of inspection, water level must not drop. Inspect joints for leaks.
 4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1-inch wg. Use U-tube or manometer inserted in trap of water closet to measure this pressure. Air pressure must remain constant without introducing additional air throughout period of inspection. Inspect plumbing fixture connections for gas and water leaks.
 5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
 6. Prepare reports for tests and required corrective action.
- E. Test force-main piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
1. Leave uncovered and unconcealed new, altered, extended, or replaced force-main piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
 2. Cap and subject piping to static-water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
 3. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
 4. Prepare reports for tests and required corrective action.

3.9 CLEANING

- A. Clean interior of piping. Remove dirt and debris as work progresses.
- B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.
- C. Place plugs in ends of uncompleted piping at end of day and when work stops.

3.10 PROTECTION

- A. Not Used

END OF SECTION 221316

SECTION 22 3400**FUEL-FIRED DOMESTIC WATER HEATERS****PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

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

1.2 SUMMARY

- A. This Section includes the following fuel-fired water heaters:
 - 1. Commercial, atmospheric, storage, gas water heaters.
 - 2. Commercial, power-burner, storage, gas water heaters.
 - 3. Compression tanks.
 - 4. Water heater accessories.

1.3 SUBMITTALS

- A. Product Data: For each type and size of water heater indicated. Include rated capacities, operating characteristics, furnished specialties, and accessories.
- B. Shop Drawings: Diagram power, signal, and control wiring.
- C. Product Certificates: For each type of commercial water heater, signed by product manufacturer.

1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain same type of water heaters through one source from a single manufacturer.
- B. Product Options: Drawings indicate size, profiles, and dimensional requirements of water heaters and are based on the specific system indicated. Refer to Division 01 Section "Product Requirements."
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- D. ASME Compliance:
 - 1. Where ASME-code construction is indicated, fabricate and label commercial water heater storage tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
 - 2. Where ASME-code construction is indicated, fabricate and label commercial, finned-tube water heaters to comply with ASME Boiler and Pressure Vessel Code: Section IV.

- E. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9" for all components that will be in contact with potable water.

1.5 COORDINATION

- A. Coordinate size and location of concrete bases with Architectural and Structural Drawings.

1.6 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of fuel-fired water heaters that fail in materials or workmanship within specified warranty period.

- 1. Failures include, but are not limited to, the following:
 - a. Structural failures including storage tank and supports.
 - b. Faulty operation of controls.
 - c. Deterioration of metals, metal finishes, and other materials beyond normal use.
- 2. Warranty Period(s): From date of Substantial Completion:
 - a. Household, Gas Water Heaters:
 - 1) Storage Tank: Five years.
 - 2) Controls and Other Components: Two years.
 - b. Instantaneous, Gas Water Heaters:
 - 1) Heat Exchanger: Five years.
 - 2) Controls and Other Components: Three years.
 - c. Commercial, Gas Water Heaters:
 - 1) Storage Tank: Three years.
 - 2) Controls and Other Components: Three years.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
 - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 HOUSEHOLD, GAS WATER HEATERS

A. Commercial, High-Efficiency, Gas Water Heaters: Comply with ANSI Z21.10.3/CSA 4.3.

1. Manufacturers:
 - a. AERCO International.
 - b. Bradford White Corporation.
 - c. Heat Transfer Products, Inc.
 - d. Laars Heating Systems; Waterpik Technologies, Inc.
 - e. Lochinvar Corporation.
 - f. Patterson-Kelley.
 - g. RBI Water Heaters; a Mestek, Inc. Company.
 - h. Smith, A. O. Water Products Company.
 - i. State Industries, Inc.
 - j. Weben-Jarco, Inc.
2. Description: Manufacturer's proprietary design to provide at least 84 percent combustion efficiency at optimum operating conditions. Following features and attributes may be modified or omitted if water heater otherwise complies with requirements for performance.
3. Storage-Tank Construction: ASME-code steel with 150-psig minimum working-pressure rating.
 - a. Tappings: Factory fabricated of materials compatible with tank. Attach tappings to tank before testing.
 - 1) NPS 2 and Smaller: Threaded ends according to ASME B1.20.1.
 - 2) NPS 2-1/2 and Larger: Flanged ends according to ASME B16.5 for steel and stainless-steel flanges, and according to ASME B16.24 for copper and copper-alloy flanges.
 - b. Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.
 - c. Lining: [Cement] [Glass] [Nickel plate] [Phenolic coating] [Sheet copper] complying with NSF 61 barrier materials for potable-water tank linings, including extending lining into and through tank fittings and outlets.
4. Factory-Installed, Storage-Tank Appurtenances:
 - a. Anode Rod: Replaceable magnesium.
 - b. Dip Tube: Provide unless cold-water inlet is near bottom of tank.
 - c. Drain Valve: Corrosion-resistant metal complying with ASSE 1005.
 - d. Insulation: Comply with ASHRAE/IESNA 90.1. Surround entire storage tank except connections and controls.
 - e. Jacket: Steel with enameled finish.
 - f. Combination Temperature and Pressure Relief Valves: ANSI Z21.22/CSA 4.4. Include one or more relief valves with total relieving capacity at least as great as heat input, and include pressure setting less than water heater working-pressure rating. Select one relief valve with sensing element that extends into storage tank.
5. Burner or Heat Exchanger: Comply with UL 795 or approved testing agency requirements for high-efficiency water heaters and for natural-gas fuel.
6. Temperature Control: Adjustable thermostat.

7. Safety Controls: Automatic, high-temperature-limit and low-water cutoff devices or systems.
8. Building Automation System Interface: Normally closed dry contacts for enabling and disabling water heater.
9. Draft Hood: Draft diverter; complying with ANSI Z21.12.

2.3 WATER HEATER ACCESSORIES

- A. Gas Shutoff Valves: ANSI Z21.15/CGA 9.1, manually operated. Furnish for installation in piping.
- B. Gas Pressure Regulators: ANSI Z21.18, appliance type. Include pressure rating, capacity, and pressure differential required between gas supply and water heater.
- C. Gas Automatic Valves: ANSI Z21.21, appliance, electrically operated, on-off automatic valve.
- D. Combination Temperature and Pressure Relief Valves: Include relieving capacity at least as great as heat input, and include pressure setting less than water heater working-pressure rating. Select each relief valve with sensing element that extends into storage tank.
 1. Gas Water Heaters: ANSI Z21.22/CSA 4.4.
 2. Oil-Fired Water Heaters: ASME rated and stamped and complying with ASME PTC 25.3.
- E. Pressure Relief Valves: Include pressure setting less than working-pressure rating of water heater.
 1. Gas Water Heaters: ANSI Z21.22/CSA 4.4.
 2. Oil-Fired Water Heaters: ASME rated and stamped and complying with ASME PTC 25.3.
- F. Water Heater Stand and Drain Pan Units: High-density-polyethylene-plastic, 18-inch- high, enclosed-base stand complying with IAPMO PS 103 and IAS No. 2. Include integral or separate drain pan with raised edge and NPS 1 drain outlet with ASME B1.20.1 pipe thread.
- G. Water Heater Stands: Water heater manufacturer's factory-fabricated steel stand for floor mounting and capable of supporting water heater and water. Provide dimension that will support bottom of water heater a minimum of 18 inches above the floor.
- H. Water Heater Mounting Brackets: Water heater manufacturer's factory-fabricated steel bracket for wall mounting and capable of supporting water heater and water.
- I. Drain Pans: Corrosion-resistant metal with raised edge. Provide dimensions not less than base of water heater and include drain outlet not less than NPS 3/4.
- J. Piping Manifold Kits: Water heater manufacturer's factory-fabricated inlet and outlet piping arrangement for multiple-unit installation. Include piping and valves for field assembly that is capable of isolating each water heater and of providing balanced flow through each water heater.

2.4 SOURCE QUALITY CONTROL

- A. Test and inspect water heater storage tanks, specified to be ASME-code construction, according to ASME Boiler and Pressure Vessel Code.

- B. Hydrostatically test commercial water heater storage tanks before shipment to minimum of one and one-half times pressure rating.
- C. Prepare test reports.

PART 3 - EXECUTION

3.1 WATER HEATER INSTALLATION

- A. Install commercial water heaters on concrete bases.
 - 1. Exception: Omit concrete bases for commercial water heaters if installation on stand, bracket, suspended platform, or direct on floor is indicated.
 - 2. Concrete base construction requirements are specified in Division 22 Section "Common Work Results for Plumbing."
- B. Install water heaters level and plumb, according to layout drawings, original design, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.
- C. Install seismic restraints for commercial water heaters. Anchor to substrate.
- D. Install gas water heaters according to NFPA 54.
- E. Install gas shutoff valves on gas supplies to gas water heaters without shutoff valves.
- F. Install gas pressure regulators on gas supplies to gas water heaters without gas pressure regulators if gas pressure regulators are required to reduce gas pressure at burner.
- G. Install automatic gas valves on gas supplies to gas water heaters, if required for operation of safety control.
- H. Install oil-fired water heaters according to NFPA 31.
- I. Install combination temperature and pressure relief valves in top portion of storage tanks. Use relief valves with sensing elements that extend into tanks. Extend commercial-water-heater, relief-valve outlet, with drain piping same as domestic water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.
- J. Install combination temperature and pressure relief valves in water piping for water heaters without storage. Extend commercial-water-heater relief-valve outlet, with drain piping same as domestic water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.
- K. Install water heater drain piping as indirect waste to spill by positive air gap into open drains or over floor drains. Install hose-end drain valves at low points in water piping for water heaters that do not have tank drains. Refer to Division 22 Section "Domestic Water Piping Specialties" for hose-end drain valves.
- L. Install thermometer on outlet piping of water heaters. Refer to Division 22 Section "Meters and Gages for Plumbing Piping" for thermometers.

- M. Install pressure gage(s) on inlet and outlet piping of commercial, fuel-fired water heater piping. Refer to Division 22 Section "Meters and Gages for Plumbing Piping" for pressure gages.
- N. Assemble and install inlet and outlet piping manifold kits for multiple water heaters. Fabricate, modify, or arrange manifolds for balanced water flow through each water heater. Include shutoff valve and thermometer in each water heater inlet and outlet, and throttling valve in each water heater outlet. Refer to Division 22 Section "General-Duty Valves for Plumbing Piping" for general-duty valves and to Division 22 Section "Meters and Gages for Plumbing Piping" for thermometers.
- O. Install piping-type heat traps on inlet and outlet piping of water heater storage tanks without integral or fitting-type heat traps.
- P. Fill water heaters with water.
- Q. Charge compression tanks with air.

3.2 CONNECTIONS

- A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to water heaters to allow service and maintenance. Arrange piping for easy removal of water heaters.
- C. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."
- D. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.3 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections, and to assist in field testing. Report results in writing.
- B. Perform the following field tests and inspections and prepare test reports:
 - 1. Leak Test: After installation, test for leaks. Repair leaks and retest until no leaks exist.
 - 2. Operational Test: After electrical circuitry has been energized, confirm proper operation.
 - 3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- C. Remove and replace water heaters that do not pass tests and inspections and retest as specified above.

3.4 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain instantaneous and commercial water heaters. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION 22 3400

SECTION 22 40 00**PLUMBING FIXTURES****PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

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

1.2 SUMMARY

- A. This Section includes the following conventional plumbing fixtures and related components:

1. Faucets for lavatories.
2. Flushometers.
3. Toilet seats.
4. Protective shielding guards.
5. Fixture supports.
6. Interceptors.
7. Hot-water dispensers.
8. Water closets.
9. Urinals.
10. Lavatories.
11. Service sinks.

- B. Related Sections include the following:

1. Division 10 Section "Toilet, Bath, and Laundry Accessories."
2. Division 22 Section "Domestic Water Piping Specialties" for backflow preventers, floor drains, and specialty fixtures not included in this Section.
3. Division 31 Section "Facility Water Distribution Piping" for exterior plumbing fixtures and hydrants.

1.3 DEFINITIONS

- A. ABS: Acrylonitrile-butadiene-styrene plastic.
- B. Accessible Fixture: Plumbing fixture that can be approached, entered, and used by people with disabilities.
- C. Cast Polymer: Cast-filled-polymer-plastic material. This material includes cultured-marble and solid-surface materials.
- D. Cultured Marble: Cast-filled-polymer-plastic material with surface coating.
- E. Fitting: Device that controls the flow of water into or out of the plumbing fixture. Fittings specified in this Section include supplies and stops, faucets and spouts, shower heads and tub

spouts, drains and tailpieces, and traps and waste pipes. Piping and general-duty valves are included where indicated.

- F. FRP: Fiberglass-reinforced plastic.
- G. PMMA: Polymethyl methacrylate (acrylic) plastic.
- H. PVC: Polyvinyl chloride plastic.
- I. Solid Surface: Nonporous, homogeneous, cast-polymer-plastic material with heat-, impact-, scratch-, and stain-resistance qualities.

1.4 SUBMITTALS

- A. Product Data: For each type of plumbing fixture indicated. Include selected fixture and trim, fittings, accessories, appliances, appurtenances, equipment, and supports. Indicate materials and finishes, dimensions, construction details, and flow-control rates.
- B. Shop Drawings: Diagram power, signal, and control wiring.
- C. Operation and Maintenance Data: For plumbing fixtures to include in emergency, operation, and maintenance manuals.
- D. Warranty: Special warranty specified in this Section.

1.5 QUALITY ASSURANCE

- A. Source Limitations: Obtain plumbing fixtures, faucets, and other components of each category through one source from a single manufacturer.
 - 1. Exception: If fixtures, faucets, or other components are not available from a single manufacturer, obtain similar products from other manufacturers specified for that category.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Regulatory Requirements: Comply with requirements in ICC A117.1, "Accessible and Usable Buildings and Facilities" Public Law 90-480, "Architectural Barriers Act" for plumbing fixtures for people with disabilities.
- D. Regulatory Requirements: Comply with requirements in Public Law 102-486, "Energy Policy Act," about water flow and consumption rates for plumbing fixtures.
- E. NSF Standard: Comply with NSF 61, "Drinking Water System Components--Health Effects," for fixture materials that will be in contact with potable water.
- F. Select combinations of fixtures and trim, faucets, fittings, and other components that are compatible.
- G. Comply with the following applicable standards and other requirements specified for plumbing fixtures:

1. Enameled, Cast-Iron Fixtures: ASME A112.19.1M.
2. Porcelain-Enameled, Formed-Steel Fixtures: ASME A112.19.4M.
3. Vitreous-China Fixtures: ASME A112.19.2M.
4. Water-Closet, Flush Valve, Tank Trim: ASME A112.19.5.
5. Water-Closet, Flushometer Tank Trim: ASSE 1037

H. Comply with the following applicable standards and other requirements specified for lavatory faucets:

1. Backflow Protection Devices for Faucets with Side Spray: ASME A112.18.3M.
2. Backflow Protection Devices for Faucets with Hose-Thread Outlet: ASME A112.18.3M.
3. Diverter Valves for Faucets with Hose Spray: ASSE 1025.
4. Faucets: ASME A112.18.1.
5. Hose-Connection Vacuum Breakers: ASSE 1011.
6. Hose-Coupling Threads: ASME B1.20.7.
7. Integral, Atmospheric Vacuum Breakers: ASSE 1001.
8. NSF Potable-Water Materials: NSF 61.
9. Pipe Threads: ASME B1.20.1.
10. Sensor-Actuated Faucets and Electrical Devices: UL 1951.
11. Supply Fittings: ASME A112.18.1.
12. Brass Waste Fittings: ASME A112.18.2.

I. Comply with the following applicable standards and other requirements specified for miscellaneous fittings:

1. Atmospheric Vacuum Breakers: ASSE 1001.
2. Brass and Copper Supplies: ASME A112.18.1.
3. Dishwasher Air-Gap Fittings: ASSE 1021.
4. Manual-Operation Flushometers: ASSE 1037.
5. Plastic Tubular Fittings: ASTM F 409.
6. Brass Waste Fittings: ASME A112.18.2.
7. Sensor-Operation Flushometers: ASSE 1037 and UL 1951.

J. Comply with the following applicable standards and other requirements specified for miscellaneous components:

1. Disposers: ASSE 1008 and UL 430.
2. Dishwasher Air-Gap Fittings: ASSE 1021.
3. Flexible Water Connectors: ASME A112.18.6.
4. Floor Drains: ASME A112.6.3.
5. Grab Bars: ASTM F 446.
6. Hose-Coupling Threads: ASME B1.20.7.
7. Hot-Water Dispensers: ASSE 1023 and UL 499.
8. Off-Floor Fixture Supports: ASME A112.6.1M.
9. Pipe Threads: ASME B1.20.1.

1.6 WARRANTY

A. Special Warranties: Manufacturer's standard form in which manufacturer agrees to repair or replace components of whirlpools that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

- a. Structural failures of unit shell.
 - b. Faulty operation of controls, blowers, pumps, heaters, and timers.
 - c. Deterioration of metals, metal finishes, and other materials beyond normal use.
2. installed.

PART 2 - PRODUCTS

2.1 LAVATORY FAUCETS

- A. Lavatory Faucets, See Editing Instruction No. 1 in the Evaluations for cautions about naming manufacturers and products. Retain one of first three subparagraphs and list of manufacturers below. See Division 01 Section "Product Requirements."
1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American Standard Companies, Inc.
 - b. Chicago Faucets.
 - c. Delta Faucet Company.
 - d. Eljer.
 - e. Elkay Manufacturing Co.
 - f. Fisher Manufacturing Co.
 - g. Grohe America, Inc.
 - h. Just Manufacturing Company.
 - i. Kohler Co.
 - j. Moen, Inc.
 - k. Royal Brass Mfg. Co.
 - l. Sayco; a Briggs Plumbing Products, Inc. Company.
 - m. Speakman Company.
 - n. T & S Brass and Bronze Works, Inc.
 - o. Zurn Plumbing Products Group; Commercial Brass Operation.

2.2 FLUSHOMETERS

- A. Flushometers,
1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings.

2.3 TOILET SEATS

- A. Toilet Seats,

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
3. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings.

2.4 FIXTURE SUPPORTS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Josam Company.
 2. MIFAB Manufacturing Inc.
 3. Smith, Jay R. Mfg. Co.
 4. Tyler Pipe; Wade Div.
 5. Watts Drainage Products Inc.; a div. of Watts Industries, Inc.
 6. Zurn Plumbing Products Group; Specification Drainage Operation.
- C. Water-Closet Supports:
 1. Description: Combination carrier designed for **accessible** and mounting height of wall-mounting, water-closet-type fixture. Include single or double, vertical or horizontal, hub-and-spigot or hubless waste fitting as required for piping arrangement; faceplates; couplings with gaskets; feet; and fixture bolts and hardware matching fixture. Include additional extension coupling, faceplate, and feet for installation in wide pipe space.
- D. Urinal Supports, :
 1. Description: Type I, urinal carrier with fixture support plates and coupling with seal and fixture bolts and hardware matching fixture for wall-mounting, urinal-type fixture. Include steel uprights with feet.
 2. Accessible-Fixture Support: Include rectangular steel uprights.
- E. Lavatory Supports:
 1. Description: Type I, lavatory carrier with exposed arms and tie rods for wall-mounting, lavatory-type fixture. Include steel uprights with feet.
 2. Accessible-Fixture Support: Include rectangular steel uprights.

2.5 HOT-WATER DISPENSERS

- A. Hot-Water Dispensers, See Drawings:

2.6 WATER CLOSETS

- A. Water Closets,:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
3. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings. Retain one of four lists below.

2.7 URINALS

A. Urinals,

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
3. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings.

2.8 LAVATORIES

A. Lavatories,

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before plumbing fixture installation.
- B. Examine cabinets, counters, floors, and walls for suitable conditions where fixtures will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Assemble plumbing fixtures, trim, fittings, and other components according to manufacturers' written instructions.
- B. Install off-floor supports, affixed to building substrate, for wall-mounting fixtures.

1. Use carrier supports with waste fitting and seal for back-outlet fixtures.
 2. Use carrier supports without waste fitting for fixtures with tubular waste piping.
 3. Use chair-type carrier supports with rectangular steel uprights for accessible fixtures.
- C. Install wall-mounting fixtures with tubular waste piping attached to supports.
- D. Install floor-mounting, back-outlet water closets attached to building floor substrate and wall bracket and onto waste fitting seals.
- E. Install fixtures level and plumb according to roughing-in drawings.
- F. Install water-supply piping with stop on each supply to each fixture to be connected to water distribution piping. Attach supplies to supports or substrate within pipe spaces behind fixtures. Install stops in locations where they can be easily reached for operation.
1. Exception: Use ball, gate, or globe valves if supply stops are not specified with fixture. Valves are specified in Division 22 Section "General-Duty Valves for Plumbing Piping."
- G. Install trap and tubular waste piping on drain outlet of each fixture to be directly connected to sanitary drainage system.
- H. Install tubular waste piping on drain outlet of each fixture to be indirectly connected to drainage system.
- I. Install flushometer valves for accessible water closets and urinals with handle mounted on wide side of compartment. Install other actuators in locations that are easy for people with disabilities to reach.
- J. Install tanks for accessible, tank-type water closets with lever handle mounted on wide side of compartment.
- K. Install toilet seats on water closets.
- L. Install trap-seal liquid in dry urinals.
- M. Install faucet-spout fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.
- N. Install water-supply flow-control fittings with specified flow rates in fixture supplies at stop valves.
- O. Install faucet flow-control fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.
- P. Install shower flow-control fittings with specified maximum flow rates in shower arms.
- Q. Install traps on fixture outlets.
1. Exception: Omit trap on fixtures with integral traps.
 2. Exception: Omit trap on indirect wastes, unless otherwise indicated.
- R. Install disposer in outlet of each sink indicated to have disposer. Install switch where indicated or in wall adjacent to sink if location is not indicated.

- S. Install dishwasher air-gap fitting at each sink indicated to have air-gap fitting. Install on countertop at sink. Connect inlet hose to dishwasher and outlet hose to disposer.
- T. Install hot-water dispensers in back top surface of sink or in countertop with spout over sink.
- U. Install escutcheons at piping wall ceiling penetrations in exposed, finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding fittings. Escutcheons are specified in Division 22 Section "Common Work Results for Plumbing."
- V. Set service basins in leveling bed of cement grout. Grout is specified in Division 22 Section "Common Work Results for Plumbing."
- W. Seal joints between fixtures and walls, floors, and countertops using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Sealants are specified in Division 07 Section "Joint Sealants."

3.3 CONNECTIONS

- A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.
- C. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."
- D. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.4 FIELD QUALITY CONTROL

- A. Verify that installed plumbing fixtures are categories and types specified for locations where installed.
- B. Check that plumbing fixtures are complete with trim, faucets, fittings, and other specified components.
- C. Inspect installed plumbing fixtures for damage. Replace damaged fixtures and components.
- D. Test installed fixtures after water systems are pressurized for proper operation. Replace malfunctioning fixtures and components, then retest. Repeat procedure until units operate properly.
- E. Install fresh batteries in sensor-operated mechanisms.

3.5 ADJUSTING

- A. Operate and adjust faucets and controls. Replace damaged and malfunctioning fixtures, fittings, and controls.
- B. Adjust water pressure at faucets and flushometer valves to produce proper flow and stream.

- C. Replace washers and seals of leaking and dripping faucets and stops.
- D. Install fresh batteries in sensor-operated mechanisms.

3.6 CLEANING

- A. Clean fixtures, faucets, and other fittings with manufacturers' recommended cleaning methods and materials. Do the following:
 - 1. Remove faucet spouts and strainers, remove sediment and debris, and reinstall strainers and spouts.
 - 2. Remove sediment and debris from drains.
- B. After completing installation of exposed, factory-finished fixtures, faucets, and fittings, inspect exposed finishes and repair damaged finishes.

3.7 PROTECTION

- A. Provide protective covering for installed fixtures and fittings.
- B. Do not allow use of plumbing fixtures for temporary facilities unless approved in writing by Owner.

END OF SECTION 224000

SECTION 22 4700**DRINKING FOUNTAINS AND WATER COOLERS****PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

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

1.2 SUMMARY

- A. This Section includes the following drinking fountains and related components:
 - 1. Drinking fountains.
 - 2. Fixture supports.

1.3 DEFINITIONS

- A. Accessible Drinking Fountain: Fixture that can be approached and used by people with disabilities.
- B. Cast Polymer: Dense, cast-filled-polymer plastic.
- C. Drinking Fountain: Fixture with nozzle for delivering stream of water for drinking.
- D. Fitting: Device that controls flow of water into or out of fixture.
- E. Fixture: Drinking fountain or water cooler unless one is specifically indicated.
- F. Remote Water Cooler: Electrically powered equipment for generating cooled drinking water.
- G. Water Cooler: Electrically powered fixture for generating and delivering cooled drinking water.

