SET NO: _____

SUWANNEE COUNTY SCHOOL BOARD

702 2nd Street N.W. Live Oak, Florida 32064

SCHOOL BOARD MEMBERS

Jerry Taylor, Chairman	District 1
Catherine Cason	District 2
Julie B. Ulmer	District 3
Ed daSilva, Vice-Chairman	District 4
J.M. Holtzclaw	District 5

ADMINISTRATION

Jerry A. Scarborough, Superintendent

SUWANNEE PRIMARY SCHOOL ADDITIONS & REMODELING OF SELECT AREAS

PROJECT MANUAL

GENERAL CONDITIONS AND TECHNICAL SPECIFICATIONS

A/E Project No. 2012.51 Phase 2

Issued for Bid: February 14, 2014

SUWANNEE PRIMARY SCHOOL ADDITIONS & REMODELING OF SELECT AREAS RZI# 2012.51, PHASE 2

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SECTION 00 11 13 - BID NOTICE

PART I - GENERAL

Legal notice is hereby given that sealed bids will be received by the SCHOOL BOARD of SUWANNEE COUNTY, 702 2nd Street N.W., Live Oak, FL 32064 until **2:00 pm (local time)** on **March 21, 2014** for the **SUWANNEE PRIMARY SCHOOL ADDITIONS & REMODELING OF SELECT AREAS**. Any bid received after the specified time and date will be rejected.

A pre-bid conference will be held at the project site on March 7, 2014. Contractors shall report to the Facilities Maintenance office, 1729 S.W. Walker Ave., Live Oak, FL 32064 at 10:30 AM; from there, an escorted visit to the school will take place.

SECURING DOCUMENTS:

Plans and specifications may be downloaded from the SUWANNEE COUNTY SCHOOLS web site at <u>http://suwannee.schooldesk.net/Bids/tabid/7303/Default.aspx</u> under Bid #14-201. Questions may be directed to Mark Carver, Director of Facilities at <u>mark.carver@suwannee.k12.fl.us</u> or John Zwick, Architect at john.zwick@architectsrzk.com.

BONDS:

Each bid shall be accompanied by a Bid Bond or Cashier's Check in the amount of 5% of the base bid payable to the SCHOOL BOARD OF SUWANNEE COUNTY as evidence of good faith and guaranteeing that the successful bidder will execute and furnish to Owner a Performance Bond meeting the standards outlined in the specifications for 100% of the contract price, within ten (10) days after being awarded the contract, said bond guaranteeing the performance payment of said contract, the premium of said bond to be paid by the said Contractor.

BIDS:

Each bid shall be made in strict accordance with the Instructions to Bidders, Section 00 21 13, and all applicable conditions and requirements specified in the project bid and contract documents.

The successful bidder, if any, will be notified after the client has awarded the contract. The Contractor will be required to complete said project within the time set forth in the contract document. The Owner reserves the right to reject any and all bids, to waive any informalities or irregularities of bids, or to accept any bid in part.

END OF SECTION 00 11 13

SECTION 00 21 13 - INSTRUCTIONS TO BIDDERS

ARTICLE 1:

GENERAL:

DEFINITIONS:

Bidding Documents include the Advertisement or Invitation to Bid, Instructions to Bidders, the bid form, other sample bidding and contract forms and the proposed Contract Documents including any Addenda issued prior to receipt of bids.

All definitions set forth in the General Conditions of the Contract for Construction, AIA Document A201, or in other Contract Documents are applicable to the Bidding Documents.

Addenda are written or graphic instruments issued by the Architect prior to the execution of the Contract which modify or interpret the bidding documents by addition, deletions, clarifications, or corrections.

A **Bid** is a complete and properly signed proposal to do the Work or designated portion thereof for the sums stipulated therein supported by data called for by the Bidding Documents.

Base Bid is the sum stated in the Bid for which the Bidder offers to perform Work described as the base, to which Work may be added or deducted for sums stated in Alternate Bids.

An **Alternate Bid** (or Alternate) is an amount stated in the Bid to be added to or deducted from the amount of the Base Bid if the corresponding change in project scope or materials or methods of construction described in the Bidding Documents is accepted.

A **Unit Price** is an amount stated in the Bid as a price per unit of measurement for materials or services as described in the Contract Documents. Such prices may be used in calculating additions or deletions to the project scope.

A **Bidder** is one who submits a Bid for a prime contract with the Owner for the Work described in the proposed Contract Documents.

A **Sub-bidder** is one who submits a bid to a Bidder for materials or labor for a portion of the Work.

ARTICLE 2:

BIDDER'S REPRESENTATION:

Each Bidder by making his bid represents that: He has read and understands the Bidding Documents and his Bid is made in accordance therewith.

He has visited the site and existing structures and has familiarized himself with the local conditions under which the Work is to be performed. The "subsurface investigation" report, if applicable, is made a part of this specification and follows in another section.

His Bid is based upon the materials, systems and equipment described in the Bidding Documents without exceptions.

Bidder is advised that any additional changes over and above the Bid cost will not be considered based on the Bidder's lack of knowledge of the Bidding documents.