1.4 SUBMITTALS

- A. Product Data: For each fixture indicated. Include rated capacities, furnished specialties, and accessories.
- B. Shop Drawings: Diagram power, signal, and control wiring.
- C. Field quality-control test reports.
- D. Operation and Maintenance Data: For fixtures to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Regulatory Requirements: Comply with requirements in ICC A117.1, "Accessible and Usable Buildings and Facilities"; Public Law 90-480, "Architectural Barriers Act" ; and Public Law 101-336, "Americans with Disabilities Act" ; for fixtures for people with disabilities.
- C. NSF Standard: Comply with NSF 61, "Drinking Water System Components--Health Effects," for fixture materials that will be in contact with potable water.
- D. ARI Standard: Comply with ARI's "Directory of Certified Drinking Water Coolers" for style classifications.
- E. ARI Standard: Comply with ARI 1010, "Self-Contained, Mechanically Refrigerated Drinking-Water Coolers," for water coolers and with ARI's "Directory of Certified Drinking Water Coolers" for type and style classifications.
- F. ASHRAE Standard: Comply with ASHRAE 34, "Designation and Safety Classification of Refrigerants," for water coolers. Provide HFC 134a (tetrafluoroethane) refrigerant, unless otherwise indicated.

1.6 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Filter Cartridges: Equal to percent of amount installed for each type and size indicated, but no fewer than 1 of each.

PART 2 - PRODUCTS

2.1 DRINKING FOUNTAINS

- A. Drinking Fountains,
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 3. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
 - a. Filtrine Manufacturing Company; Drinking Water Division.
 - b. Halsey Taylor.
 - c. Haws Corporation.
 - d. Most Dependable Fountains, Inc.
 - e. Murdock, Inc.
 - f. Oasis Corporation.

- g. Stern-Williams Co., Inc.
 - h. Sunroc Corp.
- 4. Description: Accessible, Style F, freestanding drinking fountain.
 - a. Pedestal:
 - 1) Material: Painted cast iron or steel.
 - 2) Shape: Rectangular.
 - b. Receptor(s):
 - 1) Number: [One] [Two] [Three].
 - 2) Material: Chrome-plated brass or stainless steel.
 - 3) Shape: Rectangular.
 - 4) Bubbler: One for each receptor, with adjustable stream regulator, located on deck.
 - c. Controls: Push bar with adjustable stream regulator.
 - d. Access to Internal Components: Panel in pedestal.
 - e. Supply: NPS 3/8 with ball, gate, or globe valve.
 - f. Drain: Grid with NPS 1-1/4 minimum horizontal waste and trap complying with ASME A112.18.2.

B. Drinking Fountains:

- 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- 3. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
 - a. Murdock, Inc.
- 4. Description: Accessible, Style F, antifreeze, freestanding drinking fountain designed to operate without draining into ground.
 - a. Pedestal: Rectangular, painted cast iron or steel.
 - b. Receptor: Rectangular, chrome-plated brass or stainless steel with bubbler.
 - c. Control: Foot pedal with control valve assembly.
 - d. Supply: NPS 1/2 with underground shutoff and flow-control valve assembly.
 - e. Drain: Grid with NPS 1 minimum waste to drainage system.
 - f. Bury Depth, Grade to Valve Components: 36 inches.

C. Drinking Fountains:

- 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

3. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
 - a. Elkay Manufacturing Co.
 - b. Filtrine Manufacturing Company; Drinking Water Division.
 - c. Halsey Taylor.
 - d. Haws Corporation.
 - e. Murdock, Inc.
 - f. Oasis Corporation.
 - g. Stern-Williams Co., Inc.
 - h. Sunroc Corp.
 - i. Select from manufacturers below for cast-polymer drinking fountains.
 - j. Elkay Manufacturing Co.
 - k. Filtrine Manufacturing Company; Drinking Water Division.
 - l. Halsey Taylor.
 - m. Haws Corporation.
 - n. Stern-Williams Co., Inc.
 - o. Sunroc Corp.
 - p. Select from manufacturers below for vitreous-china drinking fountains:
 - q. American Standard, Inc.
 - r. Crane Plumbing, L.L.C./Fiat Products.
 - s. Eljer.
 - t. Kohler Co.
 - u. Sunroc Corp.
4. Description: Accessible, Style W, wall-mounting drinking fountain.
 - a. Material: Stainless steel or Vitreous china complying with ASME 112.19.2M for drinking fountains with backsplash.
 - b. Receptor Shape: Rectangular.
 - c. Back Panel: Stainless-steel wall plate behind drinking fountain.
 - d. Bubblers: [One] [Two] [Three], with adjustable stream regulator, located on deck.
 - e. Control: Push bar.
 - f. Supply: NPS 3/8 with ball, gate, or globe valve.
 - g. Drain: Grid with NPS 1-1/4 minimum horizontal waste and trap complying with ASME A112.18.2.
 - h. Support: Type I, water cooler carrier. Refer to "Fixture Supports" Article.

D. Drinking Fountains:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
3. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
 - a. Elkay Manufacturing Co.
 - b. Filtrine Manufacturing Company; Drinking Water Division.
 - c. Halsey Taylor.
 - d. Haws Corporation.
 - e. Oasis Corporation.
 - f. Sunroc Corp.
 - g. Crane Plumbing, L.L.C./Fiat Products.

h. Kohler Co.

4. Description: [Accessible,]Style WS, wall-mounting, semirecessed drinking fountain.

- a. Material: Stainless steel or Vitreous china complying with ASME A112.19.2M for semirecessed drinking fountains.
- b. Receptor Shape: Concave with projecting bowl.
- c. Bubbler: One, with adjustable stream regulator, located on deck.
- d. Control: Push bar.
- e. Supply: NPS 3/8 with ball, gate, or globe valve.
- f. Drain: Integral punched grid with NPS 1-1/4 minimum horizontal waste and trap complying with ASME A112.18.2.
- g. Support: Mounting frame or brackets for attaching to substrate.

E. Drinking Fountains:

- 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- 3. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
 - a. Elkay Manufacturing Co.
 - b. Filtrine Manufacturing Company; Drinking Water Division.
 - c. Halsey Taylor.
 - d. Haws Corporation.
 - e. Oasis Corporation.
- 4. Description: Style RE, stainless-steel, recessed drinking fountain.
 - a. Receptor Shape: Concave with flush wall flange.
 - b. Bubbler: One, with adjustable stream regulator, located on deck.
 - c. Control: Push bar.
 - d. Supply: NPS 3/8 with ball, gate, or globe valve.
 - e. Drain: Grid with NPS 1-1/4 minimum horizontal waste and trap complying with ASME A112.18.2.
 - f. Support: Mounting frame or brackets for attaching to substrate.

2.2 FIXTURE SUPPORTS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Josam Co.
 - 2. MIFAB Manufacturing, Inc.
 - 3. Smith, Jay R. Mfg. Co.
 - 4. Tyler Pipe; Wade Div.
 - 5. Watts Drainage Products Inc.; a div. of Watts Industries, Inc.
 - 6. Zurn Plumbing Products Group; Specification Drainage Operation.

- C. Description: ASME A112.6.1M, water cooler carriers. Include vertical, steel uprights with feet and tie rods and bearing plates with mounting studs matching fixture to be supported.
 - 1. Type I: Hanger-type carrier with two vertical uprights.
 - 2. Type II: Bilevel, hanger-type carrier with three vertical uprights.
 - 3. Supports for Accessible Fixtures: Include rectangular, vertical, steel uprights instead of steel pipe uprights.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine roughing-in for water and waste piping systems to verify actual locations of piping connections before fixture installation. Verify that sizes and locations of piping and types of supports match those indicated.
- B. Examine walls and floors for suitable conditions where fixtures are to be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLICATIONS

- A. Use carrier off-floor supports for wall-mounting fixtures, unless otherwise indicated.
- B. Use mounting frames for recessed water coolers, unless otherwise indicated.
- C. Set freestanding and pedestal drinking fountains on floor.
- D. Set remote water coolers on floor, unless otherwise indicated.
- E. Use chrome-plated brass or copper tube, fittings, and valves in locations exposed to view. Plain copper tube, fittings, and valves may be used in concealed locations.

3.3 INSTALLATION

- A. Install off-floor supports affixed to building substrate and attach wall-mounting fixtures, unless otherwise indicated.
- B. Install mounting frames affixed to building construction and attach recessed water coolers to mounting frames, unless otherwise indicated.
- C. Install fixtures level and plumb. For fixtures indicated for children, install at height required by authorities having jurisdiction.
- D. Install water-supply piping with shutoff valve on supply to each fixture to be connected to water distribution piping. Use ball, gate, or globe valve. Install valves in locations where they can be easily reached for operation. Valves are specified in Division 22 Section "General-Duty Valves for Plumbing Piping."

- E. Install trap and waste piping on drain outlet of each fixture to be connected to sanitary drainage system.
- F. Install pipe escutcheons at wall penetrations in exposed, finished locations. Use deep-pattern escutcheons where required to conceal protruding pipe fittings. Escutcheons are specified in Division 22 Section "Common Work Results for Plumbing."
- G. Seal joints between fixtures and walls and floors using sanitary-type, one-part, mildew-resistant, silicone sealant. Match sealant color to fixture color. Sealants are specified in Division 07 Section "Joint Sealants."

3.4 CONNECTIONS

- A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.
- C. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."
- D. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.5 FIELD QUALITY CONTROL

- A. Water Cooler Testing: After electrical circuitry has been energized, test for compliance with requirements. Test and adjust controls and safeties.
 - 1. Remove and replace malfunctioning units and retest as specified above.
 - 2. Report test results in writing.

3.6 ADJUSTING

- A. Adjust fixture flow regulators for proper flow and stream height.
- B. Adjust water cooler temperature settings.

3.7 CLEANING

- A. After completing fixture installation, inspect unit. Remove paint splatters and other spots, dirt, and debris. Repair damaged finish to match original finish.
- B. Clean fixtures, on completion of installation, according to manufacturer's written instructions.

END OF SECTION 224700

SECTION 23 05 00
COMMON WORK RESULTS FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
1. Piping materials and installation instructions common to most piping systems.
 2. Transition fittings.
 3. Dielectric fittings.
 4. Mechanical sleeve seals.
 5. Sleeves.
 6. Escutcheons.
 7. Grout.
 8. HVAC demolition.
 9. Equipment installation requirements common to equipment sections.
 10. Painting and finishing.
 11. Concrete bases.
 12. Supports and anchorages.

1.3 DEFINITIONS

- A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.
- B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
- C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
- D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and chases.
- E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.
- F. The following are industry abbreviations for plastic materials:
1. CPVC: Chlorinated polyvinyl chloride plastic.

2. PE: Polyethylene plastic.
3. PVC: Polyvinyl chloride plastic.

G. The following are industry abbreviations for rubber materials:

1. EPDM: Ethylene-propylene-diene terpolymer rubber.
2. NBR: Acrylonitrile-butadiene rubber.

1.4 SUBMITTALS

A. Product Data: For the following:

1. Transition fittings.
2. Dielectric fittings.
3. Mechanical sleeve seals.
4. Escutcheons.

B. Welding certificates.

1.5 QUALITY ASSURANCE

A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."

B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

C. Electrical Characteristics for HVAC Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.7 COORDINATION

A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for HVAC installations.

B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.

- C. Coordinate requirements for access panels and doors for HVAC items requiring access that are concealed behind finished surfaces. Access panels and doors are specified in Division 08 Section "Access Doors and Frames."

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the manufacturers specified.
 - 2. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.2 PIPE, TUBE, AND FITTINGS

- A. Refer to individual Division 23 piping Sections for pipe, tube, and fitting materials and joining methods.
- B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.3 JOINING MATERIALS

- A. Refer to individual Division 23 piping Sections for special joining materials not listed below.
- B. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
 - 1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.
 - a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
 - b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.
 - 2. AWWA C110, rubber, flat face, 1/8 inch thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.
- C. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.
- D. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.
- E. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
- F. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated; and AWS A5.8, BAg1, silver alloy for refrigerant piping, unless otherwise indicated.

- G. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
- H. Solvent Cements for Joining Plastic Piping:
 - 1. CPVC Piping: ASTM F 493.
 - 2. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.
- I. Fiberglass Pipe Adhesive: As furnished or recommended by pipe manufacturer.

2.4 TRANSITION FITTINGS

- A. Plastic-to-Metal Transition Fittings: CPVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.
 - 1. Manufacturers:
 - a. Eslon Thermoplastics.
 - b. Prior Approved
- B. Plastic-to-Metal Transition Adaptors: One-piece fitting with manufacturer's SDR 11 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.
 - 1. Manufacturers:
 - a. Thompson Plastics, Inc.
 - b. Prior Approved
- C. Plastic-to-Metal Transition Unions: MSS SP-107, CPVC four-part union. Include brass end, solvent-cement-joint end, rubber O-ring, and union nut.
 - 1. Manufacturers:
 - a. NIBCO INC.
 - b. NIBCO, Inc.; Chemtrol Div.
 - c. Prior Approved

2.5 DIELECTRIC FITTINGS

- A. Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.
- B. Insulating Material: Suitable for system fluid, pressure, and temperature.
- C. Dielectric Unions: Factory-fabricated, union assembly, for 250-psig minimum working pressure at 180 deg F.
 - 1. Available Manufacturers:
 - a. Capitol Manufacturing Co.
 - b. Central Plastics Company.
 - c. Eclipse, Inc.

- d. Epco Sales, Inc.
 - e. Hart Industries, International, Inc.
 - f. Watts Industries, Inc.; Water Products Div.
 - g. Zurn Industries, Inc.; Wilkins Div.
- D. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150- or 300-psig minimum working pressure as required to suit system pressures.
 - 1. Manufacturers:
 - a. Capitol Manufacturing Co.
 - b. Central Plastics Company.
 - c. Epco Sales, Inc.
 - d. Watts Industries, Inc.; Water Products Div.
- E. Dielectric-Flange Kits: Companion-flange assembly for field assembly. Include flanges, full-face- or ring-type neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.
 - 1. Manufacturers:
 - a. Advance Products & Systems, Inc.
 - b. Calpico, Inc.
 - c. Central Plastics Company.
 - d. Pipeline Seal and Insulator, Inc.
 - 2. Separate companion flanges and steel bolts and nuts shall have 150- or 300-psig minimum working pressure where required to suit system pressures.
- F. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig minimum working pressure at 225 deg F.
 - 1. Manufacturers:
 - a. Calpico, Inc.
 - b. Lochinvar Corp.
- G. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig minimum working pressure at 225 deg F.
 - 1. Manufacturers:
 - a. Perfection Corp.
 - b. Precision Plumbing Products, Inc.
 - c. Sioux Chief Manufacturing Co., Inc.
 - d. Victaulic Co. of America.

2.6 MECHANICAL SLEEVE SEALS

- A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.
 - 1. Manufacturers:

- a. Advance Products & Systems, Inc.
 - b. Calpico, Inc.
 - c. Metraflex Co.
 - d. Pipeline Seal and Insulator, Inc.
2. Sealing Elements: EPDM or NBR interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
 3. Pressure Plates: Carbon steel. Include two for each sealing element.
 4. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.7 SLEEVES

- A. Galvanized-Steel Sheet: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.
- B. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.
- C. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
- D. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.
 1. Underdeck Clamp: Clamping ring with set screws.
- E. Molded PVC: Permanent, with nailing flange for attaching to wooden forms.
- F. PVC Pipe: ASTM D 1785, Schedule 40.
- G. Molded PE: Reusable, PE, tapered-cup shaped, and smooth-outer surface with nailing flange for attaching to wooden forms.

2.8 ESCUTCHEONS

- A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.
- B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome-plated finish.
- C. One-Piece, Cast-Brass Type: With set screw.
 1. Finish: Polished chrome-plated
- D. Split-Casting, Cast-Brass Type: With concealed hinge and set screw.
 1. Finish: Polished chrome-plated
- E. One-Piece, Stamped-Steel Type: With [set screw] [spring clips] [set screw or spring clips] and chrome-plated finish.

- F. Split-Plate, Stamped-Steel Type: With concealed hinge, set screw, and chrome-plated finish.
- G. One-Piece, Floor-Plate Type: Cast-iron floor plate.
- H. Split-Casting, Floor-Plate Type: Cast brass with concealed hinge and set screw.

2.9 GROUT

- A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.
 - 1. Characteristics: Post-hardening, volume-adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
 - 2. Design Mix: 5000-psi , 28-day compressive strength.
 - 3. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 HVAC DEMOLITION

- A. Refer to Division 01 Section "Cutting and Patching" and Division 02 Section "Selective Structure Demolition" for general demolition requirements and procedures.
- B. Disconnect, demolish, and remove HVAC systems, equipment, and components indicated to be removed.
 - 1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
 - 2. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.
 - 3. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
 - 4. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material.
 - 5. Equipment to Be Removed: Disconnect and cap services and remove equipment.
 - 6. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
 - 7. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
- C. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

3.2 PIPING SYSTEMS - COMMON REQUIREMENTS

- A. Install piping according to the following requirements and Division 23 Sections specifying piping systems.
- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction

loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

- C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.
- D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- F. Install piping to permit valve servicing.
- G. Install piping at indicated slopes.
- H. Install piping free of sags and bends.
- I. Install fittings for changes in direction and branch connections.
- J. Install piping to allow application of insulation.
- K. Select system components with pressure rating equal to or greater than system operating pressure.
- L. Install escutcheons for penetrations of walls, ceilings, and floors according to the following:
 - 1. New Piping:
 - a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
 - b. Chrome-Plated Piping: One-piece, cast-brass type with polished chrome-plated finish.
 - c. Insulated Piping: One-piece, stamped-steel type with spring clips.
 - d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished chrome-plated finish.
 - e. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, stamped-steel type.
 - f. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, cast-brass type with polished chrome-plated finish.
 - g. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, stamped-steel type and set screw.
 - h. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass type with polished chrome-plated finish.
 - i. Bare Piping in Unfinished Service Spaces: One-piece, stamped-steel type with concealed hinge and set screw.
 - j. Bare Piping in Equipment Rooms: One-piece, cast-brass type.
 - k. Bare Piping in Equipment Rooms: One-piece, stamped-steel type with set screw.
 - l. Bare Piping at Floor Penetrations in Equipment Rooms: One-piece, floor-plate type.
 - 2. Existing Piping: Use the following:
 - a. Chrome-Plated Piping: Split-casting, cast-brass type with chrome-plated finish.
 - b. Insulated Piping: Split-plate, stamped-steel type with concealed hinge and spring clips.

- c. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split-casting, cast-brass type with chrome-plated finish.
 - d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split-plate, stamped-steel type with concealed hinge and spring clips.
 - e. Bare Piping at Ceiling Penetrations in Finished Spaces: Split-casting, cast-brass type with chrome-plated finish.
 - f. Bare Piping at Ceiling Penetrations in Finished Spaces: Split-plate, stamped-steel type with concealed hinge and set screw.
 - g. Bare Piping in Unfinished Service Spaces: Split-casting, cast-brass type with polished chrome-plated finish.
 - h. Bare Piping in Unfinished Service Spaces: Split-plate, stamped-steel type with concealed hinge and set screw or spring clips.
 - i. Bare Piping in Equipment Rooms: Split-casting, cast-brass type.
 - j. Bare Piping in Equipment Rooms: Split-plate, stamped-steel type with set screw or spring clips.
 - k. Bare Piping at Floor Penetrations in Equipment Rooms: Split-casting, floor-plate type.
- M. Sleeves are not required for core-drilled holes.
- N. Permanent sleeves are not required for holes formed by removable PE sleeves.
- O. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs.
- P. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.
- 1. Cut sleeves to length for mounting flush with both surfaces.
 - a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
 - 2. Install sleeves in new walls and slabs as new walls and slabs are constructed.
 - 3. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:
 - a. [PVC] [Steel] Pipe Sleeves: For pipes smaller than NPS 6.
 - b. Steel Sheet Sleeves: For pipes NPS 6 and larger, penetrating gypsum-board partitions.
 - c. Stack Sleeve Fittings: For pipes penetrating floors with membrane waterproofing. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level. Refer to Division 07 Section "Sheet Metal Flashing and Trim" for flashing.
 - 1) Seal space outside of sleeve fittings with grout.
 - 4. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using joint sealants appropriate for size, depth, and location of joint. Refer to Division 07 Section "Joint Sealants" for materials and installation.
- Q. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

1. Install steel pipe for sleeves smaller than 6 inches in diameter.
 2. Install cast-iron "wall pipes" for sleeves 6 inches and larger in diameter.
 3. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
- R. Underground, Exterior-Wall Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
1. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
- S. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 07 Section "Penetration Firestopping" for materials.
- T. Verify final equipment locations for roughing-in.
- U. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

3.3 PIPING JOINT CONSTRUCTION

- A. Join pipe and fittings according to the following requirements and Division 23 Sections specifying piping systems.
- B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.
- E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.
- F. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

- G. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.
- H. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.
- I. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
 - 1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
 - 2. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.
 - 3. PVC Pressure Piping: Join schedule number ASTM D 1785, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D 2855.
 - 4. PVC Nonpressure Piping: Join according to ASTM D 2855.
- J. Plastic Pressure Piping Gasketed Joints: Join according to ASTM D 3139.
- K. Plastic Nonpressure Piping Gasketed Joints: Join according to ASTM D 3212.
- L. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.
 - 1. Plain-End Pipe and Fittings: Use butt fusion.
 - 2. Plain-End Pipe and Socket Fittings: Use socket fusion.
- M. Fiberglass Bonded Joints: Prepare pipe ends and fittings, apply adhesive, and join according to pipe manufacturer's written instructions.

3.4 PIPING CONNECTIONS

- A. Make connections according to the following, unless otherwise indicated:
 - 1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
 - 2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.
 - 3. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.
 - 4. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

3.5 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

- A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.
- B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

- C. Install HVAC equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.
- D. Install equipment to allow right of way for piping installed at required slope.

3.6 PAINTING

- A. Painting of HVAC systems, equipment, and components is specified in Division 09 Sections "Interior Painting" and "Exterior Painting."
- B. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.7 CONCRETE BASES

- A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.
 - 1. Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit.
 - 2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of the base.
 - 3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
 - 4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 5. Install anchor bolts to elevations required for proper attachment to supported equipment.
 - 6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
 - 7. Use 3000-psi 28-day compressive-strength concrete and reinforcement as specified in Division 03 Section "Cast-in-Place Concrete."

3.8 ERECTION OF METAL SUPPORTS AND ANCHORAGES

- A. Refer to Division 05 Section "Metal Fabrications" for structural steel.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor HVAC materials and equipment.
- C. Field Welding: Comply with AWS D1.1.

3.9 ERECTION OF WOOD SUPPORTS AND ANCHORAGES

- A. Cut, fit, and place wood grounds, nailers, blocking, and anchorages to support, and anchor HVAC materials and equipment.
- B. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.

- C. Attach to substrates as required to support applied loads.

3.10 GROUTING

- A. Mix and install grout for HVAC equipment base bearing surfaces, pump and other equipment base plates, and anchors.
- B. Clean surfaces that will come into contact with grout.
- C. Provide forms as required for placement of grout.
- D. Avoid air entrapment during placement of grout.
- E. Place grout, completely filling equipment bases.
- F. Place grout on concrete bases and provide smooth bearing surface for equipment.
- G. Place grout around anchors.
- H. Cure placed grout.

END OF SECTION 23 05 00

SECTION 23 05 13**COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT****PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

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

1.2 SUMMARY

- A. Section includes general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on ac power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

1.3 COORDINATION

- A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:
 - 1. Motor controllers.
 - 2. Torque, speed, and horsepower requirements of the load.
 - 3. Ratings and characteristics of supply circuit and required control sequence.
 - 4. Ambient and environmental conditions of installation location.

PART 2 - PRODUCTS**2.1 GENERAL MOTOR REQUIREMENTS**

- A. Comply with requirements in this Section except when stricter requirements are specified in HVAC equipment schedules or Sections.
- B. Comply with NEMA MG 1 unless otherwise indicated.
- C. Comply with IEEE 841 for severe-duty motors.

2.2 MOTOR CHARACTERISTICS

- A. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 3300 feet above sea level.
- B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

2.3 POLYPHASE MOTORS

- A. Description: NEMA MG 1, Design B, medium induction motor.
- B. Efficiency: Energy efficient, as defined in NEMA MG 1.
- C. Service Factor: 1.15.
- D. Multispeed Motors: Variable torque.
 - 1. For motors with 2:1 speed ratio, consequent pole, single winding.
 - 2. For motors with other than 2:1 speed ratio, separate winding for each speed.
- E. Multispeed Motors: Separate winding for each speed.
- F. Rotor: Random-wound, squirrel cage.
- G. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.
- H. Temperature Rise: Match insulation rating.
- I. Insulation: Class F>.
- J. Code Letter Designation:
 - 1. Motors 15 HP and Larger: NEMA starting Code F or Code G.
 - 2. Motors Smaller than 15 HP: Manufacturer's standard starting characteristic.
- K. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

2.4 POLYPHASE MOTORS WITH ADDITIONAL REQUIREMENTS

- A. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.
- B. Motors Used with Variable Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.
 - 1. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width modulated inverters.
 - 2. Energy- and Premium-Efficient Motors: Class B temperature rise; Class F insulation.
 - 3. Inverter-Duty Motors: Class F temperature rise; Class H insulation.
 - 4. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.
- C. Severe-Duty Motors: Comply with IEEE 841, with 1.15 minimum service factor.

2.5 SINGLE-PHASE MOTORS

- A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:
 - 1. Permanent-split capacitor.
 - 2. Split phase.
 - 3. Capacitor start, inductor run.
 - 4. Capacitor start, capacitor run.
- B. Multispeed Motors: Variable-torque, permanent-split-capacitor type.
- C. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.
- D. Motors 1/20 HP and Smaller: Shaded-pole type.
- E. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 23 05 13

SECTION 23 05 53**IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT****PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Equipment labels.
 - 2. Warning signs and labels.
 - 3. Pipe labels.
 - 4. Duct labels.
 - 5. Stencils.
 - 6. Valve tags.
 - 7. Warning tags.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples: For color, letter style, and graphic representation required for each identification material and device.
- C. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.
- D. Valve numbering scheme.
- E. Valve Schedules: For each piping system to include in maintenance manuals.