ARTICLE 3:

BIDDING DOCUMENTS:

Copies:

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

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

Interpretation or correction of bidding documents:

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

Bidders requiring clarification or interpretation of the Bidding Documents shall make a written request to the Architect, to reach him at least ten (10) days prior to the date for receipt of bids.

Any interpretation, correction of change of the Bidding Documents will be made by Addendum. Interpretations, corrections or changes of the Bidding Documents made in any other manner will not be binding, and bidders shall not rely upon such interpretations, corrections and changes.

Substitutions:

The material, products and equipment described in the Bidding Documents establish a standard of required function, dimension, appearance and quality to be met by any proposed substitution.

The Bidder shall be allowed to submit Bids on materials and equipment other than those which the specifications are based upon, within the constraints of the individual specifications sections and section 01 60 00.

"Relevant Product Data" shall name the specific substitute product or equipment item by model, type, size, etc., along with product/equipment performance data; appearance, photos and samples; add drawn information to indicated approximate fabrication, location and installation information. The Contractor shall be responsible for installing all substitute products of equipment in a manner consistent with the general design of the facility as interpreted by the Architect/Engineer. Furthermore, the Contractor shall be responsible to interface all substitute products or equipment in a complete and finished manner with no additional cost to the Owner.

Addenda:

Addenda will be mailed or delivered to all general contractors and plan rooms who are known by the Architect to have received a complete set of Bidding Documents.

Copies of Addenda will be made available for inspection wherever Bidding Documents are on file for that purpose.

Typically, no Addenda will be issued later than Five (5) calendar days prior to the date for receipt of bids except an Addendum, if necessary, postponing the date for receipt of bids or withdrawing the request for bids. To maintain a bid date, faxed or emailed addenda may be issued up to the day prior to receiving bids.

Each bidder shall ascertain prior to submitting his bid that he has received all Addenda issued, and he shall acknowledge their receipt on his price proposal document.

ARTICLE 4:

BIDDING PROCEDURE:

Form and Style of Bids:

Bids shall be submitted in duplicate (2) on the forms provided by herein.

All blanks on the bid form shall be filled in.

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 written amount shall govern.

Any interlineation, alteration or erasure must be initialed by the signer of the Bid.

All requested alternates (or unit prices) shall be bid.

Bidder shall make no additional stipulations on the bid form nor qualify his bid in any other manner.

Each copy of the Bid shall include the legal name of Bidder and a statement whether Bidder is a sole proprietor, a partnership, a corporation, or any other legal entity, and each copy shall be signed by the person or persons legally authorized to bind the Bidder to a contract. A Bid by a corporation shall further give the State of Incorporation and have the corporate seal affixed. A Bid submitted by an agent shall have a current Power of Attorney attached certifying agent's authority to bind Bidder.

Bid Security:

Each bid shall be accompanied by a bid security in the amount of at least 5% of the bid in the form of a Cashier's Check made payable to the Owner or a Bid Bond executed by the bidder pledging that the Bidder will enter into a contract with the Owner on the terms stated in his Bid and will, furnish bonds as described hereunder in Article 8 covering the faithful performance of the Contract and the payment of all obligations arising thereunder. Should the Bidder refuse to enter into such Contract or fail to furnish such bonds, if required, the amount of the bid security shall be forfeited to the owner as liquidated damages, not as penalty.

The Owner will have the right to retain the bid security of Bidders until either (a), the Contract has been executed and bonds, if required, have been furnished or (b) the sixty (60) days has elapsed so that Bids may be withdrawn, or (c), all Bids have been rejected.

Submission of Bids:

All copies of the bid, and the bid security shall be enclosed in sealed, separate, opaque envelopes, the envelope shall be addressed to the party receiving the Bids and shall be identified with the Project name, the Bidder's name and address, and the portion of the project or category of work for which the Bid is submitted. If the bid is sent by mail, the sealed envelopes shall be enclosed in a separate mailing envelope with the notation "BID ENCLOSED" on the face thereof.

Bids shall be deposited at the designated location prior to the time and date for receipt of bids indicated in the Advertisement or Invitation to Bid, or any extension thereof made by Addendum.

Bidder shall assume full responsibility for timely delivery at location designated for receipt of Bids.

Oral, telephonic or telegraphic Bids are invalid and will not receive consideration.

Modification of Withdrawal of Bid:

A Bid may not be modified, withdrawn or canceled by the Bidder for sixty (60) days following the time and date designated for the receipt of Bids, and Bidder so agrees in submitting his Bid.

Prior to the time and date designated for receipt of Bids, Bids submitted early may be modified or withdrawn only by notice to the party receiving Bids at the place and prior to the time designated for receipt of Bids.

Such notice shall be in writing over the signature of the Bidder or be by telegram; if by telegram, written confirmation over the signature of Bidder must have been mailed and postmarked on or before the date and time set for receipt of Bids; it shall be so worded as not to reveal the amount of the original Bid.

Withdrawn Bids may be resubmitted up to the time designated for the receipt of Bids provided that they are then fully in conformance with these Instructions to Bidders.

Bid security, shall be in an amount sufficient for the Bid as modified or resubmitted.

List of Subcontractors:

The Bidder shall submit a list of names of Subcontractors, other persons or organizations (including those who are to furnish materials or fabricate equipment) proposed for the principal portions of the Work within 24 hours of the bid receipt time.

The Bidder shall use AIA Document G805, "List of Subcontractors" for this submittal. The Bidder shall not list himself as a material supplier or subcontractor unless A.I.A. Doc. 305 "Contractor: Qualification Statement" clearly identifies a capability for the work. The Bidder must identify a subcontractor for each section of work or risk rejection of his bid. The Bidder, if awarded this contract, may not change the subcontractor without first submitting a written request to the Architect and receiving written acknowledgment in reply.

ARTICLE 5:

CONSIDERATION OF BIDS:

Opening of Bids:

Unless stated otherwise in the Advertisement or Invitation to Bid, the properly identified Bids received on time may or may not be opened publicly or made public at the discretion of the Owner.

Rejection of Bids:

The Owner shall have the right to reject any or all Bids and in particular to reject a Bid not accompanied by any required bid security or data required by the Bidding Documents or a Bid in any way incomplete or irregular.

Acceptance of Bid (Award):

The Owner shall have the right to waive any informality or irregularity in any Bid received.

It is the intent of the Owner, if he accepts any Alternates, to accept them in any order or combination to determine the low Bidder.

ARTICLE 6:

QUALIFICATION OF CONTRACTORS:

Prospective Contractors shall have current experience (within 5 years) of working on public school property. A completed A.I.A. Document A305 (or equivalent) will be required of the lower three bidders to be submitted within 72 hours of the bid opening.

ARTICLE 7:

POST-BID INFORMATION:

Submissions:

The Bidder will be required to establish to the satisfaction of the Architect and the Owner the reliability and responsibility of the proposed Subcontractors to furnish and perform the Work described in the sections of the Specifications pertaining to such proposed Subcontractors' respective trades.

Prior to the award of the Contract, the Architect will notify the Bidder in writing if either the Owner or the Architect, after due investigation, has reasonable and substantial objection to any person or organization on such list. If the Owner or Architect has a reasonable and substantial objection to any person or organization on such list, and refuses to accept such person or organization, the Bidder may, at his option, (1) withdraw his bid, or (2) submit an acceptable substitute Subcontractor. In the event of either withdrawal or disqualification under this Subparagraph, bid security will not be forfeited.

Subcontractors and other persons and organizations proposed in writing by the Bidder and accepted by the Owner and the Architect must be used on the Work for which they were proposed and accepted; and, shall not be changed except with the written acknowledgment of the Owner and the Architect.

ARTICLE 8:

PERFORMANCE BOND AND LABOR AND MATERIAL PAYMENT BOND:

Owner's Right to Require Bonds:

The Owner shall require the Bidder to furnish bonds covering the faithful performance of the Contract and the payment of all obligations arising thereunder in such form and amount as the Owner has prescribed in the Supplementary General Conditions, and with such sureties secured through the Bidder's usual sources as may be agreeable to the parties. The furnishing of such bonds shall be paid by the Contractor.

Time of Delivery and Form of Bonds:

The Bidder shall deliver the required bonds to the Owner not later than ten working days (10) from the Award of the Contract and prior to commencement of the Work.

Unless otherwise specified in the Bidding Documents, the bonds shall be written in the form of A.I.A. Document A311, Performance Bond and Labor and Material Payment Bond, meeting the current laws and regulations in the State of Florida including Florida State Statue 255.05 or 713.23 whichever may apply.

The Bidder shall require the Attorney-In-Fact who executes the required bonds on behalf of the surety to affix thereto a certified and current copy of his Power of Attorney.

ARTICLE 9:

FORM OF AGREEMENT BETWEEN OWNER AND CONTRACTOR:

Form To Be Used:

Unless otherwise provided in the Bidding Documents, the Agreement for the Work will be written on the Standard Form of Agreement between Owner and Contractor where the basis of payment is a Stipulated Sum. A.I.A. Document A101.

END OF SECTION 00 21 13

SECTION 00 30 00 - AVAILABLE INFORMATION

PART 1 GENERAL

This section includes references to:

Geotechnical Data

<u> PART 2 – DATA</u>

GEOTECHNICAL DATA:

If applicable, a subsurface soils and geotechnical report with soils stabilization and foundation recommends will be included with the construction documents for the benefit of bidders and contractors working on the project.

The geotechnical work has been undertaken and prepared by: To be included later.

If there are questions regarding results and recommendations, inquiries shall be made directly to the geotechnical engineer. The geotechnical report for this work, if applicable, is included with this Specifications Book.

END OF SECTION 00 30 00

SECTION 00 42 00 - BID PROPOSAL FORM

PART 1 - GENERAL

FROM: (Bidder's Name)____

hereinafter called "Bidder"

TO: SUWANNEE COUNTY SCHOOL BOARD 702 2nd Street, N.W. Live Oak, FL 32064

hereinafter called "Owner"

PROJECT:

Pursuant to and in compliance with the invitation to bid and the proposed Contract Documents relating to SUWANNEE PRIMARY SCHOOL ADDITIONS & REMODELING OF SELECT AREAS.

hereinafter called the "Work"

PROPOSAL:

The undersigned, as bidder, declares that he has examined the site of the Work and informed himself fully in regard to all conditions pertaining to the places where work is to be done, exclusive of destructive investigation; that he has examined the plans and specifications for work and contractual documents relative thereto; that he has read all special provisions furnished prior to the opening of bids; and, that he has satisfied himself relative to the work to be performed.