1.4 COORDINATION

- A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- B. Coordinate installation of identifying devices with locations of access panels and doors.
- C. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Metal Labels for Equipment:

1. Material and Thickness: Brass, 0.032-inch Stainless steel, 0.025-inch or anodized aluminum, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
2. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
3. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
4. Fasteners: Stainless-steel rivets or self-tapping screws.
5. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Plastic Labels for Equipment:

1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.
2. Letter Color: Black.
3. Background Color: White.
4. Maximum Temperature: Able to withstand temperatures up to 160 deg F .
5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
6. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
7. Fasteners: Stainless-steel rivets or self-tapping screws.
8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

C. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified.

D. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.2 WARNING SIGNS AND LABELS

- A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.
- B. Letter Color: Black.
- C. Background Color: Yellow.

- D. Maximum Temperature: Able to withstand temperatures up to 160 deg F .
- E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
- F. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches , 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
- G. Fasteners: Stainless-steel rivets or self-tapping screws.
- H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- I. Label Content: Include caution and warning information, plus emergency notification instructions.

2.3 PIPE LABELS

- A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.
- B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.
- C. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.
- D. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.
 - 1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.
 - 2. Lettering Size: At least 1-1/2 inches high.

2.4 DUCT LABELS

- A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.
- B. Letter Color: Black.
- C. Background Color: White.
- D. Maximum Temperature: Able to withstand temperatures up to 160 deg F .
- E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch .
- F. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

- G. Fasteners: Stainless-steel rivets or self-tapping screws.
- H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- I. Duct Label Contents: Include identification of duct service using same designations or abbreviations as used on Drawings, duct size, and an arrow indicating flow direction.
 - 1. Flow-Direction Arrows: Integral with duct system service lettering to accommodate both directions, or as separate unit on each duct label to indicate flow direction.
 - 2. Lettering Size: At least 1-1/2 inches high.

2.5 STENCILS

- A. Stencils: Prepared with letter sizes according to ASME A13.1 for piping; minimum letter height of 1-1/4 inches for ducts; and minimum letter height of 3/4 inch for access panel and door labels, equipment labels, and similar operational instructions.
 - 1. Stencil Material: Fiberboard or metal.
 - 2. Stencil Paint: Exterior, gloss, alkyd enamel black unless otherwise indicated. Paint may be in pressurized spray-can form.
 - 3. Identification Paint: Exterior, alkyd enamel in colors according to ASME A13.1 unless otherwise indicated.

2.6 VALVE TAGS

- A. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers.
 - 1. Tag Material: Stainless steel, 0.025-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
 - 2. Fasteners: Brass wire-link or beaded chain; or S-hook.
- B. Valve Schedules: For each piping system, on 8-1/2-by-11-inch bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.
 - 1. Valve-tag schedule shall be included in operation and maintenance data.

2.7 WARNING TAGS

- A. Warning Tags: Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with matte finish suitable for writing.
 - 1. Size: Approximately 4 by 7 inches .
 - 2. Fasteners: Reinforced grommet and wire or string.
 - 3. Nomenclature: Large-size primary caption such as "DANGER," "CAUTION," or "DO NOT OPERATE."
 - 4. Color: Yellow background with black lettering.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 EQUIPMENT LABEL INSTALLATION

- A. Install or permanently fasten labels on each major item of mechanical equipment.
- B. Locate equipment labels where accessible and visible.

3.3 PIPE LABEL INSTALLATION

- A. Piping Color-Coding: Painting of piping is specified in Division 09 Section "Interior Painting"
- B. Stenciled Pipe Label Option: Stenciled labels may be provided instead of manufactured pipe labels, at Installer's option. Install stenciled pipe labels, complying with ASME A13.1, on each piping system.
 - 1. Identification Paint: Use for contrasting background.
 - 2. Stencil Paint: Use for pipe marking.
- C. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
 - 1. Near each valve and control device.
 - 2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
 - 3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
 - 4. At access doors, manholes, and similar access points that permit view of concealed piping.
 - 5. Near major equipment items and other points of origination and termination.
 - 6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
 - 7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

3.4 DUCT LABEL INSTALLATION

- A. Install [plastic-laminated] [self-adhesive] duct labels with permanent adhesive on air ducts in the following color codes:
 - 1. Blue: For cold-air supply ducts.
 - 2. Yellow: For hot-air supply ducts.
 - 3. Green: For exhaust-, outside-, relief-, return-, and mixed-air ducts.
 - 4. ASME A13.1 Colors and Designs: For hazardous material exhaust.

- B. Stenciled Duct Label Option: Stenciled labels, showing service and flow direction, may be provided instead of plastic-laminated duct labels, at Installer's option, if lettering larger than 1 inch high is needed for proper identification because of distance from normal location of required identification.
- C. Locate labels near points where ducts enter into concealed spaces and at maximum intervals of 50 feet in each space where ducts are exposed or concealed by removable ceiling system.

3.5 VALVE-TAG INSTALLATION

- A. Install tags on valves and control devices in piping systems, except check valves; valves within factory-fabricated equipment units; shutoff valves; faucets; convenience and lawn-watering hose connections; and HVAC terminal devices and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.

3.6 WARNING-TAG INSTALLATION

- A. Write required message on, and attach warning tags to, equipment and other items where required.

END OF SECTION 230553

SECTION 23 05 93**TESTING, ADJUSTING, AND BALANCING FOR HVAC****PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Balancing Air Systems:
 - a. Constant-volume air systems.
 - b. Dual-duct systems.
 - c. Variable-air-volume systems.
 - d. Multizone systems.
 - e. Induction-unit systems.
 - 2. Balancing Hydronic Piping Systems:
 - a. Constant-flow hydronic systems.
 - b. Variable-flow hydronic systems.
 - c. Primary-secondary hydronic systems.

1.3 DEFINITIONS

- A. AABC: Associated Air Balance Council.
- B. NEBB: National Environmental Balancing Bureau.
- C. TAB: Testing, adjusting, and balancing.
- D. TABB: Testing, Adjusting, and Balancing Bureau.
- E. TAB Specialist: An entity engaged to perform TAB Work.

1.4 SUBMITTALS

- A. Qualification Data: Within 15 days of Contractor's Notice to Proceed, submit documentation that the TAB contractor and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article.
- B. Contract Documents Examination Report: Within 30 days of Contractor's Notice to Proceed, submit the Contract Documents review report as specified in Part 3.

- C. Strategies and Procedures Plan: Within 30 days of Contractor's Notice to Proceed, submit TAB strategies and step-by-step procedures as specified in "Preparation" Article.
- D. Certified TAB reports.
- E. Sample report forms.
- F. Instrument calibration reports, to include the following:
 - 1. Instrument type and make.
 - 2. Serial number.
 - 3. Application.
 - 4. Dates of use.
 - 5. Dates of calibration.

1.5 QUALITY ASSURANCE

- A. TAB Contractor Qualifications: Engage a TAB entity certified by AABC NEBB or TABB.
 - 1. TAB Field Supervisor: Employee of the TAB contractor and certified by AABC NEBB or TABB.
 - 2. TAB Technician: Employee of the TAB contractor and who is certified by AABC NEBB or TABB as a TAB technician.
- B. TAB Conference: Meet with Architect Construction Manager on approval of the TAB strategies and procedures plan to develop a mutual understanding of the details. Require the participation of the TAB field supervisor and technicians. Provide seven days' advance notice of scheduled meeting time and location.
 - 1. Agenda Items:
 - a. The Contract Documents examination report.
 - b. The TAB plan.
 - c. Coordination and cooperation of trades and subcontractors.
 - d. Coordination of documentation and communication flow.
- C. Certify TAB field data reports and perform the following:
 - 1. Review field data reports to validate accuracy of data and to prepare certified TAB reports.
 - 2. Certify that the TAB team complied with the approved TAB plan and the procedures specified and referenced in this Specification.
- D. TAB Report Forms: Use standard TAB contractor's forms approved by Architect.
- E. Instrumentation Type, Quantity, Accuracy, and Calibration: As described in ASHRAE 111, Section 5, "Instrumentation."

1.6 PROJECT CONDITIONS

- A. Full Owner Occupancy: Owner will occupy the site and existing building during entire TAB period. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

- B. Partial Owner Occupancy: Owner may occupy completed areas of building before Substantial Completion. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

1.7 COORDINATION

- A. Notice: Provide seven days' advance notice for each test. Include scheduled test dates and times.
- B. Perform TAB after leakage and pressure tests on air and water distribution systems have been satisfactorily completed.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems' designs that may preclude proper TAB of systems and equipment.
- B. Examine systems for installed balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices are accessible.
- C. Examine the approved submittals for HVAC systems and equipment.
- D. Examine design data including HVAC system descriptions, statements of design assumptions for environmental conditions and systems' output, and statements of philosophies and assumptions about HVAC system and equipment controls.
- E. Examine ceiling plenums and underfloor air plenums used for supply, return, or relief air to verify that they meet the leakage class of connected ducts as specified in Division 23 Section "Metal Ducts" and are properly separated from adjacent areas. Verify that penetrations in plenum walls are sealed and fire-stopped if required.
- F. Examine equipment performance data including fan and pump curves.
 - 1. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
 - 2. Calculate system-effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from the conditions used to rate equipment performance. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," or in SMACNA's "HVAC Systems - Duct Design." Compare results with the design data and installed conditions.
- G. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.
- H. Examine test reports specified in individual system and equipment Sections.

- I. Examine HVAC equipment and filters and verify that bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.
- J. Examine terminal units, such as variable-air-volume boxes, and verify that they are accessible and their controls are connected and functioning.
- K. Examine strainers. Verify that startup screens are replaced by permanent screens with indicated perforations.
- L. Examine three-way valves for proper installation for their intended function of diverting or mixing fluid flows.
- M. Examine heat-transfer coils for correct piping connections and for clean and straight fins.
- N. Examine system pumps to ensure absence of entrained air in the suction piping.
- O. Examine operating safety interlocks and controls on HVAC equipment.
- P. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.2 PREPARATION

- A. Prepare a TAB plan that includes strategies and step-by-step procedures.
- B. Complete system-readiness checks and prepare reports. Verify the following:
 - 1. Permanent electrical-power wiring is complete.
 - 2. Hydronic systems are filled, clean, and free of air.
 - 3. Automatic temperature-control systems are operational.
 - 4. Equipment and duct access doors are securely closed.
 - 5. Balance, smoke, and fire dampers are open.
 - 6. Isolating and balancing valves are open and control valves are operational.
 - 7. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.
 - 8. Windows and doors can be closed so indicated conditions for system operations can be met.

3.3 GENERAL PROCEDURES FOR TESTING AND BALANCING

- A. Perform testing and balancing procedures on each system according to the procedures contained in AABC's "National Standards for Total System Balance" ASHRAE 111 NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems" SMACNA's "HVAC Systems - Testing, Adjusting, and Balancing" and in this Section.
- B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures.
 - 1. After testing and balancing, patch probe holes in ducts with same material and thickness as used to construct ducts.
 - 2. After testing and balancing, install test ports and duct access doors that comply with requirements in Division 23 Section "Air Duct Accessories."

3. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish according to Division 23 Section "HVAC Insulation."
- C. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.
- D. Take and report testing and balancing measurements in inch-pound (IP) units.

3.4 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

- A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.
- B. Prepare schematic diagrams of systems' "as-built" duct layouts.
- C. For variable-air-volume systems, develop a plan to simulate diversity.
- D. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.
- E. Check airflow patterns from the outdoor-air louvers and dampers and the return- and exhaust-air dampers through the supply-fan discharge and mixing dampers.
- F. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.
- G. Verify that motor starters are equipped with properly sized thermal protection.
- H. Check dampers for proper position to achieve desired airflow path.
- I. Check for airflow blockages.
- J. Check condensate drains for proper connections and functioning.
- K. Check for proper sealing of air-handling-unit components.
- L. Verify that air duct system is sealed as specified in Division 23 Section "Metal Ducts."

3.5 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

- A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.
 1. Measure total airflow.
 - a. Where sufficient space in ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow.
 2. Measure fan static pressures as follows to determine actual static pressure:
 - a. Measure outlet static pressure as far downstream from the fan as practical and upstream from restrictions in ducts such as elbows and transitions.

- b. Measure static pressure directly at the fan outlet or through the flexible connection.
 - c. Measure inlet static pressure of single-inlet fans in the inlet duct as near the fan as possible, upstream from the flexible connection, and downstream from duct restrictions.
 - d. Measure inlet static pressure of double-inlet fans through the wall of the plenum that houses the fan.
 3. Measure static pressure across each component that makes up an air-handling unit, rooftop unit, and other air-handling and -treating equipment.
 - a. Report the cleanliness status of filters and the time static pressures are measured.
 4. Measure static pressures entering and leaving other devices, such as sound traps, heat-recovery equipment, and air washers, under final balanced conditions.
 5. Review Record Documents to determine variations in design static pressures versus actual static pressures. Calculate actual system-effect factors. Recommend adjustments to accommodate actual conditions.
 6. Obtain approval from Architect for adjustment of fan speed higher or lower than indicated speed. Comply with requirements in Division 23 Sections for air-handling units for adjustment of fans, belts, and pulley sizes to achieve indicated air-handling-unit performance.
 7. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload will occur. Measure amperage in full-cooling, full-heating, economizer, and any other operating mode to determine the maximum required brake horsepower.
- B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows within specified tolerances.
 1. Measure airflow of submain and branch ducts.
 - a. Where sufficient space in submain and branch ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow for that zone.
 2. Measure static pressure at a point downstream from the balancing damper, and adjust volume dampers until the proper static pressure is achieved.
 3. Remeasure each submain and branch duct after all have been adjusted. Continue to adjust submain and branch ducts to indicated airflows within specified tolerances.
- C. Measure air outlets and inlets without making adjustments.
 1. Measure terminal outlets using a direct-reading hood or outlet manufacturer's written instructions and calculating factors.
- D. Adjust air outlets and inlets for each space to indicated airflows within specified tolerances of indicated values. Make adjustments using branch volume dampers rather than extractors and the dampers at air terminals.
 1. Adjust each outlet in same room or space to within specified tolerances of indicated quantities without generating noise levels above the limitations prescribed by the Contract Documents.
 2. Adjust patterns of adjustable outlets for proper distribution without drafts.

3.6 PROCEDURES FOR DUAL-DUCT SYSTEMS

- A. Verify that the cooling coil is capable of full-system airflow, and set mixing boxes at full-cold airflow position for fan volume.
- B. Measure static pressure in both hot and cold ducts at the end of the longest duct run to determine that sufficient static pressure exists to operate controls of mixing boxes and to overcome resistance in the ducts and outlets downstream from mixing boxes.
 - 1. If insufficient static pressure exists, increase airflow at the fan.
- C. Test and adjust the constant-volume mixing boxes as follows:
 - 1. Verify both hot and cold operations by adjusting the thermostat and observing changes in air temperature and volume.
 - 2. Verify sufficient inlet static pressure before making volume adjustments.
 - 3. Adjust mixing boxes to indicated airflows within specified tolerances. Measure airflow by Pitot-tube traverse readings or by measuring static pressure at mixing-box taps if provided by mixing-box manufacturer.
- D. Do not overpressurize ducts.
- E. Remeasure static pressure in both hot and cold ducts at the end of the longest duct run to determine that sufficient static pressure exists to operate controls of mixing boxes and to overcome resistance in the ducts and outlets downstream from mixing boxes.
- F. Adjust variable-air-volume, dual-duct systems in the same way as constant-volume, dual-duct systems; adjust maximum- and minimum-airflow setting of each mixing box.

3.7 PROCEDURES FOR VARIABLE-AIR-VOLUME SYSTEMS

- A. Compensating for Diversity: When the total airflow of all terminal units is more than the indicated airflow of the fan, place a selected number of terminal units at a minimum set-point airflow with the remainder at maximum-airflow condition until the total airflow of the terminal units equals the indicated airflow of the fan. Select the reduced-airflow terminal units so they are distributed evenly among the branch ducts.
- B. Pressure-Independent, Variable-Air-Volume Systems: After the fan systems have been adjusted, adjust the variable-air-volume systems as follows:
 - 1. Set outdoor-air dampers at minimum, and set return- and exhaust-air dampers at a position that simulates full-cooling load.
 - 2. Select the terminal unit that is most critical to the supply-fan airflow and static pressure. Measure static pressure. Adjust system static pressure so the entering static pressure for the critical terminal unit is not less than the sum of the terminal-unit manufacturer's recommended minimum inlet static pressure plus the static pressure needed to overcome terminal-unit discharge system losses.
 - 3. Measure total system airflow. Adjust to within indicated airflow.
 - 4. Set terminal units at maximum airflow and adjust controller or regulator to deliver the designed maximum airflow. Use terminal-unit manufacturer's written instructions to make this adjustment. When total airflow is correct, balance the air outlets downstream from terminal units the same as described for constant-volume air systems.

5. Set terminal units at minimum airflow and adjust controller or regulator to deliver the designed minimum airflow. Check air outlets for a proportional reduction in airflow the same as described for constant-volume air systems.
 - a. If air outlets are out of balance at minimum airflow, report the condition but leave outlets balanced for maximum airflow.
 6. Remeasure the return airflow to the fan while operating at maximum return airflow and minimum outdoor airflow.
 - a. Adjust the fan and balance the return-air ducts and inlets the same as described for constant-volume air systems.
 7. Measure static pressure at the most critical terminal unit and adjust the static-pressure controller at the main supply-air sensing station to ensure that adequate static pressure is maintained at the most critical unit.
 8. Record final fan-performance data.
- C. Pressure-Dependent, Variable-Air-Volume Systems without Diversity: After the fan systems have been adjusted, adjust the variable-air-volume systems as follows:
1. Balance variable-air-volume systems the same as described for constant-volume air systems.
 2. Set terminal units and supply fan at full-airflow condition.
 3. Adjust inlet dampers of each terminal unit to indicated airflow and verify operation of the static-pressure controller. When total airflow is correct, balance the air outlets downstream from terminal units the same as described for constant-volume air systems.
 4. Readjust fan airflow for final maximum readings.
 5. Measure operating static pressure at the sensor that controls the supply fan if one is installed, and verify operation of the static-pressure controller.
 6. Set supply fan at minimum airflow if minimum airflow is indicated. Measure static pressure to verify that it is being maintained by the controller.
 7. Set terminal units at minimum airflow and adjust controller or regulator to deliver the designed minimum airflow. Check air outlets for a proportional reduction in airflow the same as described for constant-volume air systems.
 - a. If air outlets are out of balance at minimum airflow, report the condition but leave the outlets balanced for maximum airflow.
 8. Measure the return airflow to the fan while operating at maximum return airflow and minimum outdoor airflow.
 - a. Adjust the fan and balance the return-air ducts and inlets the same as described for constant-volume air systems.
- D. Pressure-Dependent, Variable-Air-Volume Systems with Diversity: After the fan systems have been adjusted, adjust the variable-air-volume systems as follows:
1. Set system at maximum indicated airflow by setting the required number of terminal units at minimum airflow. Select the reduced-airflow terminal units so they are distributed evenly among the branch ducts.
 2. Adjust supply fan to maximum indicated airflow with the variable-airflow controller set at maximum airflow.
 3. Set terminal units at full-airflow condition.

4. Adjust terminal units starting at the supply-fan end of the system and continuing progressively to the end of the system. Adjust inlet dampers of each terminal unit to indicated airflow. When total airflow is correct, balance the air outlets downstream from terminal units the same as described for constant-volume air systems.
5. Adjust terminal units for minimum airflow.

3.8 PROCEDURES FOR MOTORS

- A. Motors, 1/2 HP and Larger: Test at final balanced conditions and record the following data:
 1. Manufacturer's name, model number, and serial number.
 2. Motor horsepower rating.
 3. Motor rpm.
 4. Efficiency rating.
 5. Nameplate and measured voltage, each phase.
 6. Nameplate and measured amperage, each phase.
 7. Starter thermal-protection-element rating.
- B. Motors Driven by Variable-Frequency Controllers: Test for proper operation at speeds varying from minimum to maximum. Test the manual bypass of the controller to prove proper operation. Record observations including name of controller manufacturer, model number, serial number, and nameplate data.

3.9 TOLERANCES

- A. Set HVAC system's air flow rates and water flow rates within the following tolerances:
 1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus or minus 10 percent
 2. Air Outlets and Inlets: Plus or minus 10 percent.
 3. Heating-Water Flow Rate: Plus or minus 10 percent
 4. Cooling-Water Flow Rate: Plus or minus 10 percent

3.10 REPORTING

- A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article, prepare a report on the adequacy of design for systems' balancing devices. Recommend changes and additions to systems' balancing devices to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance measuring and balancing devices.
- B. Status Reports: Prepare biweekly progress reports to describe completed procedures, procedures in progress, and scheduled procedures. Include a list of deficiencies and problems found in systems being tested and balanced. Prepare a separate report for each system and each building floor for systems serving multiple floors.

3.11 FINAL REPORT

- A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.

1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.
 2. Include a list of instruments used for procedures, along with proof of calibration.
- B. Final Report Contents: In addition to certified field-report data, include the following:
1. Pump curves.
 2. Fan curves.
 3. Manufacturers' test data.
 4. Field test reports prepared by system and equipment installers.
 5. Other information relative to equipment performance; do not include Shop Drawings and product data.
- C. General Report Data: In addition to form titles and entries, include the following data:
1. Title page.
 2. Name and address of the TAB contractor.
 3. Project name.
 4. Project location.
 5. Architect's name and address.
 6. Engineer's name and address.
 7. Contractor's name and address.
 8. Report date.
 9. Signature of TAB supervisor who certifies the report.
 10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
 11. Summary of contents including the following:
 - a. Indicated versus final performance.
 - b. Notable characteristics of systems.
 - c. Description of system operation sequence if it varies from the Contract Documents.
 12. Nomenclature sheets for each item of equipment.
 13. Data for terminal units, including manufacturer's name, type, size, and fittings.
 14. Notes to explain why certain final data in the body of reports vary from indicated values.
 15. Test conditions for fans and pump performance forms including the following:
 - a. Settings for outdoor-, return-, and exhaust-air dampers.
 - b. Conditions of filters.
 - c. Cooling coil, wet- and dry-bulb conditions.
 - d. Face and bypass damper settings at coils.
 - e. Fan drive settings including settings and percentage of maximum pitch diameter.
 - f. Inlet vane settings for variable-air-volume systems.
 - g. Settings for supply-air, static-pressure controller.
 - h. Other system operating conditions that affect performance.
- D. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present each system with single-line diagram and include the following:
1. Quantities of outdoor, supply, return, and exhaust airflows.
 2. Water and steam flow rates.
 3. Duct, outlet, and inlet sizes.
 4. Pipe and valve sizes and locations.
 5. Terminal units.

6. Balancing stations.
7. Position of balancing devices.

E. Air-Handling-Unit Test Reports: For air-handling units with coils, include the following:

1. Unit Data:
 - a. Unit identification.
 - b. Location.
 - c. Make and type.
 - d. Model number and unit size.
 - e. Manufacturer's serial number.
 - f. Unit arrangement and class.
 - g. Discharge arrangement.
 - h. Sheave make, size in inches, and bore.
 - i. Center-to-center dimensions of sheave, and amount of adjustments in inches.
 - j. Number, make, and size of belts.
 - k. Number, type, and size of filters.
2. Motor Data:
 - a. Motor make, and frame type and size.
 - b. Horsepower and rpm.
 - c. Volts, phase, and hertz.
 - d. Full-load amperage and service factor.
 - e. Sheave make, size in inches, and bore.
 - f. Center-to-center dimensions of sheave, and amount of adjustments in inches.
3. Test Data (Indicated and Actual Values):
 - a. Total air flow rate in cfm.
 - b. Total system static pressure in inches wg.
 - c. Fan rpm.
 - d. Discharge static pressure in inches wg.
 - e. Filter static-pressure differential in inches wg.
 - f. Preheat-coil static-pressure differential in inches wg.
 - g. Cooling-coil static-pressure differential in inches wg.
 - h. Heating-coil static-pressure differential in inches wg.
 - i. Outdoor airflow in cfm.
 - j. Return airflow in cfm.
 - k. Outdoor-air damper position.
 - l. Return-air damper position.
 - m. Vortex damper position.

F. Apparatus-Coil Test Reports:

1. Coil Data:
 - a. System identification.
 - b. Location.
 - c. Coil type.
 - d. Number of rows.
 - e. Fin spacing in fins per inch o.c.
 - f. Make and model number.
 - g. Face area in sq. ft..

- h. Tube size in NPS
- i. Tube and fin materials.
- j. Circuiting arrangement.

2. Test Data (Indicated and Actual Values):

- a. Air flow rate in cfm .
- b. Average face velocity in fpm.
- c. Air pressure drop in inches wg.
- d. Outdoor-air, wet- and dry-bulb temperatures in deg F.
- e. Return-air, wet- and dry-bulb temperatures in deg F.
- f. Entering-air, wet- and dry-bulb temperatures in deg F .
- g. Leaving-air, wet- and dry-bulb temperatures in deg F .
- h. Water flow rate in gpm (L/s).
- i. Water pressure differential in feet of head or psig.
- j. Entering-water temperature in deg F
- k. Leaving-water temperature in deg F.
- l. Refrigerant expansion valve and refrigerant types.
- m. Refrigerant suction pressure in psig.
- n. Refrigerant suction temperature in deg F.
- o. Inlet steam pressure in psig.