The Bidder proposes and agrees, if this proposal is accepted, to contract with the Owner in the form of the Work in full and complete accordance with the shown, described, and reasonable intended requirements of the plans and specifications and contract documents to the full and entire satisfaction of the Owner, with a definite understanding that no money will be allowed for extra work except as set forth in the attached General Conditions and Contract Documents.

The proposal amounts, whether base bid or alternate, shall include all overhead, profit, state sales tax, building permit cost, utility fees and any other such costs as required for the work.

BASE BID:

All labor, material, services, and equipment necessary for completion of the work shown on the Drawings and in the Specifications, including the work described as an "Alternate".

For the lump Sum of

_____Dollars (\$_______)

ALTERNATE BID(S):

Alternate No. 01: Remodeling of the existing Music Suite into a new Administrative Reception as identified throughout the drawings.

THE VALUE TO BE DEDUCTED from the base bid for this alternate is: _____

Dollars (\$.00).

ADDENDUM RECEIPT:

Bidders shall acknowledge below the receipt of any and all addenda, if any, to the plans and specifications listing and addenda by number and date.

Addendum No.	Date
Addendum No.	Date
Addendum No.	Date
Addendum No.	Date

FURTHERMORE:

The undersigned, as bidder, hereby declares that the only person or persons interested in the proposal as Principal or Principals is, or are, named herein and that no other person that herein mentioned has any interest in this proposal or in the contract to be entered into, that this proposal is made without connections with any other person, company or parties making a bid.

The Bidder understands that the Owner reserves the right to reject this bid, but that this bid shall remain open and shall not be withdrawn for a period of forty-five (45) days from the date prescribed its opening.

The Bidder further proposes and agrees to commence work under its contract within seven (7) days from the date of written notice to proceed, and shall substantially complete all work under the contract, except the alternate area, by August 17, 2014. An additional sixty (60) calendar days would be allocated for the alternate area. The district anticipates issuing a written Notice To Proceed on or about April 9, 2014.

The Bidder understands and agrees that no contractual relationship exists, or is created between the Owner and the Bidder by the tendering of this bid proposal.

RESPECTFULLY SUBMITTED,

Name of Firm

BY:_____

TITLE:_____

END OF SECTION 00 42 00

SECTION 00 43 13 - BID BOND

DESCRIPTION:

The Bidder shall provide a Bid Guaranty in accordance with Section 00010 and 00100, in the amount of at least 5% of the bid in the form of a cashier's check made payable to the Owner or a bid bond executed by the bidder, as principal, and having a surety thereon of a Surety company meeting the standard outlined in the Supplementary General Conditions.

EXECUTION:

The Bid Bond, AIA Document A310 shall be executed and accompany the Bidders Bid with method prescribed in Section 00100.

END OF SECTION 00 43 13

SECTION 00 45 13 - BIDDING CONTRACTOR QUALIFICATION STATEMENT

DESCRIPTION:

Prospective Contractors (Bidders) shall execute and submit per specification Section 00 21 13 AIA Document A305, "Contractor's Qualification Statement," a copy of which is available at the Architect's office at the cost of printing only.

END OF SECTION 00 45 13

SECTION 00 52 00 - AGREEMENT BETWEEN OWNER AND CONTRACTOR

DESCRIPTION:

The following AIA Document A101, "Standard Form of Agreement Between Owner and Contractor - Stipulated Sum" shall be the format between the successful Bidder for this work and the Owner.

PROVISIONS:

Article 3 of AIA Document A101 will identify liquidated damages as follows:

"It is specifically agreed by and between the Owner and Contractor that the Owner may retain a sum in the amount as scheduled below from the amount of compensation to be paid the Contractor, herein above, Sundays and Holidays included that the work remains substantially incomplete.

CONTRACT AMOUNT	FIRST <u>15 DAYS</u>	SECOND <u>15 DAYS</u>	31ST DAY & <u>THEREAFTER</u>
Under \$50,000	\$50.00	\$100.00	\$200.00
\$50,000 to \$99,999	\$100.00	\$200.00	\$500.00
\$100,000 to \$5,000,000	\$200.00	\$400.00	\$1,000.00
\$5,000,000 and up	\$1,000.00	\$2,000.00	\$3,000.00

This amount as scheduled, is agreed upon as a proper measure of Liquidated Damages which the Owner will sustain per day by failure of the Contractor to complete the work by the item stipulated in this Contract and is not to be construed in any sense as a penalty provision.

The Contractor shall take into account all contingent work which has to be done by other parties, and shall not plead his want of knowledge of said contingent work as an excuse for delay in his work, or for non-performance."

EXECUTION:

The Agreement shall be executed by legal representatives of the Owner and the Contractor.

END OF SECTION 00 52 00

SECTION 00 60 00- PROJECT FORMS

INSTRUCTIONS:

The forms and certificates listed below are to be used by the Contractor for submissions for contractual and administrative requirements specified herein.

Requirements and instructions on the forms may constitute extensions of, or additions to, the contractual conditions of the contract and the general requirements of the specifications.

Prepare all forms as required with all blank spaces filled in, in ink or typewritten.

PROJECT FORM LISTING:

END OF SECTION 00 60 00

SECTION 00 61 13 - PERFORMANCE AND PAYMENT BOND

DESCRIPTION:

The successful bidder shall provide a "Performance Bond" and "Labor and Material Payment Bond" AIA Documents, A311, copies which follow in accordance with the Owner-Contractor Agreement (Section 00500) and in compliance with current laws and regulations in the State of Florida, including Florida State Statute 255.05 or 713.23 whichever may apply in the amount equal to 100% of the contract price.

EXECUTION:

Within ten (10) calendar days of the award of the contract, and prior to the commencement of construction the Contractor shall submit the Performance and Payment Bond to the Owner fully completed and executed in the manner specified. See Section 00 73 00, Supplementary General Conditions, for additional provision regarding these Bonds.

The Contractor shall provide the name and address of his bonding agent and surety company to all subcontractors and agencies supplying materials or work on this contracted project.

END OF SECTION 00 61 13

SECTION 00 72 00 - GENERAL CONDITIONS

REFERENCE:

The general conditions of this contract are the American Institute of Architects Document A201, "General Conditions of the Contract for Construction", 2007, Fourteenth Edition, hereinafter referred to as the "General Conditions".

A copy of the General Conditions may be obtained from the Architects office at cost. Additional copies may be purchased from the American Institute of Architects, 1735 New York Avenue, N.W., Washington, D.C. 20006.

The General Conditions shall apply to each and every section of the Work as though written in full therein.

DEFINITIONS:

The following definitions shall amend the General Conditions in a manner to specifically apply to this project.

<u>Contract Documents:</u> The Contract Documents, as referred to herein, consist of the Contract, the Legal Advertisements covering Opening of Bids, the Performance Bond, the Labor, and Material Payment Bond, the Instruction to Bidders and General Conditions, the Special Conditions, Technical Specifications, Contract Drawings, and Addenda, all incorporated into the contract before its execution. These documents apply to each and every division and section of the specifications, the plans and working drawings and all modifications issued after the execution of the contract, as if written in full therein. All plans and drawings, general requirements, and technical specifications, modifications, and all other items included as a part of the Summary of Work Section 01 10 00 are also a full and effective portion of the Contract Documents.

Owner: As herein used shall mean: SUWANNEE COUNTY SCHOOL BOARD

<u>Architect:</u> As herein referred to shall mean Architects RZK, Inc., 600 Florida Avenue, Suite 202, Cocoa, Florida 32922.

<u>Contractor</u>: As used herein refers to the person, firm, or corporation authorized to do business in the State of Florida with whom a contract has been made directly or through accredited representatives that have entered into a contract with the Owner for the performance of the work described by these documents.

<u>Other Contractors:</u> As used herein shall mean any person, firm or corporation with whom a contract has been made by the Owner for the performance of any work on the site of this building, which work is not a portion of the work covered by this contract.

Inspector: As used herein shall mean any authorized representative of the Owner.

<u>Subcontractor:</u> As used herein refers to and shall include all those performing labor or furnishing materials under the supervision and control of the Contractor and not in privity of contract with the Owner.

<u>Superintendent:</u> As used herein refers to the executive representative of the Contractor who is present on the work at all times during progress, authorized to receive and fulfill instructions from the Architect, and capable of superintending work efficiently.

<u>Surety:</u> As used herein shall mean the firm, corporation, or individual which is bound by the Performance Bond, Labor and Material Payment Bond, with and for the Contractor, and which

engages to be responsible for the Contractor's acceptable Performance, Labor and Material Payment of the work and for payment of all debts pertaining thereto.

<u>Project:</u> As used herein shall mean the construction of **Suwannee Primary School Additions & Remodeling of Select Areas.**

<u>Proposal Guarantee:</u> As used herein shall mean the Bid Bond or good faith deposit, acceptable to the Owner, designated in the proposal to be furnished by the bidder as a guarantee of good faith to enter into a contract with the Board, if the contract is awarded to him.

<u>Written Notice</u>: Shall be deemed to have been duly served if delivered in person to the individual or to a member of the firm or to an officer of the corporation for whom it is intended, or if delivered at or sent by certified or registered mail to the last business address known to him who gives notice.

Work: As used herein means labor or materials furnished by the Contractor or Subcontractor.

<u>Completion:</u> As used herein means that the facility called for is fully executed and completed in accordance with the contract.

Plans: As used herein include all drawings and specifications.

<u>Punch List:</u> Is a compilation of items which have been found to require further attention by Contractor.

END OF SECTION 00 72 00

SECTION 00 73 00 - SUPPLEMENTARY GENERAL CONDITIONS

SCOPE:

The Supplementary General Conditions modify, change, delete from or add to the General Conditions (A.I.A. 2007 Edition) and shall apply to each and every Section of the Work as though written in full therein.

SUPPLEMENTARY CONDITIONS:

The following paragraphs and subparagraphs take precedence over the General Conditions. Where any part of the General Conditions is modified or deleted by the Supplementary General Conditions, the unaltered provisions remain in effect.

Paragraph numbers and titles refer to like numbers and titles in the General Conditions.