G. Gas- and Oil-Fired Heat Apparatus Test Reports: In addition to manufacturer's factory startup equipment reports, include the following:

1. Unit Data:

- a. System identification.
- b. Location.
- c. Make and type.
- d. Model number and unit size.
- e. Manufacturer's serial number.
- f. Fuel type in input data.
- g. Output capacity in Btu/h.
- h. Ignition type.
- i. Burner-control types.
- j. Motor horsepower and rpm.
- k. Motor volts, phase, and hertz.
- l. Motor full-load amperage and service factor.
- m. Sheave make, size in inches, and bore.
- n. Center-to-center dimensions of sheave, and amount of adjustments in inches.

2. Test Data (Indicated and Actual Values):

- a. Total air flow rate in cfm.
- b. Entering-air temperature in deg F.
- c. Leaving-air temperature in deg F.
- d. Air temperature differential in deg F.
- e. Entering-air static pressure in inches wg.
- f. Leaving-air static pressure in inches wg.
- g. Air static-pressure differential in inches wg.
- h. Low-fire fuel input in Btu/h
- i. High-fire fuel input in Btu/h.
- j. Manifold pressure in psig.
- k. High-temperature-limit setting in deg F.
- l. Operating set point in Btu/h.

- m. Motor voltage at each connection.
- n. Motor amperage for each phase.
- o. Heating value of fuel in Btu/h.

H. Fan Test Reports: For supply, return, and exhaust fans, include the following:

1. Fan Data:

- a. System identification.
- b. Location.
- c. Make and type.
- d. Model number and size.
- e. Manufacturer's serial number.
- f. Arrangement and class.
- g. Sheave make, size in inches, and bore.
- h. Center-to-center dimensions of sheave, and amount of adjustments in inches.

2. Motor Data:

- a. Motor make, and frame type and size.
- b. Horsepower and rpm.
- c. Volts, phase, and hertz.
- d. Full-load amperage and service factor.
- e. Sheave make, size in inches, and bore.
- f. Center-to-center dimensions of sheave, and amount of adjustments in inches.
- g. Number, make, and size of belts.

3. Test Data (Indicated and Actual Values):

- a. Total airflow rate in cfm.
- b. Total system static pressure in inches wg.
- c. Fan rpm.
- d. Discharge static pressure in inches wg.
- e. Suction static pressure in inches wg.

I. Round, Flat-Oval, and Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:

1. Report Data:

- a. System and air-handling-unit number.
- b. Location and zone.
- c. Traverse air temperature in deg F.
- d. Duct static pressure in inches wg.
- e. Duct size in inches.
- f. Duct area in sq. ft.
- g. Indicated air flow rate in cfm .
- h. Indicated velocity in fpm .
- i. Actual air flow rate in cfm .
- j. Actual average velocity in fpm .
- k. Barometric pressure in psig .

J. Air-Terminal-Device Reports:

1. Unit Data:

- a. System and air-handling unit identification.
- b. Location and zone.
- c. Apparatus used for test.
- d. Area served.
- e. Make.
- f. Number from system diagram.
- g. Type and model number.
- h. Size.
- i. Effective area in sq. ft.

2. Test Data (Indicated and Actual Values):

- a. Air flow rate in cfm
- b. Air velocity in fpm
- c. Preliminary air flow rate as needed in cfm
- d. Preliminary velocity as needed in fpm
- e. Final air flow rate in cfm
- f. Final velocity in fpm
- g. Space temperature in deg F

K. Instrument Calibration Reports:

1. Report Data:

- a. Instrument type and make.
- b. Serial number.
- c. Application.
- d. Dates of use.
- e. Dates of calibration.

3.12 INSPECTIONS

A. Initial Inspection:

1. After testing and balancing are complete, operate each system and randomly check measurements to verify that the system is operating according to the final test and balance readings documented in the final report.
2. Check the following for each system:
 - a. Measure airflow of at least 10 percent of air outlets.
 - b. Measure water flow of at least 5 percent of terminals.
 - c. Measure room temperature at each thermostat/temperature sensor. Compare the reading to the set point.
 - d. Verify that balancing devices are marked with final balance position.
 - e. Note deviations from the Contract Documents in the final report.

B. Final Inspection:

1. After initial inspection is complete and documentation by random checks verifies that testing and balancing are complete and accurately documented in the final report, request that a final inspection be made by Architect.
2. The TAB contractor's test and balance engineer shall conduct the inspection in the presence of Architect.

3. Architect shall randomly select measurements, documented in the final report, to be rechecked. Rechecking shall be limited to either 10 percent of the total measurements recorded or the extent of measurements that can be accomplished in a normal 8-hour business day.
 4. If rechecks yield measurements that differ from the measurements documented in the final report by more than the tolerances allowed, the measurements shall be noted as "FAILED."
 5. If the number of "FAILED" measurements is greater than 10 percent of the total measurements checked during the final inspection, the testing and balancing shall be considered incomplete and shall be rejected.
- C. TAB Work will be considered defective if it does not pass final inspections. If TAB Work fails, proceed as follows:
1. Recheck all measurements and make adjustments. Revise the final report and balancing device settings to include all changes; resubmit the final report and request a second final inspection.
 2. If the second final inspection also fails, Owner may contract the services of another TAB contractor to complete TAB Work according to the Contract Documents and deduct the cost of the services from the original TAB contractor's final payment.
- D. Prepare test and inspection reports.

3.13 ADDITIONAL TESTS

- A. Within 90 days of completing TAB, perform additional TAB to verify that balanced conditions are being maintained throughout and to correct unusual conditions.
- B. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional TAB during near-peak summer and winter conditions.

END OF SECTION 23 05 93

SECTION 23 0700**HVAC 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. Insulation Materials:
 - a. Mineral fiber.
- 2. Fire-rated insulation systems.
- 3. Adhesives.
- 4. Sealants.
- 5. Factory-applied jackets.
- 6. Field-applied fabric-reinforcing mesh.
- 7. Field-applied cloths.
- 8. Field-applied jackets.
- 9. Tapes.
- 10. Securements.
- 11. Corner angles.

B. Related Sections:

- 1. Division 21 Section "Fire-Suppression Systems Insulation."
- 2. Division 22 Section "Plumbing Insulation."
- 3. Division 23 Section "Metal Ducts" for duct liners.
- 4. Division 33 Section "Underground Hydronic Energy Distribution" for loose-fill pipe insulation in underground piping outside the building.
- 5. Division 33 Section "Underground Steam and Condensate Distribution Piping" for loose-fill pipe insulation in underground piping outside the building.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated. Include thermal conductivity, thickness, and jackets (both factory and field applied, if any).

B. LEED Submittal:

- 1. Product Data for Credit EQ 4.1: For adhesives and sealants, including printed statement of VOC content.

C. Shop Drawings:

- 1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.

2. Detail attachment and covering of heat tracing inside insulation.
3. Detail insulation application at pipe expansion joints for each type of insulation.
4. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
5. Detail removable insulation at piping specialties, equipment connections, and access panels.
6. Detail application of field-applied jackets.
7. Detail application at linkages of control devices.
8. Detail field application for each equipment type.

D. Samples: For each type of insulation and jacket indicated. Identify each Sample, describing product and intended use.

1. Sample Sizes:

- a. Preformed Pipe Insulation Materials: 12 inches long by NPS 2 .
- b. Sheet Form Insulation Materials: 12 inches square.
- c. Jacket Materials for Pipe: 12 inches long by NPS 2 .
- d. Sheet Jacket Materials: 12 inches square.
- e. Manufacturer's Color Charts: For products where color is specified, show the full range of colors available for each type of finish material.

E. Qualification Data: For qualified Installer.

F. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.

G. Field quality-control reports.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.

B. Fire-Test-Response Characteristics: Insulation and related materials shall have fire-test-response characteristics indicated, as determined by testing identical products per ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing and inspecting agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.6 COORDINATION

- A. Coordinate size and location of supports, hangers, and insulation shields specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment."
- B. Coordinate clearance requirements with piping Installer for piping insulation application, duct Installer for duct insulation application, and equipment Installer for equipment insulation application. Before preparing piping and ductwork Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.
- C. Coordinate installation and testing of heat tracing.

1.7 SCHEDULING

- A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.
- B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

- A. Comply with requirements in Part 3 schedule articles for where insulating materials shall be applied.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.
- D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.
- E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
- F. Calcium Silicate:
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Industrial Insulation Group (The); Thermo-12 Gold.
 - 2. Preformed Pipe Sections: Flat-, curved-, and grooved-block sections of noncombustible, inorganic, hydrous calcium silicate with a non-asbestos fibrous reinforcement. Comply with ASTM C 533, Type I.
 - 3. Flat-, curved-, and grooved-block sections of noncombustible, inorganic, hydrous calcium silicate with a non-asbestos fibrous reinforcement. Comply with ASTM C 533, Type I.
 - 4. Prefabricated Fitting Covers: Comply with ASTM C 450 and ASTM C 585 for dimensions used in preforming insulation to cover valves, elbows, tees, and flanges.

- G. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type I. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1. Products: Subject to compliance with requirements, provide the following:

- a. CertainTeed Corp.; Duct Wrap.
- b. Johns Manville; Microlite.
- c. Knauf Insulation; Duct Wrap.
- d. Manson Insulation Inc.; Alley Wrap.
- e. Owens Corning; All-Service Duct Wrap.

2.2 FIRE-RATED INSULATION SYSTEMS

- A. Fire-Rated Board: Structural-grade, press-molded, xonolite calcium silicate, fireproofing board suitable for operating temperatures up to 1700 deg F. Comply with ASTM C 656, Type II, Grade 6. tested and certified to provide a 1-hour fire rating by a NRTL acceptable to authority having jurisdiction.

1. Products: Subject to compliance with requirements, provide the following:

- a. Johns Manville; Super Firetemp M.

- B. Fire-Rated Blanket: High-temperature, flexible, blanket insulation with FSK jacket that is tested and certified to provide a [1] [2]-hour fire rating by a NRTL acceptable to authority having jurisdiction.

1. Products: Subject to compliance with requirements, provide one of the following:

- a. CertainTeed Corp.; FlameChek.
- b. Johns Manville; Firetemp Wrap.
- c. Nelson Firestop Products; Nelson FSB Flameshield Blanket.
- d. Thermal Ceramics; FireMaster Duct Wrap.
- e. 3M; Fire Barrier Wrap Products.
- f. Unifrax Corporation; FyreWrap.
- g. Vesuvius; PYROSCAT FP FASTR Duct Wrap.

2.3 ADHESIVES

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.

- B. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

1. Products: Subject to compliance with requirements, [provide the following] [provide one of the following] [available products that may be incorporated into the Work include, but are not limited to, the following]:

- a. Childers Products, Division of ITW; CP-82.
- b. Foster Products Corporation, H. B. Fuller Company; 85-20.
- c. ITW TACC, Division of Illinois Tool Works; S-90/80.
- d. Marathon Industries, Inc.; 225.
- e. Mon-Eco Industries, Inc.; 22-25.

2. Color: White.

2.4 SEALANTS

A. Joint Sealants:

B. FSK and Metal Jacket Flashing Sealants:

1. Products: Subject to compliance with requirements, [provide the following] [provide one of the following] [available products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. Childers Products, Division of ITW; CP-76-8.
 - b. Foster Products Corporation, H. B. Fuller Company; 95-44.
 - c. Marathon Industries, Inc.; 405.
 - d. Mon-Eco Industries, Inc.; 44-05.
 - e. Vimasco Corporation; 750.
 - f. <Insert manufacturer's name; product name or designation.>
2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F (Minus 40 to plus 121 deg C).
5. Color: Aluminum.
6. For indoor applications, use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.5 FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.

B. FSK Jacket: Aluminum-foil-face, fiberglass-reinforced scrim with kraft-paper backing.

C. Metal Jacket:

1. Products: Subject to compliance with requirements, provide one of the following]:
 - a. Childers Products, Division of ITW; Metal Jacketing Systems.
 - b. PABCO Metals Corporation; Surefit.
 - c. RPR Products, Inc.; Insul-Mate.
2. Aluminum Jacket: Comply with ASTM B 209 , Alloy 3003, 3005, 3105 or 5005, Temper H-14.
 - a. Sheet and roll stock ready for shop or field sizing
 - b. Finish and thickness are indicated in field-applied jacket schedules.
 - c. Moisture Barrier for Indoor Applications: [1-mil-thick, heat-bonded polyethylene and kraft paper] [3-mil- thick, heat-bonded polyethylene and kraft paper] [2.5-mil-thick Polysurlyn].
 - d. Moisture Barrier for Outdoor Applications: [3-mil- thick, heat-bonded polyethylene and kraft paper] [2.5-mil- thick Polysurlyn].
 - e. Factory-Fabricated Fitting Covers:
 - 1) Same material, finish, and thickness as jacket.
 - 2) Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.
 - 3) Tee covers.
 - 4) Flange and union covers.

- 5) End caps.
- 6) Beveled collars.
- 7) Valve covers.
- 8) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.
- 9) Tee covers.
- 10) Flange and union covers.
- 11) End caps.
- 12) Beveled collars.
- 13) Valve covers.
- 14) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

2.6 TAPES

A. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.

- 1. Products: Subject to compliance with requirements, [provide the following] [provide one of the following] [available products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0800.
 - b. Compac Corp.; 120.
 - c. Ideal Tape Co., Inc., an American Biltrite Company; 488 AWF.
 - d. Venture Tape; 3520 CW.
 - e. <Insert manufacturer's name; product name or designation.>
- 2. Width: 2 inches (50 mm).
- 3. Thickness: 3.7 mils (0.093 mm).
- 4. Adhesion: 100 ounces force/inch (1.1 N/mm) in width.
- 5. Elongation: 5 percent.
- 6. Tensile Strength: 34 lbf/inch (6.2 N/mm) in width.

2.7 SECUREMENTS

A. Bands:

- 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Products; Bands.
 - b. PABCO Metals Corporation; Bands.
 - c. RPR Products, Inc.; Bands.
- 2. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 304; 0.015 inch (thick, 1/2 inch wide with closed seal
- 3. Aluminum: ASTM B 209 , Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 1/2 inch wide with closed seal].
- 4. Springs: Twin spring set constructed of stainless steel with ends flat and slotted to accept metal bands. Spring size determined by manufacturer for application.

2.8 CORNER ANGLES

- A. PVC Corner Angles: 30 mils thick, minimum 1 by 1 inch , PVC according to ASTM D 1784, Class 16354-C. White or color-coded to match adjacent surface.

- B. Aluminum Corner Angles: 0.040 inch thick, minimum 1 by 1 inch , aluminum according to ASTM B 209, Alloy 3003, 3005, 3105 or 5005; Temper H-14.
- C. Stainless-Steel Corner Angles: 0.024 inch thick, minimum 1 by 1 inch , stainless steel according to ASTM A 167 or ASTM A 240/A 240M, Type 304.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.
 - 1. Verify that systems and equipment to be insulated have been tested and are free of defects.
 - 2. Verify that surfaces to be insulated are clean and dry.
 - 3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.
- B. Surface Preparation: Clean and prepare surfaces to be insulated. Before insulating, apply a corrosion coating to insulated surfaces as follows:
 - 1. Stainless Steel: Coat 300 series stainless steel with an epoxy primer 5 mils thick and an epoxy finish 5 mils thick if operating in a temperature range between 140 and 300 deg F . Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
 - 2. Carbon Steel: Coat carbon steel operating at a service temperature between 32 and 300 deg F with an epoxy coating. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
- C. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.
- D. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.3 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment, ducts and fittings, and piping including fittings, valves, and specialties.
- B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of equipment, duct system, and pipe system as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- G. Keep insulation materials dry during application and finishing.
- H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- I. Install insulation with least number of joints practical.
- J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
 - 1. Install insulation continuously through hangers and around anchor attachments.
 - 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
 - 3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
 - 4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
- K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- L. Install insulation with factory-applied jackets as follows:
 - 1. Draw jacket tight and smooth.
 - 2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
 - 3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 4 inches o.c.
 - a. For below ambient services, apply vapor-barrier mastic over staples.
 - 4. Cover joints and seams with tape as recommended by insulation material manufacturer to maintain vapor seal.
 - 5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct and pipe flanges and fittings.
- M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

P. For above ambient services, do not install insulation to the following:

1. Vibration-control devices.
2. Testing agency labels and stamps.
3. Nameplates and data plates.
4. Manholes.
5. Handholes.
6. Cleanouts.

3.4 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.

C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches .
4. Seal jacket to wall flashing with flashing sealant.

D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

E. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions. Terminate insulation at fire damper sleeves for fire-rated wall and partition penetrations. Externally insulate damper sleeves to match adjacent insulation and overlap duct insulation at least 2 inches .

1. Comply with requirements in Division 07 Section "Penetration Firestopping"irestopping and fire-resistive joint sealers.

3.5 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:

1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity, unless otherwise indicated.
 2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
 3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
 4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
 5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below ambient services, provide a design that maintains vapor barrier.
 6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
 7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below ambient services and a breather mastic for above ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
 8. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
 9. Stencil or label the outside insulation jacket of each union with the word "UNION." Match size and color of pipe labels.
- C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes, vessels, and equipment. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.
- D. Install removable insulation covers at locations indicated. Installation shall conform to the following:
1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
 2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
 3. Construct removable valve insulation covers in same manner as for flanges except divide the two-part section on the vertical center line of valve body.

4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.6 MINERAL-FIBER INSULATION INSTALLATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above ambient surfaces, secure laps with outward clinched staples at 6 inches o.c.
4. For insulation with factory-applied jackets on below ambient surfaces, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch (25 mm), and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

E. Blanket Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of duct and plenum surfaces.

2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
 3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
 - a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
 - b. On duct sides with dimensions larger than 18 inches, place pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
 - c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
 - d. Do not overcompress insulation during installation.
 - e. Impale insulation over pins and attach speed washers.
 - f. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
 4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from 1 edge and 1 end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.
 - a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
 - b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to 2 times the insulation thickness but not less than 3 inches.
 5. Overlap unfaced blankets a minimum of 2 inches on longitudinal seams and end joints. At end joints, secure with steel bands spaced a maximum of 18 inches o.c.
 6. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
 7. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch-wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.
- F. Board Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.
1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100percent coverage of duct and plenum surfaces.
 2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
 3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:

- a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
 - b. On duct sides with dimensions larger than 18 inches, space pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
 - c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
 - d. Do not overcompress insulation during installation.
 - e. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from 1 edge and 1 end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.
 - a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
 - b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to 2 times the insulation thickness but not less than 3 inches .
5. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Groove and score insulation to fit as closely as possible to outside and inside radius of elbows. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
6. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch- wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

3.7 FIELD-APPLIED JACKET INSTALLATION

- A. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.

3.8 FIRE-RATED INSULATION SYSTEM INSTALLATION

- A. Where fire-rated insulation system is indicated, secure system to ducts and duct hangers and supports to maintain a continuous fire rating.
- B. Insulate duct access panels and doors to achieve same fire rating as duct.
- C. Install firestopping at penetrations through fire-rated assemblies. Fire-stop systems are specified in Division 07 Section "Penetration Firestopping."

3.9 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- B. Perform tests and inspections.
- C. Tests and Inspections:
 - 1. Inspect ductwork, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to one location(s) for each duct system defined in the "Duct Insulation Schedule, General" Article.
 - 2. Inspect field-insulated equipment, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to one location(s) for each type of equipment defined in the "Equipment Insulation Schedule" Article. For large equipment, remove only a portion adequate to determine compliance.
 - 3. Inspect pipe, fittings, strainers, and valves, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to three locations of straight pipe, three locations of threaded fittings, three locations of welded fittings, two locations of threaded strainers, two locations of welded strainers, three locations of threaded valves, and three locations of flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.
- D. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.10 DUCT INSULATION SCHEDULE, GENERAL

- A. Plenums and Ducts Requiring Insulation:
 - 1. Indoor, concealed supply and outdoor air.
- B. Items Not Insulated:
 - 1. Fibrous-glass ducts.
 - 2. Metal ducts with duct liner of sufficient thickness to comply with energy code and ASHRAE/IESNA 90.1.
 - 3. Factory-insulated flexible ducts.
 - 4. Factory-insulated plenums and casings.
 - 5. Flexible connectors.
 - 6. Vibration-control devices.
 - 7. Factory-insulated access panels and doors.

END OF SECTION 230700

SECTION 23 11 23

FACILITY NATURAL-GAS PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Pipes, tubes, and fittings.
2. Piping specialties.
3. Piping and tubing joining materials.
4. Valves.
5. Pressure regulators.
6. Service meters.
7. Mechanical sleeve seals.
8. Grout.
9. Concrete bases.

1.3 DEFINITIONS

- A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.
- B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
- C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

1.4 PERFORMANCE REQUIREMENTS

A. Minimum Operating-Pressure Ratings:

1. Piping and Valves: 100 psig minimum unless otherwise indicated.
2. Service Regulators: 65 psig minimum unless otherwise indicated.
3. Minimum Operating Pressure of Service Meter: 5 psig unless otherwise indicated.

- B. Natural-Gas System Pressure within Buildings: 0.5 psig.

1.5 SUBMITTALS

A. Product Data: For each type of the following:

1. Piping specialties.
2. Corrugated, stainless-steel tubing with associated components.
3. Valves. Include pressure rating, capacity, settings, and electrical connection data of selected models.
4. Pressure regulators. Indicate pressure ratings and capacities.
5. Dielectric fittings.
6. Mechanical sleeve seals.
7. Escutcheons.

B. Shop Drawings: For facility natural-gas piping layout. Include plans, piping layout and elevations, sections, and details for fabrication of pipe anchors, hangers, supports for multiple pipes, alignment guides, expansion joints and loops, and attachments of the same to building structure. Detail location of anchors, alignment guides, and expansion joints and loops.

1. Shop Drawing Scale: 1/4 inch per foot.
2. Detail mounting, supports, and valve arrangements for service meter assembly and pressure regulator assembly.

C. Delegated-Design Submittal: For natural-gas piping and equipment 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 seismic restraints.
2. Design Calculations: Calculate requirements for selecting seismic restraints.

D. Coordination Drawings: Plans and details, drawn to scale, on which natural-gas piping is shown and coordinated with other installations, using input from installers of the items involved.

E. Site Survey: Plans, drawn to scale, on which natural-gas piping is shown and coordinated with other services and utilities.

F. Qualification Data: For qualified professional engineer.

G. Welding certificates.

H. Field quality-control reports.

I. Operation and Maintenance Data: For pressure regulators to include in emergency, operation, and maintenance manuals.

1.6 QUALITY ASSURANCE

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

B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Handling Flammable Liquids: Remove and dispose of liquids from existing natural-gas piping according to requirements of authorities having jurisdiction.
- B. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.
- C. Store and handle pipes and tubes having factory-applied protective coatings to avoid damaging coating, and protect from direct sunlight.
- D. Protect stored PE pipes and valves from direct sunlight.

1.8 PROJECT CONDITIONS

- A. Perform site survey, research public utility records, and verify existing utility locations. Contact utility-locating service for area where Project is located.
- B. Interruption of Existing Natural-Gas Service: Do not interrupt natural-gas service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide purging and startup of natural-gas supply according to requirements indicated:
 - 1. Notify Architect no fewer than two days in advance of proposed interruption of natural-gas service.
 - 2. Do not proceed with interruption of natural-gas service without Architect's written permission.

1.9 COORDINATION

- A. Coordinate sizes and locations of concrete bases with actual equipment provided.
- B. Coordinate requirements for access panels and doors for valves installed concealed behind finished surfaces. Comply with requirements in Division 08 Section "Access Doors and Frames."

PART 2 - PRODUCTS

2.1 PIPES, TUBES, AND FITTINGS

- A. Steel Pipe: ASTM A 53/A 53M, black steel, Schedule 40, Type E or S, Grade B.
 - 1. Malleable-Iron Threaded Fittings: ASME B16.3, Class 150, standard pattern.
 - 2. Wrought-Steel Welding Fittings: ASTM A 234/A 234M for butt welding and socket welding.
 - 3. Unions: ASME B16.39, Class 150, malleable iron with brass-to-iron seat, ground joint, and threaded ends.
 - 4. Forged-Steel Flanges and Flanged Fittings: ASME B16.5, minimum Class 150, including bolts, nuts, and gaskets of the following material group, end connections, and facings:

- a. Material Group: 1.1.
 - b. End Connections: Threaded or butt welding to match pipe.
 - c. Lapped Face: Not permitted underground.
 - d. Gasket Materials: ASME B16.20, metallic, flat, asbestos free, aluminum o-rings, and spiral-wound metal gaskets.
 - e. Bolts and Nuts: ASME B18.2.1, carbon steel aboveground and stainless steel underground.
5. Protective Coating for Underground Piping: Factory-applied, three-layer coating of epoxy, adhesive, and PE.
- a. Joint Cover Kits: Epoxy paint, adhesive, and heat-shrink PE sleeves.
6. Mechanical Couplings:
- a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) Dresser Piping Specialties; Division of Dresser, Inc.
 - 2) Smith-Blair, Inc.
 - b. Steel flanges and tube with epoxy finish.
 - c. Buna-nitrile seals.
 - d. Steel bolts, washers, and nuts.
 - e. Coupling shall be capable of joining PE pipe to PE pipe, steel pipe to PE pipe, or steel pipe to steel pipe.
 - f. Steel body couplings installed underground on plastic pipe shall be factory equipped with anode.

2.2 PIPING SPECIALTIES

A. Appliance Flexible Connectors:

- 1. Indoor, Fixed-Appliance Flexible Connectors: Comply with ANSI Z21.24.
- 2. Indoor, Movable-Appliance Flexible Connectors: Comply with ANSI Z21.69.
- 3. Outdoor, Appliance Flexible Connectors: Comply with ANSI Z21.75.
- 4. Corrugated stainless-steel tubing with polymer coating.
- 5. Operating-Pressure Rating: 0.5 psig.
- 6. End Fittings: Zinc-coated steel.
- 7. Threaded Ends: Comply with ASME B1.20.1.
- 8. Maximum Length: 72 inches.

B. Quick-Disconnect Devices: Comply with ANSI Z21.41.

- 1. Copper-alloy convenience outlet and matching plug connector.
- 2. Nitrile seals.
- 3. Hand operated with automatic shutoff when disconnected.
- 4. For indoor or outdoor applications.
- 5. Adjustable, retractable restraining cable.

C. Y-Pattern Strainers:

- 1. Body: ASTM A 126, Class B, cast iron with bolted cover and bottom drain connection.

2. End Connections: Threaded ends for NPS 2 and smaller; flanged ends for NPS 2-1/2 and larger.
3. Strainer Screen: 40-mesh startup strainer, and perforated stainless-steel basket with 50 percent free area.
4. CWP Rating: 125 psig.

D. Basket Strainers:

1. Body: ASTM A 126, Class B, high-tensile cast iron with bolted cover and bottom drain connection.
2. End Connections: Threaded ends for NPS 2 and smaller; flanged ends for NPS 2-1/2 and larger.
3. Strainer Screen: 40-mesh startup strainer, and perforated stainless-steel basket with 50 percent free area.
4. CWP Rating: 125 psig .

E. T-Pattern Strainers:

1. Body: Ductile or malleable iron with removable access coupling and end cap for strainer maintenance.
2. End Connections: Grooved ends.
3. Strainer Screen: 40-mesh startup strainer, and perforated stainless-steel basket with 57 percent free area.
4. CWP Rating: 750 psig .

- F. Weatherproof Vent Cap: Cast- or malleable-iron increaser fitting with corrosion-resistant wire screen, with free area at least equal to cross-sectional area of connecting pipe and threaded-end connection.

2.3 JOINING MATERIALS

- A. Joint Compound and Tape: Suitable for natural gas.
- B. Welding Filler Metals: Comply with AWS D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
- C. Brazing Filler Metals: Alloy with melting point greater than 1000 deg F complying with AWS A5.8/A5.8M. Brazing alloys containing more than 0.05 percent phosphorus are prohibited.

2.4 MANUAL GAS SHUTOFF VALVES

- A. See "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles for where each valve type is applied in various services.
- B. General Requirements for Metallic Valves, NPS 2 and Smaller: Comply with ASME B16.33.
1. CWP Rating: 125 psig.
 2. Threaded Ends: Comply with ASME B1.20.1.
 3. Dryseal Threads on Flare Ends: Comply with ASME B1.20.3.
 4. Tamperproof Feature: Locking feature for valves indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.

5. Listing: Listed and labeled by an NRTL acceptable to authorities having jurisdiction for valves 1 inch and smaller.
6. Service Mark: Valves 1-1/4 inches to NPS 2 shall have initials "WOG" permanently marked on valve body.

C. General Requirements for Metallic Valves, NPS 2-1/2 and Larger: Comply with ASME B16.38.

1. CWP Rating: 125 psig.
2. Flanged Ends: Comply with ASME B16.5 for steel flanges.
3. Tamperproof Feature: Locking feature for valves indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
4. Service Mark: Initials "WOG" shall be permanently marked on valve body.

D. One-Piece, Bronze Ball Valve with Bronze Trim: MSS SP-110.

1. Manufacturers: Subject to compliance with requirements, [provide products by one of the following] [available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. BrassCraft Manufacturing Company; a Masco company.
 - b. Conbraco Industries, Inc.; Apollo Div.
 - c. Lyall, R. W. & Company, Inc.
 - d. McDonald, A. Y. Mfg. Co.
 - e. Perfection Corporation; a subsidiary of American Meter Company.
2. Body: Bronze, complying with ASTM B 584.
3. Ball: Chrome-plated brass.
4. Stem: Bronze; blowout proof.
5. Seats: Reinforced TFE; blowout proof.
6. Packing: Separate packnut with adjustable-stem packing threaded ends.
7. Ends: Threaded, flared, or socket as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
8. CWP Rating: 600 psig.
9. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
10. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

2.5 PRESSURE REGULATORS

A. General Requirements:

1. Single stage and suitable for natural gas.
2. Steel jacket and corrosion-resistant components.
3. Elevation compensator.
4. End Connections: Threaded for regulators NPS 2 and smaller; flanged for regulators NPS 2-1/2 and larger.

B. Service Pressure Regulators: Comply with ANSI Z21.80.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

- a. Actaris.
 - b. American Meter Company.
 - c. Fisher Control Valves and Regulators; Division of Emerson Process Management.
 - d. Invensys.
 - e. Richards Industries; Jordan Valve Div.
- 3. Body and Diaphragm Case: Cast iron or die-cast aluminum.
 - 4. Springs: Zinc-plated steel; interchangeable.
 - 5. Diaphragm Plate: Zinc-plated steel.
 - 6. Seat Disc: Nitrile rubber resistant to gas impurities, abrasion, and deformation at the valve port.
 - 7. Orifice: Aluminum; interchangeable.
 - 8. Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.
 - 9. Single-port, self-contained regulator with orifice no larger than required at maximum pressure inlet, and no pressure sensing piping external to the regulator.
 - 10. Pressure regulator shall maintain discharge pressure setting downstream, and not exceed 150 percent of design discharge pressure at shutoff.
 - 11. Overpressure Protection Device: Factory mounted on pressure regulator.
 - 12. Atmospheric Vent: Factory- or field-installed, stainless-steel screen in opening if not connected to vent piping.
 - 13. Maximum Inlet Pressure: 100 psig.

C. Appliance Pressure Regulators: Comply with ANSI Z21.18.

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- 2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - a. Canadian Meter Company Inc.
 - b. Eaton Corporation; Controls Div.
 - c. Harper Wyman Co.
 - d. Maxitrol Company.
 - e. SCP, Inc.
- 3. Body and Diaphragm Case: Die-cast aluminum.
- 4. Springs: Zinc-plated steel; interchangeable.
- 5. Diaphragm Plate: Zinc-plated steel.
- 6. Seat Disc: Nitrile rubber.
- 7. Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.
- 8. Factory-Applied Finish: Minimum three-layer polyester and polyurethane paint finish.
- 9. Regulator may include vent limiting device, instead of vent connection, if approved by authorities having jurisdiction.
- 10. Maximum Inlet Pressure: 1 psig.

2.6 DIELECTRIC FITTINGS

A. Dielectric Unions:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Capitol Manufacturing Company.
 - b. Central Plastics Company.

- c. Hart Industries International, Inc.
 - d. McDonald, A. Y. Mfg. Co.
 - e. Watts Regulator Co.; Division of Watts Water Technologies, Inc.
 - f. Wilkins; Zurn Plumbing Products Group.
2. Minimum Operating-Pressure Rating: 150 psig.
 3. Combination fitting of copper alloy and ferrous materials.
 4. Insulating materials suitable for natural gas.
 5. Combination fitting of copper alloy and ferrous materials with threaded, brazed-joint, plain, or welded end connections that match piping system materials.

2.7 SLEEVES

- A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.
- B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

2.8 MECHANICAL SLEEVE SEALS

- A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Advance Products & Systems, Inc.
 - b. Calpico Inc.
 - c. Metraflex Company (The).
 - d. Pipeline Seal and Insulator, Inc.
 2. Sealing Elements: EPDM interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe and sleeve.
 3. Pressure Plates: Carbon steel.
 4. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one nut and bolt for each sealing element.

2.9 ESCUTCHEONS

- A. General Requirements for Escutcheons: Manufactured wall and ceiling escutcheons and floor plates, with ID to fit around pipe or tube, and OD that completely covers opening.

2.10 GROUT

- A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.
 1. Characteristics: Post-hardening, volume adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
 2. Design Mix: 5000-psi, 28-day compressive strength.

3. Packaging: Premixed and factory packaged.

2.11 LABELING AND IDENTIFYING

- A. Detectable Warning Tape: Acid- and alkali-resistant, PE film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches wide and 4 mils thick, continuously inscribed with a description of utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored yellow.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine roughing-in for natural-gas piping system to verify actual locations of piping connections before equipment installation.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Close equipment shutoff valves before turning off natural gas to premises or piping section.
- B. Inspect natural-gas piping according to UPC to determine that natural-gas utilization devices are turned off in piping section affected.
- C. Comply with UPC requirements for prevention of accidental ignition.

3.3 OUTDOOR PIPING INSTALLATION

- A. Comply with UPC for installation and purging of natural-gas piping.
- B. Install underground, natural-gas piping buried at least 36 inches below finished grade. Comply with requirements in Division 31 Section "Earth Moving" for excavating, trenching, and backfilling.
 1. If natural-gas piping is installed less than 36 inches below finished grade, install it in containment conduit.
- C. Install underground, PE, natural-gas piping according to ASTM D 2774.
- D. Steel Piping with Protective Coating:
 1. Apply joint cover kits to pipe after joining to cover, seal, and protect joints.
 2. Repair damage to PE coating on pipe as recommended in writing by protective coating manufacturer.
 3. Replace pipe having damaged PE coating with new pipe.
- E. Copper Tubing with Protective Coating:
 1. Apply joint cover kits over tubing to cover, seal, and protect joints.

2. Repair damage to PE coating on pipe as recommended in writing by protective coating manufacturer.
- F. Install fittings for changes in direction and branch connections.
- G. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
1. Install steel pipe for sleeves smaller than 6 inches in diameter.
 2. Install cast-iron "wall pipes" for sleeves 6 inches and larger in diameter.
- H. Underground, Exterior-Wall Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
- I. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
- J. Install pressure gage downstream from each service regulator. Pressure gages are specified in Division 23 Section "Meters and Gages for HVAC Piping."

3.4 INDOOR PIPING INSTALLATION

- A. Comply with UPC for installation and purging of natural-gas piping.
- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- C. Arrange for pipe spaces, chases, slots, sleeves, and openings in building structure during progress of construction, to allow for mechanical installations.
- D. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- E. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- F. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- G. Locate valves for easy access.
- H. Install natural-gas piping at uniform grade of 2 percent down toward drip and sediment traps.
- I. Install piping free of sags and bends.
- J. Install fittings for changes in direction and branch connections.
- K. Install escutcheons at penetrations of interior walls, ceilings, and floors.

1. New Piping:
 - a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
 - b. Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished chrome-plated finish.
 - c. Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, stamped-steel type.
 - d. Piping at Ceiling Penetrations in Finished Spaces: One-piece, cast-brass type with polished chrome-plated finish.
 - e. Piping at Ceiling Penetrations in Finished Spaces: One-piece, stamped-steel type.
- L. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements in Division 07 Section "Penetration Firestopping."
- M. Verify final equipment locations for roughing-in.
- N. Comply with requirements in Sections specifying gas-fired appliances and equipment for roughing-in requirements.
- O. Drips and Sediment Traps: Install drips at points where condensate may collect, including service-meter outlets. Locate where accessible to permit cleaning and emptying. Do not install where condensate is subject to freezing.
 1. Construct drips and sediment traps using tee fitting with bottom outlet plugged or capped. Use nipple a minimum length of 3 pipe diameters, but not less than 3 inches long and same size as connected pipe. Install with space below bottom of drip to remove plug or cap.
- P. Extend relief vent connections for service regulators, line regulators, and overpressure protection devices to outdoors and terminate with weatherproof vent cap.
- Q. Conceal pipe installations in walls, pipe spaces, utility spaces, above ceilings, below grade or floors, and in floor channels unless indicated to be exposed to view.
- R. Concealed Location Installations: Except as specified below, install concealed natural-gas piping and piping installed under the building in containment conduit constructed of steel pipe with welded joints as described in Part 2. Install a vent pipe from containment conduit to outdoors and terminate with weatherproof vent cap.
 1. Above Accessible Ceilings: Natural-gas piping, fittings, valves, and regulators may be installed in accessible spaces without containment conduit.
 2. In Floors: Install natural-gas piping with welded or brazed joints and protective coating in cast-in-place concrete floors. Cover piping to be cast in concrete slabs with minimum of 1-1/2 inches of concrete. Piping may not be in physical contact with other metallic structures such as reinforcing rods or electrically neutral conductors. Do not embed piping in concrete slabs containing quick-set additives or cinder aggregate.
 3. In Floor Channels: Install natural-gas piping in floor channels. Channels must have cover and be open to space above cover for ventilation.
 4. In Walls or Partitions: Protect tubing installed inside partitions or hollow walls from physical damage using steel striker barriers at rigid supports.
 - a. Exception: Tubing passing through partitions or walls does not require striker barriers.

5. Prohibited Locations:

- a. Do not install natural-gas piping in or through circulating air ducts, clothes or trash chutes, chimneys or gas vents (flues), ventilating ducts, or dumbwaiter or elevator shafts.
 - b. Do not install natural-gas piping in solid walls or partitions.
- S. Use eccentric reducer fittings to make reductions in pipe sizes. Install fittings with level side down.
- T. Connect branch piping from top or side of horizontal piping.
- U. Install unions in pipes NPS 2 and smaller, adjacent to each valve, at final connection to each piece of equipment. Unions are not required at flanged connections.
- V. Do not use natural-gas piping as grounding electrode.
- W. Install strainer on inlet of each line-pressure regulator and automatic or electrically operated valve.
- X. Install pressure gage downstream from each line regulator. Pressure gages are specified in Division 23 Section "Meters and Gages for HVAC Piping."

3.5 VALVE INSTALLATION

- A. Install manual gas shutoff valve for each gas appliance ahead of corrugated stainless-steel tubing, aluminum, or copper connector.
- B. Install underground valves with valve boxes.
- C. Install regulators and overpressure protection devices with maintenance access space adequate for servicing and testing.
- D. Install earthquake valves aboveground outside buildings according to listing.
- E. Install anode for metallic valves in underground PE piping.

3.6 PIPING JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- C. Threaded Joints:
 - 1. Thread pipe with tapered pipe threads complying with ASME B1.20.1.
 - 2. Cut threads full and clean using sharp dies.
 - 3. Ream threaded pipe ends to remove burrs and restore full inside diameter of pipe.
 - 4. Apply appropriate tape or thread compound to external pipe threads unless dryseal threading is specified.
 - 5. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- D. Welded Joints:

1. Construct joints according to AWS D10.12/D10.12M, using qualified processes and welding operators.
 2. Bevel plain ends of steel pipe.
 3. Patch factory-applied protective coating as recommended by manufacturer at field welds and where damage to coating occurs during construction.
- E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter.
- F. Flanged Joints: Install gasket material, size, type, and thickness appropriate for natural-gas service. Install gasket concentrically positioned.
- G. Flared Joints: Cut tubing with roll cutting tool. Flare tube end with tool to result in flare dimensions complying with SAE J513. Tighten finger tight, then use wrench. Do not overtighten.
- H. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.
1. Plain-End Pipe and Fittings: Use butt fusion.
 2. Plain-End Pipe and Socket Fittings: Use socket fusion.

3.7 HANGER AND SUPPORT INSTALLATION

- A. Install seismic restraints on piping. Comply with requirements for seismic-restraint devices specified in Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment."
- B. Comply with requirements for pipe hangers and supports specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment."
- C. Install hangers for horizontal steel piping with the following maximum spacing and minimum rod sizes:
1. NPS 1 and Smaller: Maximum span, 96 inches minimum rod size, 3/8 inch.
 2. NPS 1-1/4: Maximum span, 108 inches; minimum rod size, 3/8 inch.
 3. NPS 1-1/2 and NPS 2: Maximum span, 108 inches; minimum rod size, 3/8 inch.
 4. NPS 2-1/2 to NPS 3-1/2: Maximum span, 10 feet; minimum rod size, 1/2 inch.

3.8 CONNECTIONS

- A. Connect to utility's gas main according to utility's procedures and requirements.
- B. Install natural-gas piping electrically continuous, and bonded to gas appliance equipment grounding conductor of the circuit powering the appliance according to NFPA 70.
- C. Install piping adjacent to appliances to allow service and maintenance of appliances.
- D. Connect piping to appliances using manual gas shutoff valves and unions. Install valve within 72 inches of each gas-fired appliance and equipment. Install union between valve and appliances or equipment.
- E. Sediment Traps: Install tee fitting with capped nipple in bottom to form drip, as close as practical to inlet of each appliance.

3.9 LABELING AND IDENTIFYING

- A. Install detectable warning tape directly above gas piping, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

3.10 PAINTING

- A. Comply with requirements in Division 09 painting Sections for painting interior and exterior natural-gas piping.
- B. Paint exposed, exterior metal piping, valves, service regulators, service meters and meter bars, earthquake valves, and piping specialties, except components, with factory-applied paint or protective coating.
 - 1. Alkyd System: MPI EXT 5.1D.
 - a. Prime Coat: Alkyd anticorrosive metal primer.
 - b. Intermediate Coat: Exterior alkyd enamel matching topcoat.
 - c. Topcoat: Exterior alkyd enamel flat.
 - d. Color: Gray.
- C. Paint exposed, interior metal piping, valves, service regulators, service meters and meter bars, earthquake valves, and piping specialties, except components, with factory-applied paint or protective coating.
 - 1. Latex Over Alkyd Primer System: MPI INT 5.1Q.
 - a. Prime Coat: Alkyd anticorrosive metal primer.
 - b. Intermediate Coat: Interior latex matching topcoat.
 - c. Topcoat: Interior latex flat.
 - d. Color: Gray.
- D. Damage and Touchup: Repair marred and damaged factory-applied finishes with materials and by procedures to match original factory finish.

3.11 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections:
 - 1. Test, inspect, and purge natural gas according to UPC and authorities having jurisdiction.
- C. Natural-gas piping will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.

3.12 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain earthquake valves.

3.13 OUTDOOR PIPING SCHEDULE

A. Underground natural-gas piping shall be one of the following:

1. PE pipe and fittings joined by heat fusion, or mechanical couplings; service-line risers with tracer wire terminated in an accessible location.
2. Steel pipe with wrought-steel fittings and welded joints, or mechanical couplings. Coat pipe and fittings with protective coating for steel piping.

B. Aboveground natural-gas piping shall be one of the following:

1. Steel pipe with malleable-iron fittings and threaded joints.
2. Steel pipe with wrought-steel fittings and welded joints.

3.14 INDOOR PIPING SCHEDULE FOR SYSTEM PRESSURES LESS THAN 0.5 PSIG

A. Aboveground, branch piping NPS 1 and smaller shall be the following:

1. Corrugated stainless-steel tubing with mechanical fittings having socket or threaded ends to match adjacent piping.
2. Annealed-temper, tin-lined copper tube with flared joints and fittings.

B. Aboveground, distribution piping shall be one of the following:

1. Steel pipe with malleable-iron fittings and threaded joints.
2. Steel pipe with wrought-steel fittings and welded joints.
3. Drawn-temper copper tube with wrought-copper fittings and brazed joints.

C. Underground, below building, piping shall be one of the following:

1. Steel pipe with malleable-iron fittings and threaded joints.
2. Steel pipe with wrought-steel fittings and welded joints.

D. Containment Conduit: Steel pipe with wrought-steel fittings and welded joints. Coat pipe and fittings with protective coating for steel piping.

E. Containment Conduit Vent Piping: Steel pipe with malleable-iron fittings and threaded or wrought-steel fittings with welded joints. Coat underground pipe and fittings with protective coating for steel piping.

END OF SECTION 23 11 23

SECTION 23 31 13**METAL DUCTS****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. Single-wall rectangular ducts and fittings.
2. Double-wall rectangular ducts and fittings.
3. Single-wall round ducts and fittings.
4. Double-wall round ducts and fittings.
5. Sheet metal materials.
6. Duct liner.
7. Sealants and gaskets.
8. Hangers and supports.

- B. Related Sections:

1. Division 23 Section "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing requirements for metal ducts.
2. Division 23 Section "Nonmetal Ducts" for fibrous-glass ducts, thermoset fiber-reinforced plastic ducts, thermoplastic ducts, PVC ducts, and concrete ducts.
3. Division 23 Section "HVAC Casings" for factory- and field-fabricated casings for mechanical equipment.
4. Division 23 Section "Air Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.

1.3 PERFORMANCE REQUIREMENTS

- A. Delegated Duct Design: Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and performance requirements and design criteria indicated in "Duct Schedule" Article.
- B. Structural Performance: Duct hangers and supports shall withstand the effects of gravity loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and ASCE/SEI 7

1.4 SUBMITTALS

- A. Product Data: For each type of the following products:

1. Liners and adhesives.
2. Sealants and gaskets.
3. Seismic-restraint devices.

B. Shop Drawings:

1. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.
2. Factory- and shop-fabricated ducts and fittings.
3. Duct layout indicating sizes, configuration, liner material, and static-pressure classes.
4. Elevation of top of ducts.
5. Dimensions of main duct runs from building grid lines.
6. Fittings.
7. Reinforcement and spacing.
8. Seam and joint construction.
9. Penetrations through fire-rated and other partitions.
10. Equipment installation based on equipment being used on Project.
11. Locations for duct accessories, including dampers, turning vanes, and access doors and panels.
12. Hangers and supports, including methods for duct and building attachment, and vibration isolation.

C. Delegated-Design Submittal:

1. Sheet metal thicknesses.
2. Joint and seam construction and sealing.
3. Reinforcement details and spacing.
4. Materials, fabrication, assembly, and spacing of hangers and supports.
5. Design Calculations: Calculations for selecting hangers and supports.

D. Coordination Drawings: Plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Duct installation in congested spaces, indicating coordination with general construction, building components, and other building services. Indicate proposed changes to duct layout.
2. Suspended ceiling components.
3. Structural members to which duct will be attached.
4. Size and location of initial access modules for acoustical tile.
5. Penetrations of smoke barriers and fire-rated construction.
6. Items penetrating finished ceiling including the following:
 - a. Lighting fixtures.
 - b. Air outlets and inlets.
 - c. Speakers.
 - d. Sprinklers.
 - e. Access panels.
 - f. Perimeter moldings.

E. Welding certificates.

F. Field quality-control reports.

1.5 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel," for hangers and supports.
- B. Welding Qualifications: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel," for hangers and supports.
 - 2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum," for aluminum supports.
 - 3. AWS D9.1M/D9.1, "Sheet Metal Welding Code," for duct joint and seam welding.

PART 2 - PRODUCTS

2.1 SINGLE-WALL RECTANGULAR DUCTS AND FITTINGS

- A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.
- B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 1-4, "Transverse (Girth) Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 1-5, "Longitudinal Seams - Rectangular Ducts," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 2, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.2 DOUBLE-WALL RECTANGULAR DUCTS AND FITTINGS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. McGill AirFlow LLC.
 - 2. Sheet Metal Connectors, Inc.
- B. Rectangular Ducts: Fabricate ducts with indicated dimensions for the inner duct.
- C. Outer Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.
- D. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 1-4, "Transverse (Girth) Joints," for static-

pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

- E. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 1-5, "Longitudinal Seams - Rectangular Ducts," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- F. Interstitial Insulation: Fibrous-glass liner complying with ASTM C 1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."
 - 1. Maximum Thermal Conductivity: [0.27 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.
 - 2. Install spacers that position the inner duct at uniform distance from outer duct without compressing insulation.
 - 3. Coat insulation with antimicrobial coating.
 - 4. Cover insulation with polyester film complying with UL 181, Class 1.
- G. Interstitial Insulation: Flexible elastomeric duct liner complying with ASTM C 534, Type II for sheet materials, and with NFPA 90A or NFPA 90B.
 - 1. Maximum Thermal Conductivity: [0.25 Btu x in./h x sq. ft. x deg at 75 deg F mean temperature.
- H. Inner Duct: Minimum 0.028- perforated galvanized sheet steel having 3/32-inch- diameter perforations, with overall open area of 23 percent.
- I. Formed-on Transverse Joints (Flanges): Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 1-4, "Traverse (Girth) Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- J. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 1-5, "Longitudinal Seams - Rectangular Ducts," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.3 SINGLE-WALL ROUND[AND FLAT-OVAL] DUCTS AND FITTINGS

- A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.
 - 1. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Lindab Inc.
 - b. McGill AirFlow LLC.
 - c. SEMCO Incorporated.
 - d. Sheet Metal Connectors, Inc.

e. Spiral Manufacturing Co., Inc.