ARTICLE 1 - GENERAL PROVISIONS:

- 1.1.3.1 The work of this Contract shall be the construction of the SUWANNEE PRIMARY SCHOOL ADDITIONS & REMODELING OF SELECT AREAS
- 1.1.6.1 The section, article and paragraph headings in the Specifications are inserted only as a matter of convenience and for reference, and in no way define, limit or describe the scope or intent of any provision of the Contract Documents.
- 1.2.2.1 Scope paragraphs placed at the beginning of the Sections present a brief indication of the principal Work included in that Section, but do not limit Work to subject mentioned.
- 1.2.2.2 The Specifications have been partially "streamlined" and some works and phrases have been intentionally omitted. Missing portions shall be provided by inference as with notes on drawings.
- 1.2.4 Locations of piping, ductwork, conduit, outlets and the like, shown on the mechanical and electrical drawings are diagrammatic, except where specifically indicated by dimension or as existing. Therefore, it shall be the duty of the Contractor and his subcontractors to consult with each other and verify conditions, and in each case where there is a question of doubt as to adequacy of space or indicated arrangements, to submit a workable solution to the Architect for his approval before installing the work which is questionable.
- 1.2.4.1 Failure to report a conflict or ambiguity in the Contract Documents shall be deemed evidence that the Contractor has elected to proceed in the more expensive manner.
- 1.2.5 Upon award of the Contract, the Contractor will be furnished a disk containing the Contract Drawings and Specifications.

ARTICLE 2 - OWNER

2.2.3.1 The Owner does not warrant the accuracy of said surveys or utility locations and the Contractor shall be responsible for verifying all existing conditions. Those conditions which vary substantially from that noted or reasonably inferred therefrom will be considered for a change in the contract work. 2.2.5.1 Upon award of the Contract, the Contractor will be furnished signed and sealed permit sets of the Contract Drawings and Specifications.

ARTICLE 3 - CONTRACTOR:

- 3.3.4 Contractor is responsible for correlating the work of Subcontractors and exercising general superintendence over them. Contractor shall determine the extent of work of Subcontractors so the necessary placing of sleeves, inserts, anchors, hangers, bolts, bucks, sub-bases, pipes, conduits, mounting devise and other roughing-in may be accomplished by the proper time to provide for the ultimate placing or installing of equipment and fixtures. Contractor shall see that the work of Subcontractors is performed properly so there will be a minimum of cutting of work in place.
- 3.4.3.1 Contractor and his Subcontractors shall have full control of all persons in their employ; however, the Owner/Architect shall have the right to require Contractor to remove any Contractor or Subcontractor employee(s) whose actions have a disruptive effect upon the construction site. Further, Owner shall have the right to require Contractor to replace, within ten (10) days of Contractor's receipt of Owner's written notice, any employee or supervisor of Contractor or its Subcontractors.
- 3.4.4 Contractor shall notify Owner of potential jurisdictional disputes of or claims of two or more trades for work and shall consult with the Owner relative to any potential or actual slowdowns, stoppage, picketing or any other action that might result in labor disputes or work disruption at the Project Site.
- 3.4.5 To expedite inspection and testing of materials, the Contractor shall furnish complete statements to the Architect as to the origin, composition and manufacture of all materials to be used in the Work. Such statements shall be furnished promptly after execution of the Contract but, in all cases, prior to delivery of such materials. At the Owner's option, materials may be approved at the source of supply before delivery to the site. If it is found after trial that sources of supply for previously approved materials do not produce specified products, the Contractor shall furnish materials from other sources approved by Owner.
- 3.5.1 Contractor agrees to preserve for Owner any and all warranties furnished by Subcontractors and materialmen. In the event Contractor is unable to obtain from any Subcontractor or materialmen the warranty required by the Contract Documents, Contractor expressly assumes the risk of providing such warranty in lieu of the warranty sought from such Subcontractor or materialmen. Contractor shall accept no limitation of remedies or exclusion of warranties clauses in its Subcontracts or purchase orders or, alternatively, if such clauses are included in its Subcontracts or purchase orders, Contractor agrees to be fully liable to Owner for all damages sustained by the Owner or those claiming through the Owner notwithstanding such limitation or exclusion clauses. The Owner shall not be bound by any limiting language or clauses contained in any Subcontract or purchase order entered into by Contractor and no limiting language or clauses shall reduce, affect or limit in any way Contractor's liability to Owner. Any exception to this provision must be agreed to in writing by Owner.
- 3.7.4 (related to concealed or unknown conditions): line 6, delete 21 days and insert 7 days.
- 3.7.6 Where requirements of the Contract Documents differ from laws, ordinances, rules, regulations, orders, the Building Code or the requirements of authorities having

jurisdiction, the more stringent requirements shall govern. Subject to the provisions of Subparagraph 3.7.2, any major changes in the scope of the Work as the result of laws, ordinances, rules, regulations, orders or the Building Code, the requirements of which are more stringent than the Contract Documents, shall be accompanied by appropriate Change Order Request from the Contractor.