- B. Flat-Oval Ducts: Indicated dimensions are the duct width (major dimension) and diameter of the round sides connecting the flat portions of the duct (minor dimension).
- C. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Transverse Joints - Round Duct," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
 - 1. Transverse Joints in Ducts Larger Than 60 Inches in Diameter: Flanged.
- D. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Seams - Round Duct and Fittings," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
 - 1. Fabricate round ducts larger than 90 inches in diameter with butt-welded longitudinal seams.
 - 2. Fabricate flat-oval ducts larger than 72 inches in width (major dimension) with butt-welded longitudinal seams.
- E. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "90 Degree Tees and Laterals," and Figure 3-5, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.4 DOUBLE-WALL ROUND[AND FLAT-OVAL] DUCTS AND FITTINGS

- A. Manufacturers: Subject to compliance with requirements available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Lindab Inc.
 - 2. McGill AirFlow LLC.
 - 3. SEMCO Incorporated.
 - 4. Sheet Metal Connectors, Inc.
- B. Flat-Oval Ducts: Indicated dimensions are the duct width (major dimension) and diameter of the round sides connecting the flat portions of the duct (minor dimension) of the inner duct.
- C. Outer Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on static-pressure class unless otherwise indicated.
 - 1. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Transverse Joints - Round Duct," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
 - a. Transverse Joints in Ducts Larger Than 60 Inches in Diameter: Flanged.

2. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Seams - Round Duct and Fittings," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
 - a. Fabricate round ducts larger than 90 inches in diameter with butt-welded longitudinal seams.
 - b. Fabricate flat-oval ducts larger than 72 inches in width (major dimension) with butt-welded longitudinal seams.
3. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "90 Degree Tees and Laterals," and Figure 3-5, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- D. Inner Duct: Minimum 0.028-inch perforated galvanized sheet steel having 3/32-inch- diameter perforations, with overall open area of 23 percent.
- E. Interstitial Insulation: Fibrous-glass liner complying with ASTM C 1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."
 1. Maximum Thermal Conductivity: [0.27 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.
 2. Install spacers that position the inner duct at uniform distance from outer duct without compressing insulation.
 3. Coat insulation with antimicrobial coating.
 4. Cover insulation with polyester film complying with UL 181, Class 1.
- F. Interstitial Insulation: Flexible elastomeric duct liner complying with ASTM C 534, Type II for sheet materials, and with NFPA 90A or NFPA 90B.
 1. Maximum Thermal Conductivity: .25 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.

2.5 SHEET METAL MATERIALS

- A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.
- B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
 1. Galvanized Coating Designation: G60.
 2. Finishes for Surfaces Exposed to View: Mill phosphatized.
- C. PVC-Coated, Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
 1. Galvanized Coating Designation: G60 .
 2. Minimum Thickness for Factory-Applied PVC Coating: 4 mils thick on sheet metal surface of ducts and fittings exposed to corrosive conditions, and minimum 1 mil thick on opposite surface.

3. Coating Materials: Acceptable to authorities having jurisdiction for use on ducts listed and labeled by an NRTL for compliance with UL 181, Class 1.
- D. Carbon-Steel Sheets: Comply with ASTM A 1008/A 1008M, with oiled, matte finish for exposed ducts.
- E. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, Type 304 or 316, as indicated in the "Duct Schedule" Article; cold rolled, annealed, sheet. Exposed surface finish shall be No. 2B, No. 2D, No. 3, or No. 4 as indicated in the "Duct Schedule" Article.
- F. Aluminum Sheets: Comply with ASTM B 209 Alloy 3003, H14 temper; with mill finish for concealed ducts, and standard, one-side bright finish for duct surfaces exposed to view.
- G. Reinforcement Shapes and Plates: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
 1. Where black- and galvanized-steel shapes and plates are used to reinforce aluminum ducts, isolate the different metals with butyl rubber, neoprene, or EPDM gasket materials.
- H. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.6 DUCT LINER

- A. Fibrous-Glass Duct Liner: Comply with ASTM C 1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."
 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 2. Basis-of-Design Product: Subject to compliance with requirements, provide product name or designation or comparable product by one of the following:
 - a. CertainTeed Corporation; Insulation Group.
 - b. Johns Manville.
 - c. Knauf Insulation.
 - d. Owens Corning.
 - 1) Type I, Flexible: 0.27 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.
 - 2) Type II, Rigid: 0.23 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.
- B. Flexible Elastomeric Duct Liner: Preformed, cellular, closed-cell, sheet materials complying with ASTM C 534, Type II, Grade 1; and with NFPA 90A or NFPA 90B.
 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 2. Basis-of-Design Product: Subject to compliance with requirements, provide product name or designation or comparable product by one of the following:
 - a. Aeroflex USA Inc.
 - b. Armacell LLC.

- c. Rubatex International, LLC
 - 3. Surface-Burning Characteristics: Maximum flame-spread index of 25 and maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.
 - 4. Liner Adhesive: As recommended by insulation manufacturer and complying with NFPA 90A or NFPA 90B.
- C. Natural-Fiber Duct Liner: 85 percent cotton, 10 percent borate, and 5 percent polybinding fibers, treated with a microbial growth inhibitor and complying with NFPA 90A or NFPA 90B.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 2. Basis-of-Design Product: Subject to compliance with requirements, product name or designation or comparable product by one of the following:
 - a. Bonded Logic, Inc.
 - b. Reflectix Inc.
 - 3. Maximum Thermal Conductivity: [0.24 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature when tested according to ASTM C 518.
 - 4. Surface-Burning Characteristics: Maximum flame-spread index of 25 and maximum smoke-developed index of 50 when tested according to ASTM E 84; certified by an NRTL.
 - 5. Liner Adhesive: As recommended by insulation manufacturer and complying with NFPA 90A or NFPA 90B.
- D. Insulation Pins and Washers:
 - 1. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch- diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.
 - 2. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- thick galvanized steel; with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.
- E. Shop Application of Duct Liner: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-19, "Flexible Duct Liner Installation."
 - 1. Adhere a single layer of indicated thickness of duct liner with at least 90 percent adhesive coverage at liner contact surface area. Attaining indicated thickness with multiple layers of duct liner is prohibited.
 - 2. Apply adhesive to transverse edges of liner facing upstream that do not receive metal nosing.
 - 3. Butt transverse joints without gaps, and coat joint with adhesive.
 - 4. Fold and compress liner in corners of rectangular ducts or cut and fit to ensure butted-edge overlapping.
 - 5. Do not apply liner in rectangular ducts with longitudinal joints, except at corners of ducts, unless duct size and dimensions of standard liner make longitudinal joints necessary.
 - 6. Apply adhesive coating on longitudinal seams in ducts with air velocity of 2500 fpm.
 - 7. Secure liner with mechanical fasteners 4 inches from corners and at intervals not exceeding 12 inches transversely; at 3 inches from transverse joints and at intervals not exceeding 18 inches longitudinally.

8. Secure transversely oriented liner edges facing the airstream with metal nosings that have either channel or "Z" profiles or are integrally formed from duct wall. Fabricate edge facings at the following locations:
 - a. Fan discharges.
 - b. Intervals of lined duct preceding unlined duct.
 - c. Upstream edges of transverse joints in ducts where air velocities are higher than 2500 fpm or where indicated.
9. Secure insulation between perforated sheet metal inner duct of same thickness as specified for outer shell. Use mechanical fasteners that maintain inner duct at uniform distance from outer shell without compressing insulation.
 - a. Sheet Metal Inner Duct Perforations: 3/32-inch diameter, with an overall open area of 23 percent.
10. Terminate inner ducts with buildouts attached to fire-damper sleeves, dampers, turning vane assemblies, or other devices. Fabricated buildouts (metal hat sections) or other buildout means are optional; when used, secure buildouts to duct walls with bolts, screws, rivets, or welds.

2.7 SEALANT AND GASKETS

- A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.
- B. Two-Part Tape Sealing System:
 1. Tape: Woven cotton fiber impregnated with mineral gypsum and modified acrylic/silicone activator to react exothermically with tape to form hard, durable, airtight seal.
 2. Tape Width: 3 inches.
 3. Sealant: Modified styrene acrylic.
 4. Water resistant.
 5. Mold and mildew resistant.
 6. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
 7. Service: Indoor and outdoor.
 8. Service Temperature: Minus 40 to plus 200 deg F.
 9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum.
- C. Water-Based Joint and Seam Sealant:
 1. Application Method: Brush on.
 2. Solids Content: Minimum 65 percent.
 3. Shore A Hardness: Minimum 20.
 4. Water resistant.
 5. Mold and mildew resistant.
 6. VOC: Maximum 75 g/L (less water).
 7. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
 8. Service: Indoor or outdoor.
 9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.

D. Solvent-Based Joint and Seam Sealant:

1. Application Method: Brush on.
2. Base: Synthetic rubber resin.
3. Solvent: Toluene and heptane.
4. Solids Content: Minimum 60 percent.
5. Shore A Hardness: Minimum 60.
6. Water resistant.
7. Mold and mildew resistant.
8. Service: Indoor or outdoor.
9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.

E. Flanged Joint Sealant: Comply with ASTM C 920.

1. General: Single-component, acid-curing, silicone, elastomeric.
2. Type: S.
3. Grade: NS.
4. Class: 25.
5. Use: O.

F. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.

G. Round Duct Joint O-Ring Seals:

1. Seal shall provide maximum leakage class of 3 cfm/100 sq. ft. at 1-inch wg and shall be rated for 10-inch wg static-pressure class, positive or negative.
2. EPDM O-ring to seal in concave bead in coupling or fitting spigot.
3. Double-lipped, EPDM O-ring seal, mechanically fastened to factory-fabricated couplings and fitting spigots.

2.8 HANGERS AND SUPPORTS

- A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.
- B. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.
- C. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 4-1, "Rectangular Duct Hangers Minimum Size," and Table 4-2, "Minimum Hanger Sizes for Round Duct."
- D. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.
- E. Steel Cables for Stainless-Steel Ducts: Stainless steel complying with ASTM A 492.
- F. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.
- G. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.
- H. Trapeze and Riser Supports:

1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
2. Supports for Stainless-Steel Ducts: Stainless-steel shapes and plates.
3. Supports for Aluminum Ducts: Aluminum or galvanized steel coated with zinc chromate.

PART 3 - EXECUTION

3.1 DUCT INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and Coordination Drawings.
- B. Install ducts according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.
- C. Install round and flat-oval ducts in maximum practical lengths.
- D. Install ducts with fewest possible joints.
- E. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.
- F. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.
- G. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.
- H. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.
- I. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.
- J. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches
- K. Where ducts pass through fire-rated interior partitions and exterior walls, install fire dampers. Comply with requirements in Division 23 Section "Air Duct Accessories" for fire and smoke dampers.
- L. Protect duct interiors from moisture, construction debris and dust, and other foreign materials. Comply with SMACNA's "Duct Cleanliness for New Construction Guidelines."

3.2 INSTALLATION OF EXPOSED DUCTWORK

- A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.

- B. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system.
- C. Grind welds to provide smooth surface free of burrs, sharp edges, and weld splatter. When welding stainless steel with a No. 3 or 4 finish, grind the welds flush, polish the exposed welds, and treat the welds to remove discoloration caused by welding.
- D. Maintain consistency, symmetry, and uniformity in the arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.
- E. Repair or replace damaged sections and finished work that does not comply with these requirements.

3.3 DUCT SEALING

- A. Seal ducts for duct static-pressure, seal classes, and leakage classes specified in "Duct Schedule" Article according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

3.4 HANGER AND SUPPORT INSTALLATION

- A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Hangers and Supports."
- B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.
 - 1. Where practical, install concrete inserts before placing concrete.
 - 2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
 - 3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.
 - 4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.
- C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 4-1 , "Rectangular Duct Hangers Minimum Size," and Table 4-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.
- D. Hangers Exposed to View: Threaded rod and angle or channel supports.
- E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum intervals of 16 feet .
- F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.5 SEISMIC-RESTRAINT-DEVICE INSTALLATION

- A. Install ducts with hangers and braces designed to support the duct and to restrain against seismic forces required by applicable building codes. Comply with SMACNA's "Seismic Restraint Manual: Guidelines for Mechanical Systems">
 - 1. Space lateral supports a maximum of 40 feet o.c., and longitudinal supports a maximum of 80 feet o.c.
 - 2. Brace a change of direction longer than 12 feet.
- B. Select seismic-restraint devices with capacities adequate to carry present and future static and seismic loads.
- C. Install cables so they do not bend across edges of adjacent equipment or building structure.
- D. Install cable restraints on ducts that are suspended with vibration isolators.
- E. Install seismic-restraint devices using methods approved by an evaluation service member of the ICC Evaluation Service.
- F. Attachment to Structure: If specific attachment is not indicated, anchor bracing and restraints to structure, to flanges of beams, to upper truss chords of bar joists, or to concrete members.
- G. Drilling for and Setting Anchors:
 - 1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcement or embedded items during drilling. Notify the Architect if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
 - 2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
 - 3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
 - 4. Set anchors to manufacturer's recommended torque, using a torque wrench.
 - 5. Install zinc-coated steel anchors for interior applications and stainless-steel anchors for applications exposed to weather.

3.6 CONNECTIONS

- A. Make connections to equipment with flexible connectors complying with Division 23 Section "Air Duct Accessories."
- B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.7 PAINTING

- A. Paint interior of metal ducts that are visible through registers and grilles and that do not have duct liner. Apply one coat of flat, black, latex paint over a compatible galvanized-steel primer. Paint materials and application requirements are specified in Division 09 painting Sections.

3.8 FIELD QUALITY CONTROL

- A. Perform tests and inspections.

3.9 DUCT CLEANING

- A. Clean new and existing duct system(s) before testing, adjusting, and balancing.

3.10 DUCT SCHEDULE

- A. Supply Ducts:

- 1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units

- a. Pressure Class: Positive 1-inch wg.
 - b. Minimum SMACNA Seal Class: [A] [B] [C].
 - c. SMACNA Leakage Class for Rectangular: 12
 - d. SMACNA Leakage Class for Round and Flat Oval: 12.

- 2. Ducts Connected to Constant-Volume Air-Handling Units :

- a. Pressure Class: Positive 2-inch wg.
 - b. Minimum SMACNA Seal Class: A
 - c. SMACNA Leakage Class for Rectangular: 6.
 - d. SMACNA Leakage Class for Round and Flat Oval: 6.

- B. Return Ducts:

- 1. Ducts Connected to Air-Handling Units :

- a. Pressure Class: Positive or negative 2-inch wg.
 - b. Minimum SMACNA Seal Class: [A] [B].
 - c. SMACNA Leakage Class for Rectangular: 6.
 - d. SMACNA Leakage Class for Round and Flat Oval: 6.

- C. Exhaust Ducts:

- 1. Ducts Connected to Fans Exhausting (ASHRAE 62.1, Class 1 and 2) Air:

- a. Pressure Class: Negative 1-inch wg
 - b. Minimum SMACNA Seal Class: [A] [B] [C] if negative pressure, and A if positive pressure.
 - c. SMACNA Leakage Class for Rectangular: 12.
 - d. SMACNA Leakage Class for Round and Flat Oval: 6.

- D. Intermediate Reinforcement:

- 1. Galvanized-Steel Ducts: Galvanized steel.
 - 2. PVC-Coated Ducts:

- a. Exposed to Airstream: Match duct material.
 - b. Not Exposed to Airstream: Galvanized.

3. Stainless-Steel Ducts:
 - a. Exposed to Airstream: Match duct material.
 - b. Not Exposed to Airstream: Galvanized.
 4. Aluminum Ducts: Aluminum.
- E. Liner:
- F. Branch Configuration:
1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-6, "Branch Connections."
 - a. Rectangular Main to Rectangular Branch: 45-degree entry.
 - b. Rectangular Main to Round Branch: Spin in.
 2. Round and Flat Oval: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "90 Degree Tees and Laterals," and Figure 3-5, "Conical Tees." Saddle taps are permitted in existing duct.
 - a. Velocity 1000 fpm or Lower: 90-degree tap.
 - b. Velocity 1000 to 1500 fpm : Conical tap.
 - c. Velocity 1500 fpm or Higher: 45-degree lateral.

END OF SECTION 23 31 13

SECTION 23 33 00
AIR DUCT ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:

1. Backdraft and pressure relief dampers.
2. Barometric relief dampers.
3. Manual volume dampers.
4. Control dampers.
5. Fire dampers.
6. Ceiling dampers.
7. Smoke dampers.
8. Combination fire and smoke dampers.
9. Corridor dampers.
10. Flange connectors.
11. Duct silencers.
12. Turning vanes.
13. Remote damper operators.
14. Duct-mounted access doors.
15. Flexible connectors.
16. Flexible ducts.
17. Duct security bars.
18. Duct accessory hardware.

- B. Related Sections:

1. Division 23 Section "HVAC Gravity Ventilators" for roof-mounted ventilator caps.
2. Division 28 Section "Fire Detection and Alarm" for duct-mounted fire and smoke detectors.

1.3 SUBMITTALS

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

1. For duct silencers, include pressure drop and dynamic insertion loss data. Include breakout noise calculations for high transmission loss casings.

- B. Shop Drawings: For duct accessories. Include plans, elevations, sections, details and attachments to other work.

1. Detail duct accessories fabrication and installation in ducts and other construction. Include dimensions, weights, loads, and required clearances; and method of field assembly into duct systems and other construction. Include the following:
 - a. Special fittings.
 - b. Manual volume damper installations.
 - c. Control damper installations.
 - d. Fire-damper, smoke-damper, combination fire- and smoke-damper, ceiling, and corridor damper installations, including sleeves; and duct-mounted access doors and remote damper operators.
 - e. Duct security bars.
 - f. Wiring Diagrams: For power, signal, and control wiring.
 - C. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which ceiling-mounted access panels and access doors required for access to duct accessories are shown and coordinated with each other, using input from Installers of the items involved.
 - D. Source quality-control reports.
 - E. Operation and Maintenance Data: For air duct accessories to include in operation and maintenance manuals.
- 1.4 QUALITY ASSURANCE
- A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."
 - B. Comply with AMCA 500-D testing for damper rating.
- 1.5 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. Fusible Links: Furnish quantity equal to 10 percent of amount installed.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.
- B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
 1. Galvanized Coating Designation: G60.
 2. Exposed-Surface Finish: Mill phosphatized.

- C. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, Type 304, and having a [No. 2] <Insert finish designation> finish for concealed ducts and <Insert finish designation> finish for exposed ducts.
- D. Aluminum Sheets: Comply with ASTM B 209, Alloy 3003, Temper H14; with mill finish for concealed ducts and standard, 1-side bright finish for exposed ducts.
- E. Extruded Aluminum: Comply with ASTM B 221, Alloy 6063, Temper T6.
- F. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.
- G. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches .

2.2 BACKDRAFT AND PRESSURE RELIEF DAMPERS

- 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]:
 - 1. Air Balance Inc.; a division of Mestek, Inc.
 - 2. American Warming and Ventilating; a division of Mestek, Inc.
 - 3. Cesco Products; a division of Mestek, Inc.
 - 4. Duro Dyne Inc.
 - 5. Greenheck Fan Corporation.
 - 6. Lloyd Industries, Inc.
 - 7. Nailor Industries Inc.
 - 8. NCA Manufacturing, Inc.
 - 9. Pottorff; a division of PCI Industries, Inc.
 - 10. Ruskin Company.
 - 11. SEMCO Incorporated.
 - 12. Vent Products Company, Inc.
- B. Description: Gravity balanced.
- C. Maximum Air Velocity: 2000 fpm .
- D. Maximum System Pressure: 1-inch wg .
- E. Frame: 0.052-inch- thick, galvanized sheet steel with welded corners.
- F. Blades: Multiple single-piece blades, [center-pivoted,] maximum 6-inch width, 0.025-inch-thick, roll-formed aluminum with sealed edges.
- G. Blade Action: Parallel.
- H. Blade Seals: Vinyl foam Extruded vinyl, mechanically locked or Neoprene, mechanically locked.
- I. Blade Axles:
 - 1. Material: Nonferrous metal.
 - 2. Diameter: 0.20 inch .

- J. Tie Bars and Brackets: Aluminum.
- K. Return Spring: Adjustable tension.
- L. Bearings: Steel ball.
- M. Accessories:
 - 1. Adjustment device to permit setting for varying differential static pressure.
 - 2. Counterweights and spring-assist kits for vertical airflow installations.
 - 3. Electric actuators.
 - 4. Chain pulls.
 - 5. Screen Mounting: Front mounted in sleeve.
 - a. Sleeve Thickness: 20-gage minimum.
 - b. Sleeve Length: 6 inches minimum.
 - 6. Screen Mounting: Rear mounted.
 - 7. Screen Material: Galvanized steel.
 - 8. Screen Type: Bird.
 - 9. 90-degree stops.

2.3 MANUAL VOLUME DAMPERS

- A. Standard, Steel, Manual Volume Dampers:
 - 1. Manufacturers: Subject to compliance with requirements, [provide products by one of the following] [available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. Air Balance Inc.; a division of Mestek, Inc.
 - b. American Warming and Ventilating; a division of Mestek, Inc.
 - c. Flexmaster U.S.A., Inc.
 - d. McGill AirFlow LLC.
 - e. METALAIR, Inc.
 - f. Nailor Industries Inc.
 - g. Pottorff; a division of PCI Industries, Inc.
 - h. Ruskin Company.
 - i. Trox USA Inc.
 - j. Vent Products Company, Inc.
 - 2. Standard leakage rating.
 - 3. Suitable for horizontal or vertical applications.
 - 4. Frames:
 - a. Hat-shaped, galvanized-steel channels, 0.064-inch minimum thickness.
 - b. Mitered and welded corners.
 - c. Flanges for attaching to walls and flangeless frames for installing in ducts.
 - 5. Blades:
 - a. Multiple or single blade.
 - b. Parallel- or opposed-blade design.
 - c. Stiffen damper blades for stability.

- d. Galvanized-steel, 0.064 inch thick.
 - 6. Blade Axles: Galvanized steel.
 - 7. Bearings:
 - a. Oil-impregnated bronze.
 - b. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.
 - 8. Tie Bars and Brackets: Galvanized steel.
- B. Standard, Aluminum, Manual Volume Dampers:
- 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Air Balance Inc.; a division of Mestek, Inc.
 - b. American Warming and Ventilating; a division of Mestek, Inc.
 - c. Flexmaster U.S.A., Inc.
 - d. McGill AirFlow LLC.
 - e. METALAIRE, Inc.
 - f. Nailor Industries Inc.
 - g. Pottorff; a division of PCI Industries, Inc.
 - h. Ruskin Company.
 - i. Trox USA Inc.
 - j. Vent Products Company, Inc.
 - 2. Standard leakage rating[, with linkage outside airstream.
 - 3. Suitable for horizontal or vertical applications.
 - 4. Frames: Hat-shaped, 0.10-inch- thick, aluminum sheet channels; frames with flanges for attaching to walls and flangeless frames for installing in ducts.
 - 5. Blades:
 - a. Multiple or single blade.
 - b. Parallel- or opposed-blade design.
 - c. Stiffen damper blades for stability.
 - d. Roll-Formed Aluminum Blades: 0.10-inch- thick aluminum sheet.
 - e. Extruded-Aluminum Blades: 0.050-inch- thick extruded aluminum.
 - 6. Blade Axles: Galvanized steel.
 - 7. Bearings:
 - a. Oil-impregnated bronze.
 - b. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.
 - 8. Tie Bars and Brackets: Aluminum.
- C. Damper Hardware:
- 1. Zinc-plated, die-cast core with dial and handle made of 3/32-inch- thick zinc-plated steel, and a 3/4-inch hexagon locking nut.
 - 2. Include center hole to suit damper operating-rod size.
 - 3. Include elevated platform for insulated duct mounting.

2.4 FIRE AND SMOKE DAMPERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Air Balance Inc.; a division of Mestek, Inc.
 - 2. Cesco Products; a division of Mestek, Inc.
 - 3. Greenheck Fan Corporation.
 - 4. Nailor Industries Inc.
 - 5. Ruskin Company.
- B. Type: Static and dynamic; rated and labeled according to UL 555 and UL 555S by an NRTL.
- C. Closing rating in ducts up to 4-inch wg static pressure class and minimum 4000-fpm velocity.
- D. Fire Rating: 1-1/2 and 3 hours.
- E. Frame: Curtain type with blades outside airstream; fabricated with roll-formed, 0.034-inch- thick galvanized steel; with mitered and interlocking corners.
- F. Heat-Responsive Device: Replaceable, 165 deg F rated, fusible links.
- G. Heat-Responsive Device: Electric resettable link and switch package, factory installed, rated.
- H. Smoke Detector: Integral, factory wired for single-point connection.
- I. Frame: Curtain type with blades outside airstream; fabricated with roll-formed, 0.034-inch- thick galvanized steel; with mitered and interlocking corners.
- J. Blades: Roll-formed, horizontal, interlocking, 0.034-inch- thick, galvanized sheet steel. In place of interlocking blades, use full-length, 0.034-inch- thick, galvanized-steel blade connectors.
- K. Leakage: Class I or Class II, see wall rating.
- L. Rated pressure and velocity to exceed design airflow conditions.
- M. Mounting Sleeve: Factory-installed, 0.052-inch- thick, galvanized sheet steel; length to suit wall or floor application with factory-furnished silicone calking.
- N. Master control panel for use in dynamic smoke-management systems.
- O. Damper Motors: Modulating action.
- P. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Division 23 Section "Common Motor Requirements for HVAC 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. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in
 - 3. Permanent-Split-Capacitor or Shaded-Pole Motors: With oil-immersed and sealed gear trains.
 - 4. Spring-Return Motors: Equip with an integral spiral-spring mechanism where indicated. Enclose entire spring mechanism in a removable housing designed for service or

adjustments. Size for running torque rating of 150 in. x lbf and breakaway torque rating of 150 in. x lbf.