- 3.7.7 On behalf of the Owner, the Contractor shall file a Notice-Of-Commencement, in accordance with State of Florida laws, with the applicable jurisdiction for the project.
- 3.9.2 Delete existing paragraph 3.9.2 and insert: "Contractor's superintendent(s) and/or project manager(s) shall have had recent experience in the type of Work to be performed under this Contract which shall be specified in a written Notice to Owner. Owner shall be deemed to accept such person(s) unless, within fourteen (14) days after receipt of such notice, Owner objects in writing to the selection. If Owner so objects, Contractor shall select another person and the above process shall be repeated. No adjustment in Contract time or Contract Sum shall be permitted for compliance with this subparagraph. Should Contractor's superintendent or project manager have to be replaced during the course of this Contract, this subparagraph shall apply."
- 3.11.1 The Job Superintendent, and the plumbing, heating, ventilation and electrical subcontractors shall make and keep current red line corrections on drawings, showing exact location of underground lines. The red line drawings shall include all underground or concealed pipes, conduit, ducts, and all existing items which were not installed exactly as shown on drawings. Failure to keep record drawings current will delay processing of monthly payments.
- 3.12.11 Architect's approval of Shop Drawings or Samples of Product Data which deviate from the Contract Documents does not authorize change to the Contract. Any changes to the Contract affected by such Shop Drawings, Samples or Product Data, shall be recorded by the Contractor on the as-builts record drawings. Construction cost associated with changes indicated in approved shop drawing shall be borne by the Contractor who proposes the change.
- 3.13.1 Contractor's proposed use of the Site shall be subject to Owner's prior written approval.
- 3.15.3 At reasonably frequent intervals during progress of Work, Contractor shall clean up site, building and access, and dispose of waste materials, rubbish and debris. Contractor shall provide containers and location on site for collection of waste materials, rubbish and debris. Contractor shall not allow waste materials, rubbish and debris and debris to accumulate and become an unsightly or hazardous condition.

Contractor shall lower waste materials in a controlled manner with as few handlings as possible and shall not drop or throw materials from heights. Contractor shall schedule cleaning operations so that dust and other contaminants resulting from cleaning process will not fall on wet, newly painted surfaces.

Contractor shall schedule clean-up operations such that it does not interfere with the Owner's operations should that apply.

Contractor shall conduct clean-up and disposal operations to comply with local ordinances and anti-pollution laws. Burning or burying of rubbish and waste materials on the site is not permitted. Disposal of volatile fluid wastes (such as mineral spirits, oil, or paint thinner) in storm or sanitary sewer systems or into

streams or waterways or onto the ground is not permitted. Contractor shall remove waste materials, rubbish and debris from the Site and legally dispose of at public or private dumping areas off Owner's property.

Contractor shall vacuum clean interior building areas when ready to receive finish painting and continue vacuum cleaning on an as needed basis until the building areas are ready for Beneficial Occupancy.

3.18.1 (related to indemnification), first sentence, will be amended, in part, to read, "To the fullest extent permitted by law the Contractor shall indemnify and hold harmless the Owner, Architect, Architect's consultants, and agents, employees of any of them from and against claims, damages, losses and expenses, including, but not limited to attorneys' fees, arising out of or resulting from performance of the Work.

ARTICLE 4 - ARCHITECT

4.2.4.1 The Owner and Contractor shall issue all communications between each other simultaneously to the Architect.

ARTICLE 7 - CHANGES IN THE WORK

- 7.1.4 If Contractor wishes to make a claim for an increase in the Contract Sum, he shall give Owner written notice thereof within ten days after the occurrence of the event given rise to such claim. The amount of the adjustment shall be determined by one of the methods set forth in subparagraph 7.3.3. Any change in the Contract Sum resulting from such claim shall be authorized by written Change Order and shall not be valid or effective unless the written Change Order has been signed by Contractor, Owner and Architect.
- 7.2.2 For change order work, the maximum allowance of 5% profit and 10% overhead shall apply to the Contractor for work performed by his forces and to subcontractors and sub-subcontractors (combined if by both) for actual receipted material and direct labor costs. The Contractor may mark up subcontractor and sub-subcontractor cost by 5% maximum.
- 7.3.3.5 For each method previously listed (7.3.3.1 through 7.3.3.4) The Contractor shall submit a detailed cost breakdown for each task listed in a Proposal Request, AIA Doc. G709, or Change Order request. A cost breakdown shall mean the elements listed in 7.3.7.1 through 7.3.7.5. All cost elements shall be related directly to the tasks listed in the Proposal Request or Change Order Request. Other than profit, overhead and bond premiums, no cost shall be determined in a percentage basis. The Contractor shall submit a reply to the Architect's Proposal Request within ten (10) days of its date unless a letter is received by the Architect prior to the tenth day stating the cause for a delayed response. Upon receipt of a Contractor response, the Owner and Architect shall review the amounts. The Architect shall prepare a change order directive, AIA Doc. G701 as negotiated or deny the change order request; or, direct the work of the change order as allowed by Subparagraph 7.3.7.
- 7.3.3.6 Mark-ups for overhead, profit and commission shall be per subparagraph 7.2.2
- 7.3.5.1 In the event of failure to reach a timely agreement on a proposal submitted by the Contractor, the Architect and Owner may direct the Contractor to proceed whereby

the cost shall be determined in accordance with 7.3.7 but in no case shall that cost exceed the increase of the proposal.