5. Outdoor Motors and Motors in Outdoor-Air Intakes: Equip with O-ring gaskets designed to make motors weatherproof. Equip motors with internal heaters to permit normal operation at minus 40 deg F .
6. Nonspring-Return Motors: For dampers larger than 25 sq. ft., size motor for running torque rating of 150 in. x lbf and breakaway torque rating of 300 in. x lbf.
7. Electrical Connection: 115 V, single phase, 60 Hz.

Q. Accessories:

1. Auxiliary switches for signaling, fan control or [position indication.
2. Test and reset switches mounted.

2.5 DUCT ACCESS PANEL ASSEMBLIES

- A. Manufacturers: Subject to compliance with requirements available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Ductmate Industries, Inc.
2. Flame Gard, Inc.
3. 3M.

- B. Labeled according to UL 1978 by an NRTL.

- C. Panel and Frame: Minimum thickness 0.0528-inch carbon] steel.

- D. Fasteners: Carbon steel. Panel fasteners shall not penetrate duct wall.

- E. Gasket: Comply with NFPA 96; grease-tight, high-temperature ceramic fiber, rated for minimum 2000 deg F .

- F. Minimum Pressure Rating: 10-inch wg , positive or negative.

2.6 FLEXIBLE CONNECTORS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Ductmate Industries, Inc.
2. Duro Dyne Inc.
3. Ventfabrics, Inc.
4. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

- B. Materials: Flame-retardant or noncombustible fabrics.

- C. Coatings and Adhesives: Comply with UL 181, Class 1.

- D. Metal-Edged Connectors: Factory fabricated with a fabric strip 3-1/2 inches wide attached to 2 strips of 2-3/4-inch- wide, 0.028-inch- thick, galvanized sheet steel or 0.032-inch- thick aluminum sheets. Provide metal compatible with connected ducts.

- E. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.

1. Minimum Weight: 26 oz./sq. yd.
 2. Tensile Strength: 480 lbf/inch in the warp and 360 lbf/inch in the filling.
 3. Service Temperature: Minus 40 to plus 200 deg F .
- F. Outdoor System, Flexible Connector Fabric: Glass fabric double coated with weatherproof, synthetic rubber resistant to UV rays and ozone.
1. Minimum Weight: 24 oz./sq. yd..
 2. Tensile Strength: 530 lbf/inch in the warp and 440 lbf/inch in the filling.
 3. Service Temperature: Minus 50 to plus 250 deg F.
- G. High-Temperature System, Flexible Connectors: Glass fabric coated with silicone rubber.
1. Minimum Weight: 16 oz./sq. yd..
 2. Tensile Strength: 285 lbf/inch in the warp and 185 lbf/inch in the filling.
 3. Service Temperature: Minus 67 to plus 500 deg F.
- H. High-Corrosive-Environment System, Flexible Connectors: Glass fabric with chemical-resistant coating.
1. Minimum Weight: 14 oz./sq. yd..
 2. Tensile Strength: 450 lbf/inch in the warp and 340 lbf/inch in the filling.
 3. Service Temperature: Minus 67 to plus 500 deg F .
- I. Thrust Limits: Combination coil spring and elastomeric insert with spring and insert in compression, and with a load stop. Include rod and angle-iron brackets for attaching to fan discharge and duct.
1. Frame: Steel, fabricated for connection to threaded rods and to allow for a maximum of 30 degrees of angular rod misalignment without binding or reducing isolation efficiency.
 2. Outdoor Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
 3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
 4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
 5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
 6. Elastomeric Element: Molded, oil-resistant rubber or neoprene.
 7. Coil Spring: Factory set and field adjustable for a maximum of 1/4-inch (6-mm) movement at start and stop.

2.7 FLEXIBLE DUCTS

- 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]:
1. Flexmaster U.S.A., Inc.
 2. McGill AirFlow LLC.
 3. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
- B. Noninsulated, Flexible Duct: UL 181, Class 1, 2-ply vinyl film supported by helically wound, spring-steel wire.
1. Pressure Rating: 10-inch wg positive and 1.0-inch wg negative.

2. Maximum Air Velocity: 4000 fpm .
 3. Temperature Range: Minus 10 to plus 160 deg F .
- C. Noninsulated, Flexible Duct: UL 181, Class 1, black polymer film supported by helically wound, spring-steel wire.
1. Pressure Rating: 4-inch wg positive and 0.5-inch wg negative.
 2. Maximum Air Velocity: 4000 fpm.
 3. Temperature Range: Minus 20 to plus 175 deg F .
- D. Noninsulated, Flexible Duct: UL 181, Class 1, multiple layers of aluminum laminate supported by helically wound, spring-steel wire.
1. Pressure Rating: 10-inch wg positive and 1.0-inch wg negative.
 2. Maximum Air Velocity: 4000 fpm.
 3. Temperature Range: Minus 20 to plus 210 deg F .
- E. Noninsulated, Flexible Duct: UL 181, Class 1, aluminum laminate and polyester film with latex adhesive supported by helically wound, spring-steel wire.
1. Pressure Rating: 10-inch wg positive and 1.0-inch wg negative.
 2. Maximum Air Velocity: 4000 fpm .
 3. Temperature Range: Minus 20 to plus 210 deg F .
- F. Noninsulated, Flexible Duct: UL 181, Class 0, interlocking spiral of aluminum foil.
1. Pressure Rating: 8-inch wg positive or negative.
 2. Maximum Air Velocity: 5000 fpm .
 3. Temperature Range: Minus 100 to plus 435 deg F .
- G. Insulated, Flexible Duct: UL 181, Class 1, 2-ply vinyl film supported by helically wound, spring-steel wire; fibrous-glass insulation; aluminized vapor-barrier film.
1. Pressure Rating: 10-inch wg positive and 1.0-inch wg negative.
 2. Maximum Air Velocity: 4000 fpm.
 3. Temperature Range: Minus 10 to plus 160 deg F .
- H. Insulated, Flexible Duct: UL 181, Class 1, black polymer film supported by helically wound, spring-steel wire; fibrous-glass insulation; aluminized vapor-barrier film.
1. Pressure Rating: 4-inch wg positive and 0.5-inch wg negative.
 2. Maximum Air Velocity: 4000 fpm.
 3. Temperature Range: Minus 20 to plus 175 deg F .
- I. Insulated, Flexible Duct: UL 181, Class 1, multiple layers of aluminum laminate supported by helically wound, spring-steel wire; fibrous-glass insulation; aluminized vapor-barrier film.
1. Pressure Rating: 10-inch wg positive and 1.0-inch wg negative.
 2. Maximum Air Velocity: 4000 fpm .
 3. Temperature Range: Minus 20 to plus 210 deg F .
 4. Pressure Rating: 10-inch wg positive and 1.0-inch wg negative.
 5. Maximum Air Velocity: 4000 fpm.
 6. Temperature Range: Minus 20 to plus 210 deg F .

- J. Insulated, Flexible Duct: UL 181, Class 0, interlocking spiral of aluminum foil; fibrous-glass insulation; aluminized vapor-barrier film.
 - 1. Pressure Rating: 8-inch wg positive or negative.
 - 2. Maximum Air Velocity: 5000 fpm .
 - 3. Temperature Range: Minus 20 to plus 250 deg F .
- K. Flexible Duct Connectors:
 - 1. Clamps: Stainless-steel band with cadmium-plated hex screw to tighten band with a worm-gear action in sizes 3 through 18 inches, to suit duct size.
 - 2. Non-Clamp Connectors: Adhesive plus sheet metal screws.

2.8 DUCT ACCESSORY HARDWARE

- A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct-insulation thickness.
- B. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts and in NAIMA AH116, "Fibrous Glass Duct Construction Standards," for fibrous-glass ducts.
- B. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.
- C. Install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts. Where dampers are installed in ducts having duct liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel.
 - 1. Install steel volume dampers in steel ducts.
 - 2. Install aluminum volume dampers in aluminum ducts.
- D. Set dampers to fully open position before testing, adjusting, and balancing.
- E. Install test holes at fan inlets and outlets and elsewhere as indicated.
- F. Install fire[and smoke] dampers according to UL listing.
- G. Install duct security bars. Construct duct security bars from 0.164-inch steel sleeve, continuously welded at all joints and 1/2-inch- diameter steel bars, 6 inches o.c. in each direction in center of sleeve. Weld each bar to steel sleeve and each crossing bar. Weld 2-1/2-by-2-1/2-by-1/4-inch steel angle to 4 sides and both ends of sleeve. Connect duct security bars

to ducts with flexible connections. Provide 12-by-12-inch hinged access panel with cam lock in duct in each side of sleeve.

- H. Connect ducts to duct silencers with flexible duct connectors or rigidly.
- I. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:
 - 1. On both sides of duct coils.
 - 2. Upstream from duct filters.
 - 3. At outdoor-air intakes and mixed-air plenums.
 - 4. At drain pans and seals.
 - 5. Downstream from manual volume dampers, control dampers, backdraft dampers, and equipment.
 - 6. Adjacent to and close enough to fire or smoke dampers, to reset or reinstall fusible links. Access doors for access to fire or smoke dampers having fusible links shall be pressure relief access doors and shall be outward operation for access doors installed upstream from dampers and inward operation for access doors installed downstream from dampers.
 - 7. At each change in direction and at maximum 50-foot spacing.
 - 8. Upstream from turning vanes.
 - 9. Upstream or downstream from duct silencers.
 - 10. Control devices requiring inspection.
 - 11. Elsewhere as indicated.
- J. Install access doors with swing against duct static pressure.
- K. Access Door Sizes:
 - 1. One-Hand or Inspection Access: 8 by 5 inches.
 - 2. Two-Hand Access: 12 by 6 inches.
 - 3. Head and Hand Access: 18 by 10 inches.
 - 4. Head and Shoulders Access: 21 by 14 inches.
 - 5. Body Access: 25 by 14 inches.
 - 6. Body plus Ladder Access: 25 by 17 inches.
- L. Label access doors according to Division 23 Section "Identification for HVAC Piping and Equipment" to indicate the purpose of access door.
- M. Install flexible connectors to connect ducts to equipment.
- N. For fans developing static pressures of 5-inch wg and more, cover flexible connectors with loaded vinyl sheet held in place with metal straps.
- O. Connect terminal units to supply ducts with maximum 12-inch lengths of flexible duct. Do not use flexible ducts to change directions.
- P. Connect diffusers or light troffer boots to ducts[directly or] with maximum 60-inch lengths of flexible duct clamped or strapped in place.
- Q. Connect flexible ducts to metal ducts with adhesive plus sheet metal screws.
- R. Install duct test holes where required for testing and balancing purposes.

- S. Install thrust limits at centerline of thrust, symmetrical on both sides of equipment. Attach thrust limits at centerline of thrust and adjust to a maximum of 1/4-inch movement during start and stop of fans.

3.2 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Operate dampers to verify full range of movement.
2. Inspect locations of access doors and verify that purpose of access door can be performed.
3. Operate fire, smoke, and combination fire and smoke dampers to verify full range of movement and verify that proper heat-response device is installed.
4. Inspect turning vanes for proper and secure installation.
5. Operate remote damper operators to verify full range of movement of operator and damper.

END OF SECTION 23 33 00

SECTION 23 37 13**DIFFUSERS, REGISTERS, AND GRILLES****PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

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

1.2 SUMMARY**A. Section Includes:**

1. Round ceiling diffusers.
2. Rectangular and square ceiling diffusers.
3. Perforated diffusers.
4. Louver face diffusers.
5. Linear bar diffusers.
6. Linear slot diffusers.
7. Ceiling-integral continuous diffusers.
8. Light troffer diffusers.
9. Round induction diffusers.
10. Linear floor diffuser plenums.
11. Drum louvers.
12. Modular core supply grilles.
13. Continuous tubular diffusers.
14. Linear bar grilles.

B. Related Sections:

1. Division 08 Section "Louvers and Vents" for fixed and adjustable louvers and wall vents, whether or not they are connected to ducts.
2. Division 23 Section "Air Duct Accessories" for fire and smoke dampers and volume-control dampers not integral to diffusers, registers, and grilles.

1.3 SUBMITTALS**A. Product Data:** For each type of product indicated, include the following:

1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.
2. Diffuser, Register, and Grille Schedule: Indicate drawing designation, room location, quantity, model number, size, and accessories furnished.

B. Samples for Initial Selection: For diffusers, registers, and grilles with factory-applied color finishes.

- C. Samples for Verification: For diffusers, registers, and grilles, in manufacturer's standard sizes to verify color selected.
- D. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from Installers of the items involved:
 - 1. Ceiling suspension assembly members.
 - 2. Method of attaching hangers to building structure.
 - 3. Size and location of initial access modules for acoustical tile.
 - 4. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
 - 5. Duct access panels.
- E. Source quality-control reports.

PART 2 - PRODUCTS

2.1 CEILING DIFFUSERS

- A. Rectangular and Square Ceiling Diffusers :
 - 1. Manufacturers: available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - a. Carnes.
 - b. Krueger.
 - c. Price Industries.
 - d. Titus.
 - 3. Devices shall be specifically designed for variable-air-volume flows.
 - 4. Finish: Baked enamel, color selected by Architect
 - 5. Face Size: 24 by 24 inches ,12 by 12 inches.
 - 6. Mounting: Surface, T-bar.
 - 7. Pattern: Fixed, or Adjustable –see schedule.
 - 8. Dampers: Butterfly.
 - 9. Accessories:
 - a. Equalizing grid.
 - b. Plaster ring.
 - c. Safety chain.
 - d. Wire guard.
 - e. Sectorizing baffles.
 - f. Operating rod extension.

2.2 CEILING LINEAR SLOT OUTLETS

- A. Linear Bar Diffuser :
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - a. Krueger.
 - b. Price Industries.
 - c. Titus.
3. Devices shall be specifically designed for variable-air-volume flows.
4. Finish: Baked enamel, color selected by Architect.
5. Wide Core Spacing Arrangement: 1/8-inch- thick blades spaced 1/2 inch apart, 15-degree deflection.
6. Frame: 1" wide.
7. Mounting: Countersunk screw.

2.3 REGISTERS AND GRILLES

A. Adjustable Bar Grille :

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Basis-of-Design Product: Subject to compliance with requirements, provide product name or comparable product by one of the following:
 - a. Carnes.
 - b. Krueger.
 - c. Price Industries.
 - d. Titus.
3. Finish: Baked enamel, color selected by Architect.
4. Core Construction Removable.
5. Mounting: Countersunk screw.

2.4 SOURCE QUALITY CONTROL

- A. Verification of Performance: Rate diffusers, registers, and grilles according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas where diffusers, registers, and grilles are to be installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install diffusers, registers, and grilles level and plumb.

- B. Ceiling-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practical. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.
- C. Install diffusers, registers, and grilles with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

3.3 ADJUSTING

- A. After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION 23 3713

SECTION 26 0510

GENERAL ELECTRICAL REQUIREMENTS

PART 1. GENERAL

1.01 SCOPE OF WORK

- A. Electrical work shall conform with applicable provisions of other sections these specifications.

1.02 REQUIREMENTS

- A. Furnish all labor, materials, service, equipment and appliances required to complete the installation of the complete electrical system in accordance with the specifications and contract drawings.

1.03 REQUIREMENTS OF REGULATORY AGENCIES AND STANDARDS

- A. Regulatory Agencies: Installation, materials, equipment and workmanship shall conform to the applicable provisions of the latest edition of the National Electrical Code (NEC) - New Mexico State Electrical Code latest edition, the National Electrical Safety Code (NESC), and the terms and the conditions of the authorities having lawful jurisdiction pertaining to the work required. All modifications required by these codes, rules, regulations and authorities shall be made by the Contractor without additional charge to the Owner.
- B. Underwriter's Laboratories (UL): All materials, appliances, equipment or devices shall conform to the applicable standards of Underwriter's Laboratories, Inc. The label of, or listing by, UL is required.

1.04 SUBMITTALS

- A. Submit requests to use unspecified products in accordance with PRODUCT SUBSTITUTION PROCEDURES.
- B. Electrical Materials List: Within 15 days after award of contract, submit in accordance with Section 01330 - SUBMITTAL PROCEDURES. List of all electrical equipment to be furnished "as specified", a statement to that effect is sufficient.
- C. Shop Drawings: Submit shop drawings and other submittals in accordance with SUBMITTAL PROCEDURES. Show complete outlines, dimensions, electrical services, control diagrams, electrical characteristics of special nature or critical to the installation and pertinent data required for installation.

PART 2. PRODUCTS

2.01 EQUIPMENT REQUIREMENTS

- A. The electrical requirements for equipment specified or indicated on the drawings are based on information available at the time of design. If equipment furnished for installation has electrical requirements other than indicated on the electrical drawings, the Contractor shall make all adjustments to wire and conduit size, controls, over current protection and installation as required to accommodate the equipment supplied, without additional charge to the Owner. The complete responsibility and costs for such adjustments shall be assigned to the respective section of this specification under which the equipment is furnished.

2.02 MATERIALS

- A. Transportation, handling, storage, protection, and other general product requirements shall be as specified in Section 01600 - PRODUCT REQUIREMENTS.
- B. All similar materials and equipment shall be the product of the same manufacturer.
- C. Where no specific material, apparatus or appliance is mentioned, any first-class product made by a reputable manufacturer may be used, providing it conforms to the contract requirements and meets the approval of the Architect.
- D. Material and equipment shall be the standard products of manufacturers regularly engaged in the productions of such material and shall be the manufacturer's current and standard design.
- E. Altitude: Equipment affected by altitude shall perform satisfactorily for the function intended at an altitude of the project site.

PART 3. EXECUTION

3.01 GENERAL

- A. Basic requirements for examination, preparation, installation, and progress cleaning shall be as specified in Section 01700 - EXECUTION REQUIREMENTS.
- B. Fabrication, erection and installation of the complete electrical system shall be done in a first class workmanlike manner by qualified personnel experienced in such work and shall proceed in an orderly manner so as not to hold up progress of the project. The Electrical Contractor shall check all areas and surfaces where

electrical equipment material is to be installed, and report any unsatisfactory conditions before starting work. Commencement of work signifies this Contractor's acceptance of existing conditions. In the acceptance or rejection of the finished installation, no allowance will be made for lack of skill on the part of workmen.

3.02 TEMPORARY POWER AND LIGHTING

- A. Furnish and install all temporary electrical facilities required for construction and safety operations in accordance with Section 01500 - CONSTRUCTION FACILITIES.

3.03 PERFORMANCE TESTS

- A. Thoroughly test all fixtures, services and all circuits for proper operating condition and freedom from grounds and short circuits before acceptance is requested. All equipment, appliance, and devices shall be operated under load conditions.

3.04 PROJECT RECORD DOCUMENTS

- A. Maintain and submit project record documents in accordance with Section 01770 - CLOSEOUT PROCEDURES. Include location of each circuit precisely by dimension.

3.05 OPERATING INSTRUCTIONS AND MANUALS

- A. Instructions: Without additional charge to the Owner, furnish competent instruction to the Owner in the care, adjustment and operation of all parts of the electrical equipment and systems.
- B. Manuals: Prepare and submit in accordance with Section 01330 - SUBMITTAL PROCEDURES and Section 01770 CLOSEOUT PROCEDURES operating and maintenance manuals for the systems and major equipment installed. Include catalog data, shop drawings, wiring diagrams, performance curves and rating data, spare parts lists and manufacturer's operating and maintenance data.
- C. Other: The above requirements are in addition to specific instructions and manuals specified for individual systems or equipment.

3.06 DRAWINGS

- A. General: The electrical drawings show the general arrangement of all conduit, equipment, etc. and shall be followed as closely as actual building construction and the work of other trades will permit.

Because of the small scale of the electrical drawings, it is not possible to indicate all offsets, fittings and accessories which may be required.

The contractor shall investigate the structural and finish conditions affecting the

work and shall arrange his work accordingly, providing such fittings, elbow, pullboxes, and accessories as may be required to meet such conditions.

- B. Field Measurements: The Contractor shall verify the dimensions governing the electrical work at the building. No extra compensation shall be claimed or allowed on account of differences between actual dimensions and those indicated on the drawings.

3.07 LOCATION OF EQUIPMENT AND OUTLETS

- A. The approximate locations of cabinets, panelboards, wiring, power outlets, etc., are indicated on the drawings; however, they are not intended to give complete and accurate information. Determine the exact location after thoroughly examining the general building plans and by actual measurements during construction, subject to the approval of the Architect.

3.08 ELECTRICAL INSTALLATIONS

- A. 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 in accordance with PROJECT MANAGEMENT AND COORDINATION.
 - 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.
 - 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 existing utilities and services. Comply with other governing regulations.
 - 8. Install systems, materials, and equipment to conform with approved submittal data, 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 conflicts 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 access panel or doors where units are concealed behind finished surfaces. Access panels and doors are specified in ACCESS DOORS.
12. Install systems, materials, and equipment giving right-of-way priority to systems required to be installed at a specified slope.

3.09 CUTTING AND PATCHING

- A. General: Perform cutting and patching in accordance with EXECUTION REQUIREMENTS. In addition to the requirements specified in Division 1, the following requirements apply:

1. Perform cutting, fitting, and patching of electrical equipment and materials required to:
 - a. Uncover Work to provide for installation of ill-timed Work.
 - b. Remove and replace defective Work.
 - c. Remove and replace Work not conforming to requirements of the Contract Documents.
 - d. Remove samples of installed Work as specified for testing.
 - e. Install equipment and materials in existing structures, walls and ceilings of existing construction.
 - f. Upon written instructions from the Architect, uncover and restore Work to provide for Architect observation of concealed Work.
2. Protect the structure, furnishings, finishes, and adjacent materials not indicated or scheduled to be removed.
3. Provide and maintain temporary partitions or dust barriers adequate to prevent the spread of dust and dirt to adjacent areas.
4. Protection of Installed Work: During cutting and patching operations, protect adjacent installations.
5. Patch existing finished surfaces and building components using new materials matching existing materials and experienced installers. Installers' qualifications refer to the materials and methods required for the surface and building components being patched.

3.10 WARRANTY

- A. Deliver guarantees and warranties on this portion of the work in accordance with Section CLOSEOUT PROCEDURES. Warrant all equipment, materials and workmanship for one year in accordance with general conditions.

END OF SECTION 26 0510 - GENERAL ELECTRICAL REQUIREMENTS

SECTION 26 0519

CONDUCTORS

PART 1. GENERAL

1.01 CONFORMANCE

- A. Conform with applicable provisions of the General Conditions, Special Provisions, and General Requirements.

1.02 RELATED WORK IN OTHER SECTIONS

- A. Section 26 0510, General Provisions; Section 26 0526, Grounding.

PART 2. PRODUCTS

2.01 WIRES AND CABLES (600 VOLTS)

- A. Type: Conform to the applicable UL and IPCEA Standards for the use intended. Copper conductors with 600 volts insulation unless otherwise specified or noted on the drawings. Stranded conductors for No. 8 or larger where specified or noted on the drawings elsewhere.
- B. Use of aluminum conductors will not be permitted.
- C. Insulation: Type THHN insulation, 75 degrees C, for all conductors otherwise specified or noted on the drawings. 90 degrees C minimum insulation within fixture wireways of fluorescent fixtures. All control conductors shall be THHN stranded or MTW.
- D. Size: No. 14 minimum for controls and No. 12 minimum for lighting and convenience outlets, etc. unless otherwise specified or noted on the drawings. Not less than NEC requirements for the system to be installed. If the equipment to be installed required larger conductor and conduit sizes than indicated on the drawings, the required changes shall be made without additional charge to the Owner.
- E. Color Coding: Phase, neutral, and ground conductors color-coded in accordance with NEC. Connect all conductors of the same color to the same phase conductor. Color coding shall be A-black, B-red, C-blue, N-white, for 120/208 volts and A-brown, B-orange, C-yellow, N-off white for 277/480 volts, with green for all ground conductors. Conductors No. 14, 12 and 10 shall be solid color compounded for entire length.

2.02 CONNECTORS AND LUGS

- A. For Copper Conductors No. 6 and Smaller: 3M Scotch-Lok or T & B Sta-Kon compression or indent type connectors with integral or separate insulating caps.
- B. For Copper Conductors Larger than No. 6: Solderless, indent, hex screw or bolt type pressure connectors, properly taped or insulated.

2.03 TAPE

- A. Plastic tape: 8.5 mils minimum thickness, 1,000,000 megohms minimum insulation resistance, oil resistant vinyl backing, oil resistant acrylic adhesive, incapable of supporting combustion per ASTM D-568 Test Method B.

PART 3. EXECUTION

3.01 SPLICES

- A. (480 Volts and Under): Conductor lengths shall be continuous from termination to termination without splices unless approved by the Owner.

3.02 PULL WIRES

- A. In each empty conduit, except underground conduits, install a No. 14 galvanized steel pull wire or a plastic line having a tensile strength of not less than 200 pounds. In each empty underground conduit install a No. 10 AWG bare, hard drawn copper or copper clad pull wire or a plastic line having a tensile strength of no less than 200 pounds.

3.03 IN RACEWAYS

- A. Install conductors in rigid conduit. EMT or flexible metallic conduit, unless otherwise specified or noted on the drawings.

3.04 CABLE BENDS

- A. Radius of bends not less than 10 times the outer diameter of the cable.

3.05 BUNDLING

- A. Conductors No. 10 and smaller shall be neatly and securely bundled and conductors larger than No. 10 shall be neatly and securely cabled in individual circuits, utilizing marlin twine, two ply lacing or nylon straps.

3.06 CONDUCTOR PULL

- A. Conductors shall not be pulled into conduits until after all plastering or concrete work is completed and all conduits in which moisture has collected have been swabbed out.

3.07 CONNECTORS AND LUGS

- A. Install with manufacturer's recommended tools and with the type and quantity of deformations recommended by manufacturer.

3.08 LABELING

- A. All conductors and neutrals shall be tagged in every junction box and cabinet with wrap around, stick-on labels or pre-marked nylon clip sleeves identifying panel and circuit number.

END OF SECTION 16120 - CONDUCTORS

SECTION 26 0526

GROUNDING

PART 1. GENERAL

1.01 RELATED WORK IN OTHER SECTIONS

- A. Section 26 0510, General Provisions; Section 26 0533, Raceways, Boxes and Fittings; Section 26 0519, Conductors; Section 26 2726, Wiring Devices and Plates; Section 26 2416, Panelboards.

PART 2. PRODUCTS

2.01 GROUNDING SYSTEM

- A. Materials, equipment and devices related to the grounding system are specified under other sections of these specifications.

PART 3. EXECUTION

3.01 GENERAL

- A. Provide an equipment grounding system.

3.02 EQUIPMENT GROUNDING SYSTEM

- A. General: Provide a complete equipment grounding system in accordance with the minimum code requirements and as further indicated on the drawings or specified. The equipment ground (green conductor) consists of metallic conditions to ground of non-current carrying metal parts of the wiring system or apparatus connected to the system. The primary purpose of equipment grounding is to provide greater safety by limiting the electrical potential between non-current carrying parts of the system to provide a low impedance path to ground for possible ground fault currents.
- B. Conduits: Where metallic conduits terminate without mechanical connection to a metallic housing of electrical equipment by means of lock nut and bushings, provide ground bushing connected with a bare copper conductor to the ground bar in the electrical equipment. Metallic conduits containing ground wiring shall be bonded to the ground wire at both conduit entrance and exit. Install grounding conductor in each non metallic conduit or duct except those used for telephone, sound, or low-voltage signals and in all flexible conduit that does not have a built-in ground conductor. Bond the conductor at both ends to the equipment grounding system.

- C. Feeders and Branch Circuits: Provide a separate green insulated equipment grounding conductor for each single or three-phase feeder and each branch circuit with a three-phase protective device. Provide a separate green insulated equipment grounding conductor for single phase branch circuits where indicated on the drawings. Install the required grounding conductor in the common conduit or raceway with the related phase and/or neutral conductors and connect to the box or cabinet grounding terminal. Where there are parallel feeders installed in more than one raceway, each raceway shall have a green insulated equipment ground conductor.
- C. Devices: Install a minimum No. 12 green insulated equipment bonding conductor from a grounding terminal in the respective outlet or junction box to the green ground terminal of all receptacles and through flexible conduit to all light fixture housings.
- D. Motors: Install a separate green insulated equipment bonding conductor from the equipment ground bar in the motor control center of separate starter through the conduit and flexible conduit to the ground terminal in the connection box mounted on the motor. Install the grounding conductor in the common conduit or raceway with the related motor circuit conductors.

3.03 GROUNDING CONDUCTORS

- A. Equipment grounding conductors shall be green insulated conductors equivalent to the insulation on the associated phase conductor, but not less than Type THHN/THWN. The equipment grounding conductor or straps shall be sized in accordance with NEC. Where one feeder serves a series of panelboards or transformers, the equipment grounding conductor shall be continuous without splices. Grounding conductors shall not be installed through metal-sheathed holes. All connections shall be available for inspection and maintenance.

3.04 GROUND CONNECTIONS

- A. Clean surfaces thoroughly before applying ground lugs or clamps. If surface is coated the coating must be removed down to the bare metal. After the coating has been removed, apply a non-corrosive approved compound to cleaned surface and install lugs or clamps. Where galvanizing is removed from metal, it shall be painted or touched up with "Galvanox", or equal.

END OF SECTION 16450 - GROUNDING

SECTION 26 0533**RACEWAYS, BOXES, AND FITTINGS****PART 1. GENERAL****1.01 CONFORMANCE**

- A. Conform with applicable provisions of the General Conditions, Special Provisions and General Requirements.

1.02 RELATED WORK IN OTHER SECTIONS

- A. Section 26 0510, General Provisions; Section 26 0526, Grounding.

PART 2. PRODUCTS**2.01 CONDUITS**

- A. Steel Conduit: Rigid, threaded, thick wall, zinc coated on the outside and either zinc coated or coated with an approved corrosion resistant coating on the inside.
- B. Electrical Metallic Tubing (EMT): Mild steel, zinc coated on the outside and either zinc coated or coated with an approved corrosion resistant coating on the inside. Maximum, size 2 inch electrical trade size unless noted on the drawings or specifically approved.
- C. Intermediate Metal Conduit (IMC): Rigid, threaded, lightweight steel, zinc-coated on the outside and either zinc-coated or coated with an approved corrosion resistant coating on the inside.
- D. Flexible Conduit: Commercial greenfield, galvanized steel, with a separate grounding bond wire installed in the conduit in addition to other wires.
- E. Liquid Tight Flexible Conduit: Flexible galvanized steel tubing with extruded liquid tight PVC outer jacket and a continuous copper bonding conductor wound spirally between the convolutions. Where a separate grounding conductor is installed in the conduit, bonding conductor in the convolutions may be omitted.
- F. Plastic coated rigid steel conduit shall be hot galvanized steel conduit with a coating of polyvinyl chloride, minimum 15 mills (0.015), on the exterior surfaces, shall have an approved corrosion resistant coat inside and shall be Pittsburgh, J & L, Republic or approved equal.
- G. Rigid Non-Metallic Conduit: Schedule 40, high impact PVC with 7,000 psi tensile strength at 73.4 F., 11,000 psi flexural strength, 8,600 psi compression strength,

approved for 90 C. conductors. Carlon, Triangle, or approved equal.

- H. Aluminum Conduit: Rigid, threaded, thick wall type, approved for the application.
- I. Conduit Size: Minimum conduit size 1/2 inch except where specifically approved for equipment connections. Sizes not noted on drawings shall be as required by the NEC. All home runs to panel shall be 3/4 inch minimum. Conduits for #12 THHN wire shall be sized the same as for #12 TW wire.

2.02 CONDUIT FITTINGS

- A. Connectors and Couplings: Compression type threadless fittings for rigid steel conduit or IMC not permitted. Set screw type fittings for rigid aluminum conduit not permitted. EMT couplings and connectors either steel or malleable iron only. "Concrete Tight" or "Rain Tight" and either the gland and ring compression type or the stainless steel multiple point locking type. Connectors to have insulated throats. EMT fittings using set screws or indentations as a means of attachment are not permitted.
- B. Bushings: Insulated type, designed to prevent abrasion of wires without impairing the continuity of the conduit grounding system, for rigid steel conduit, IMC and rigid aluminum conduit larger than 1/2 inch size and connectors for EMT.
- C. Rigid Steel Conduit, IMC and EMT Fittings: Iron or steel only.
- D. Liquid Tight Flexible Conduit Fittings: With threaded grounding cone, a steel, nylon or equal plastic compression ring and a gland for tightening. Either steel or malleable iron only with insulated throats and male thread and locknut or male bushing with or without "O" ring seat. Each connector shall provide a low resistance ground connection between the flexible conduit and the outlet box, conduit or other equipment to which it is connected.
- E. Rigid Aluminum Conduit Fittings: Malleable iron, steel or aluminum alloy. Ferrous fittings zinc coated or cadmium plated. Aluminum alloy fittings shall conform with the characteristics defined by UL for aluminum rigid metallic conduit and shall not contain more than 0.04 percent copper.
- F. Flexible Conduit Fittings (Commercial Greenfield): Either steel or malleable iron only, with insulated throats.
- G. Fittings for PVC Coated Rigid Steel Conduit: Ells and couplings used with PVC coated rigid steel conduit shall have a factory applied coating of polyvinyl chloride, minimum 15 mills (0.015) on exterior surfaces and shall have a PVC sleeve extruded a minimum of 2" from one end of the fitting.

2.03 OUTLET BOXES

- A. Construction: Zinc coated or cadmium plated steel boxes of a class to satisfy the condition at each outlet except where unilet on conduit bodies are required. Knockout type with knockouts removed only where necessary to accommodate the conduit entering. Square cornered, straight sided gang boxes, 4 inch octagon concrete rings and 4 inch octagon hung ceiling boxes with bars may be folded type, one piece deep drawn type for all other boxes.
- B. Size: To accommodate the required number and sizes of conduits, wires and splices in accordance with NEC requirements, but not smaller than size shown or specified. Standard concrete type boxes not to exceed 6 inches deep except where necessary to permit entrance of conduits into side of boxes without interference with reinforcing bars. Special purpose boxes shall be sized for the device or application indicated.

2.04 PULLBOXES

- A. Minimum NEC requirements unless larger box is noted. As specified for outlet boxes with blank cover for pullboxes with internal volume not more than 150 cubic inches. As specified for cabinets for pullboxes with internal volume over 150 cubic inches, except covers to have same thickness as box with corrosion resistant screw or bolt attachment.

2.05 FLOOR BOXES

- A. Heavy duty, cast, adjustable type, suitable for the device or application indicated, unless noted. Provide carpet flanges in carpet areas.

PART 3. EXECUTION

3.01 CONDUIT INSTALLATIONS

- A. Conduit Systems: Rigid Steel conduit, IMC, EMT, or Rigid Non-Metallic conduit unless noted. Install steel conduits for underground runs, runs in concrete feeder circuits and where required by the NEC for mechanical protection, etc. Use flexible conduit only for motor or equipment connections and then only to the extent of minimum lengths required for connections. Install flexible conduit connections at all resilient mounted equipment. Provide liquid tight flexible conduit in exterior, wet or damp locations and for connections to the pipe mechanical system. Aluminum conduit may be used only in dry locations above ground in sizes two inches or larger for power and communications systems. Conduit and tubing shall be kept at least 6 inches from paralleled runs or hot water or steam pipes.
- B. Conduit Installation: Install concealed conduit and EMT in as direct lines as possible. Install exposed conduits and EMT parallel to or at right angles to the lines of the building. Right angle bends in exposed conduit and EMT runs shall be made with standard elbows, screw jointed conduit fittings or conduit bent to radius no less than those of standard elbows.

- C. Concealed Conduits: Install conduit systems concealed where possible unless otherwise noted. Conduit systems may be exposed in unfinished utility areas, ceiling cavities and where specifically approved by the Architect.
- D. Conduit in Concrete: Conduits shall not be installed in floor slabs poured on grade. Rigid steel conduit may be embedded in above grade concrete providing the outside diameter does not exceed 1/3 thickness of concrete slab, wall or beam, is located entirely within the center third of the member and lateral spacing of conduits is not less than 3 diameters. Aluminum conduit shall not be embedded in concrete or masonry.
- E. Conduit in Ground: PVC plastic coated rigid steel conduit shall be installed for all underground feeders and in all locations where conduit is in contact with dirt, soil, fill or earth. All fittings, couplings, ells, etc., used with conduit shall have same factory applied PC coating.
 - 1. Contractor may substitute Schedule 40 rigid non-metallic conduit for PVC plastic coated rigid steel conduit, where allowed by the Code enforcing Authority. Installations and use of rigid non-metallic conduit shall comply with NEC. An equipment grounding conductor, in accordance with NEC, shall be installed in all non-metallic conduits. All conduit sizes, shown on the plans, shall be increased to accommodate the installation of the equipment grounding conductor. All joints shall be made with solvent cement per manufacturer's recommendations and shall be watertight. Plastic conduit runs stubbing up to above grade junction boxes or conduit by installing a female adapter, 90 degree PVC coated rigid steel elbow and a PVC coated rigid steel nipple of length as required to stub conduit up. No plastic conduit shall be installed above grade. Plastic conduit shall be used for straight runs only. PVC coated rigid steel conduit shall be used for all bends, ells and offsets.
- F. Conduit Bends: In any conduit or EMT run, the number of quarter bends or equivalent between terminations at cabinets or boxes shall not exceed four bends for conduits up to 1 1/4 inch, three bends for 1 1/2 to 2 1/2 inch conduits and two bends for 3 to 4 inch conduits. Conduit runs between cabinets or boxes shall not exceed 200 feet for straight runs or 100 feet for runs with maximum number of bends. Bends in telephone feeder conduits shall be long radius.
- G. Conduit Openings: Protect all vertical runs of conduits or EMT terminating in the bottoms of boxes or cabinets, etc., from the entrance of foreign material prior to installation of conductors.
- H. Sleeves for Conduit: Install sleeves for conduit where shown or as required. Conduit sleeves not used shall be plugged with recessed type plugs. Sleeve all conduits passing through walls. Sleeves that are used shall be caulked tight with lead yarn.

3.02 CONDUIT SUPPORTS

- A. Supports: Provide supports for horizontal conduits and EMT not more than 8 feet apart with not less than two supports for each 10 foot straight length and one support near each elbow or bend including runs above suspended ceilings and within 3 feet of all junction boxes, switches, fittings, etc.
- B. Strap: Install one hole pipe straps on conduits 1 1/2 inch or smaller. Install individual pipe hangers for conduits larger than 1 1/2 inch. Spring steel fasteners with hanger rods may be used in dry locations in lieu of pipe straps.
- C. Trapezes: Install multiple (trapeze) pipe hangers where two or more horizontal conduits or EMT run parallel and at the same elevation. Secure each conduit or EMT to the horizontal hanger member by a U-bolt, one hole strap or other specially designed and approved fastener.
- D. Hanger Rods: Install 1/4 inch diameter or larger galvanized steel rods for trapezes, spring steel fasteners, clips or clamps. Wire or perforated strapping shall not be used for the support of any conduit or EMT.
- E. Fastening: Fasten pipe straps and hanger rods to concrete by means of inserts or expansion bolts to brickwork by means of expansion bolts and to hollow masonry by means of toggle bolts. Wooden plugs and shield shall not be used. Power driven fasteners may be used to attach pipe straps and hanger rods to concrete only where approved by the Architect.
- F. All conduits not embedded in concrete shall be firmly secured by means of pipe clamps, hangers, etc., equal to Caddy fasteners of ERICO Products, Inc. Wire wrapped around conduits and supporting members will not be accepted.

3.03 CONDUIT STUB-UPS

- A. All conduits run under floor shall be stubbed up to a coupling set flush with floor. This includes conduits stubbed up in walls and feeder conduits. Install flush plug until after floor is finished, then complete connections to boxes or equipment.

3.04 OUTLET BOXES

- A. Outlet boxes, covers and fittings, according to the particular use for which they are required, shall be provided in the locations marked on the drawings by symbols, and/or for use to facilitate the installation of the electrical systems. When necessary, outlets shall be relocated so that where fixtures or other fittings are installed they will be symmetrically located according to the room layout and will not interfere with other work or equipment required by the drawings and these specifications.
- B. Installation: Unless otherwise specified or shown on the drawings, outlet boxes shall be flush mounted and the front edges of the boxes or plaster covers shall be flush with the finished wall or ceiling line or if installed in walls and ceilings of

incombustible construction, not more than 1/4 inch back of same. Mount boxes with the long axes of devices vertical, unless otherwise specified. Boxes in plastered walls and ceilings shall be provided with plastic covers. A multiple of box extensions and/or covers will not be permitted. Install in a rigid and satisfactory manner with suitable metal bar hangers, box cleats, adjustable box hangers, etc. Use wood screws on wood, expansion shields on masonry and machine screws on steel work.

3.05 PULLBOXES

- A. Provide additional pullboxes wherever necessary to meet requirements for maximum length of conduit runs and maximum numbers of bends as specified under "Conduit and Fittings".

3.06 FLOOR BOXES

- A. Install level with top covers adjusted flush with finished floor or floor tile.

3.07 FIXTURE CONNECTIONS

- A. Recessed or surface light fixtures in lay-in or accessible ceilings shall be connected with minimum 1/2 inch flexible metallic conduit, 4 to 6 feet long with grounding provisions.

3.08 CLOSING OF OPENINGS

- A. Wherever slots, sleeves, or other openings are provided in floors or walls for the passage of conduits or other forms of raceway, such openings, if unused, or the spaces left in such openings, shall be filled or closed in a manner approved by the Contracting Officer.

3.09 IDENTIFICATION

- A. Refer to Section 16010, General Provisions, for identification requirements for raceways and boxes.

END OF SECTION 26 0533 - RACEWAYS BOXES & FITTINGS

SECTION 26 2726**WIRING DEVICES AND PLATES****PART 1. GENERAL****1.01 RELATED WORK IN OTHER SECTIONS**

- A. Section 26 0510, General Provisions; Section 26 0526, Grounding.

PART 2. PRODUCTS**2.01 SNAP SWITCHES**

- A. Unless otherwise specified, each snap switch (flush tumbler-toggle) shall be of the A.C. General use type for mounting in a single gang spacing, fully rated 20 amperes minimum at 120/277 volts, conforming to minimum requirements of the latest revision of the Underwriter's Laboratories, Inc., UL 20 Fifth Edition Standard Snap Switches and further requirements herein specified. Specification grade, heavy duty, single pole, 3-way or 4-way, of the maintained, momentary or lock type as indicated on the drawings. Ivory color handles unless otherwise indicated on the drawings. Silver or silver alloy contacts. A.C. 120/277 volt general use snap switches shall be capable of withstanding tests as outlined in NEMA Publications and shall be as follows unless otherwise noted.

<u>20A 120/277 AC</u>	<u>HUBBELL</u>	<u>P&S</u>	<u>AH&H</u>	<u>GE</u>
1P	1221-1	20-AC-1-1	1991-1	5951-2
3-WAY	1223-1	20-AC-3-1	1993-1	5953-2
4-WAY	1224-1	20-AC-4-1	1994-1	5954-2
3-POSITION 2CCT MOMENTARY	1557-1	1251-1	1995-1	5955-2
LIGHTED HANDLE PILOT LIGHT	1221-PL	2251-SP	2999-R	SP121-8

2.02 RECEPTACLES

- A. General: Configuration and requirements for all connector or outlet receptacles shall be in accordance with NEMA Publications. Fire resistant, non-absorptive, hot welded, phenolic composition or equal bodies and bases with metal plaster ears (integral with the supporting member). Single or duplex as shown, or as noted on the drawings. Ivory color unless otherwise noted on the drawings. Double grip contacts for each prong.
- B. Grounding Type: All receptacles shall be grounding type with a green colored hexagonal equipment ground screw of adequate size to accommodate an insulated grounding jumper (based on Table 250-95 of the NEC with minimum size No. 14

AWG). Grounding terminals of all receptacles shall be internally connected to the receptacle mounting yoke.

C. Unless otherwise noted, receptacle shall be as follows:

<u>DEVICE</u>	<u>HUBBELL</u>	<u>P&S</u>	<u>AH&H</u>	<u>GE</u>
20A-125V AC 2P 3W	5362-1	6300-1	5739-1	4108-2
20A-208V AC 4P 4W	7250	7250	7250	4127-3
30A-250V AC 3P 3W				
DRYER	9350	3853	9344	4132-3

D. Special: Receptacles for special applications shall be as indicated on the drawings.

2.03 DEVICE PLATES

- A. General: Provide plates for each switch, receptacle, signal and telephone outlet and special purpose outlet. Plates shall be stainless steel unless otherwise noted. Do not use sectional gang plates.
- B. Exposed: Plates for exposed screw jointed fittings shall match the fittings with edges of plates flush with edges of fittings. Heavy cadmium plates, steel with gasket. Plates for cast type boxes at locations subject to set or rain conditions shall be of the cast, vapor tight type. Provide hinged covers for devices.
- C. Communications: Plates for telephone and signal outlets shall each have a 3/8 inch bushed opening in the center. Wall plates for push button and buzzer outlets shall have openings to suit the push buttons and buzzers.

PART 3. EXECUTION

3.01 DEVICE PLATES

- A. Install with alignment tolerance of one-sixteenth inch and all edges in continuous contact with wall surfaces.

END OF SECTION 26 2726 - WIRING DEVICES & PLATES

SECTION 26 5113

LIGHTING EQUIPMENT

PART 1. GENERAL

1.01 CONFORMANCE

- A. Conform with applicable provisions of the General Requirements.

1.02 RELATED WORK IN OTHER SECTIONS

- A. Section 26 0510, General Electrical Requirements; Section 26 0525, Grounding.

1.03 SUBMITTALS

- A. Submit for approval complete shop drawings, catalog cuts, special installation instructions, photometric data and descriptive literature. When fixtures are proposed for substitution and prior approval has not been issued, the submittal for approval shall include catalog cuts of both the specified and proposed fixtures.

PART 2. PRODUCTS

2.01 GENERAL

- A. Furnish all lighting fixtures throughout the type indicated on the drawings, complete with lamps, sockets, wiring, fitters, hangers, plaster rings, canopies, etc., as required.

2.02 LAMPS

- A. All fixtures shall be provided with LED lighting as indicated on the plans.

2.03 FINISH

- A. Bonderized or equal treatment on all steel parts prior to applying finish. Metal parts shall be aluminum, brass, copper, bronze, or steel, with baked white enamel finish unless otherwise noted on the drawings.

2.04 CEILING TRIM

- A. Furnish proper ceiling frames for the ceiling material in which recessed fixtures are to be installed. Verify prior to ordering.

2.05 LENS

- A. When acrylic lens or diffuser is specified, it shall be molded of 100% acrylic meeting American Society for Testing Materials specifications for Methacrylate Molding and Extrusion Compounds (ASTM D788-63). Plastic diffusing panels, luminous side panels and other luminous plastic members of fixtures shall be made of not less than .125 inch thick prismatic clear acrylic material. Plastic shall be non-flammable or shall have a flame spread rate of not more than 3.2 inches per minutes for a 1/2 inch width of the material. The plastic shall be non-electrostatic or the finished parts shall be treated with an anti-static wax.

2.06 HOUSING

- A. Not less than 20 gauge steel with baked white enamel finish applied over corrosion-resistant primer unless otherwise specifically approved.

PART 3. EXECUTION

3.01 SUPPORTS

- A. Support ceiling fixtures by anchorage to the ceiling only where the ceiling is concrete or masonry units. For ceilings of other construction, anchor ceiling fixtures to metal supports provided for that purpose of suitable strength and stability, adequately attached to and supported by joists, trusses, or other structural members, unless other methods of support are specifically approved by the Architect. Where lay-in construction is used, fixtures shall be on the lay-in type. Coordinate supports for lay-in fixtures with ceiling Contractor.

3.02 CEILING TRIM AND MEANS OF SUPPORT

- A. The ceiling trim and means of support of recessed fixtures shall be coordinated with the type of the ceiling to be installed to insure proper installation.

3.03 SUSPENDED FIXTURES

- A. Provide swivel hangers to insure a plumb installation. For single unit suspended fluorescent fixtures provide tubings or stems for wiring at one point and a tubing or rod suspension provided for each unit of chassis. Provide 3/16 inch diameter rods minimum.

3.04 BLOCKING

- A. Protect housing of recessed lighting fixtures during installation by internal blocking or framing to prevent distortion of sides or dislocation of threaded lugs which upon completion must be in perfect alignment and match the corresponding holes in frames or rims so that holding screws can be installed freely without forcing and remain so they can be easily removed when servicing. Threads to receive holding screws shall be chased after plating and finishing to insure easy installation and

removal of knurled headed screws by thumb pressure.

3.05 CLEAN-UP

- A. At final inspection all fixtures and lighting equipment shall be in first class operating order, in perfect condition as to finish and free from defects, completely lamped, clean and free from dust, plaster or paint spots and complete with the required glassware, reflectors, side panels, louvers or other components necessary to complete the fixtures.

3.06 CEILING TRIM

- A. Furnish proper ceiling frames for the ceiling material in which recessed fixtures are to be installed; verify prior to ordering. Rims of all fixtures that overlap ceiling shall be installed tight and snug against the ceiling surfaces so that no light leakage occurs around the rim. If unevenness of surface of fixture allows light to show, then this contractor shall provide soft sponge filler or gasket on all fixtures requiring this treatment.

3.07 FLUSH AND RECESSED FIXTURES

- A. Special attention is directed to the special provisions for flush and recessed fixtures in the National Electrical Code. All recessed fixtures shall have top connections to the outlet boxes installed in accordance with the code. Connections to lay-in fixtures shall be made with flexible connections 4'-0" minimum length.

3.08 LAY-IN FIXTURES

- A. All lay-in fixtures shall be adequately supported to structure and not to ceiling alone.

3.09 TOP PLATES

- A. All surface mounted fixtures shall be furnished with top plated whenever applicable.

3.10 CEILING FIRE RATING

- A. All fixtures to be installed in a fire-resistive ceiling which shall be of a type suitable for such installation to ensure the maintenance of the ceiling fire rating or the fixtures shall be tented per UBC. The electrical contractor shall coordinate with the general contractor to accomplish the tenting.

END OF SECTION 26 5113 - LIGHTING EQUIPMENT