7.4.1 Minor changes so documented may, at a later date, be incorporated into the Drawings or Specifications, but this will in no way be cause for Contractor to make claim for additional cost or time if such claim has not been made promptly at the time of receipt of such instructions.

ARTICLE 8 - TIME

- 8.3.4 In case of claims for extension of time because of adverse weather, such extension of time shall be granted only when adverse weather prevented the execution of major items or Work on normal working days. The Contractor must notify the owner immediately [within one (1) hour] when a weather delay takes place. The Contractor shall provide an estimate of the probable effect of such delay on the progress of the Work. "Adverse weather" shall be defined to indicate weather which is not normal (on a 5 year average) for the Site.
- 8.3.5 For each calendar day that any part of the Work remains uncompleted after the expiration of the Contract Time; including all extensions and adjustments as agreed, sums set out in the Agreement Between Owner and Contractor as liquidated damages, shall be deducted from any monies due Contractor or, if no money is due Contractor, Owner shall have the right to recover said sum or sums from Contractor, from the surety, or from both. The amount of these deductions are to cover liquidated damages to Owner incurred by additional and other expenses due to the failure of Contractor to complete the Work or any part of the work within the time specified, and such deductions are not to be considered as penalties. The sums represent liquidated damages for the loss to Owner on account of the expense due to the employment of the Architect and to any other expenses after the expiration of completion time.
- 8.3.6 By permitting the Contractor to continue and finish the Work, or any part of it, after the date fixed for its completion or after the date to which the time for completion may have been executed, will in no way serve as a waiver on the part of the Owner of any of its rights under the Contract.
- 8.3.7 There shall be no changes in the time limits allotted for Substantial Completion of the Work except by Change Order. Provisions similar to this are included in all contract documents governing work to be performed under this Contract. In the event that Contractor fails to complete any of the various work elements in the allotted time, he shall be liable for additional costs, including all attorney's fees, which are incurred by Owner because of failure of Contractor to complete such work within such time limits.
- 8.3.8 The Contractor shall cooperate with the Owner in order to maintain the contractual schedule. If Owner determines Contractor is falling behind schedule, contractor must, upon written request of Owner, submit to the Architect and Owner operational plans detailing Contractor's plan of action to regain lost time. If Owner determines it is in its own interest, Contractor shall comply with Owner's written orders to Contractor to take such steps as are necessary to improve progress of the Work. These steps may include, but are not limited to, expediting delivery times, or increasing overtime operations. No additional compensation will be made to Contractor for work done under this subparagraph.

ARTICLE 9 - PAYMENTS AND COMPLETION

- 9.2.1 The Schedule of Values shall breakdown the bid price in an organized manner to conform to the Technical Specification Index. Include cost of all required building permits, fees, premiums, bonds, etc.
- 9.2.2 When the Owner seeks exemption from the Florida State Sales Tax, the Schedule of Values shall have a column added separating the materials and building equipment costs from other costs for each line item.
- 9.3.1.3 The Architect may require a rough draft of the proposed application to review with the Contractor prior to submitting the final submittal.
- 9.7.1 Anything to the contrary notwithstanding, Contractor may not stop the Work for Owner's failure to pay if Owner's nonpayment is caused by defects in the Certificate for Payment.
- 9.8.1.1 Substantial completion cannot be achieved by the Contractor without express written approval of the public authorities having jurisdiction over the work.

ARTICLE 10 - PROTECTION OF PERSONS AND PROPERTY

- 10.2.1.4 The Contractor shall be responsible for repair of Contractor damages to any utility lines that are visible, shown on Contract Documents or made known in advance to the Contractor. The Contractor shall promptly report to the Architect any damages to lines not made known to him in advance. Locations of underground lines shown in the drawing are based on best available information, but are not necessarily exact in regard to location or number of lines.
- 10.2.8.1 Contractor agrees to abide by OSHA and any other safety regulations or regulatory agencies. Contractor will promptly report to Architect all lost time, injuries or property damage involving its work or employees. Such report shall be in writing and in a form acceptable to Architect.
- 10.2.9 When required by law or for the safety of the Work, Contractor shall shore up, brace, underpin and protect foundations and other portions of existing structures which are in any way affected by the Work. Contractor, before commencement of any part of the Work, shall give any notices required to be given to adjoining landowners or other parties.

ARTICLE 11 - INSURANCE AND BONDS

- 11.1.3 (related to certificates of insurance), second sentence will be amended to read, "These certificates and the insurance provisions required by this Section 11.1 shall contain a provision that coverages afforded under the policies will not be <u>changed</u>, canceled or allowed to expire until at least 30 days' prior written notice has been given to the Owner.
- 11.1.5 Certificates of Insurance for all required insurance coverages shall be forwarded to the Owner prior to the beginning of construction. All insurance shall remain in effect until the Owner accepts the project as substantially complete. The Contractor shall include the cost of this insurance as part of his original bid.

11.1.5.1 Insurance Requirements.

A. Contractor's insurers shall maintain an AM Best Rating of at least A-: IX and must be licensed in the state where work is being done. Contractor's insurance coverage must be written on a per Occurrence form.

B. Contractor's Commercial General Liability, Automobile Liability, Pollution Liability (when applicable) and Umbrella Liability policies shall be endorsed to name Suwannee County School Board (SCSB), its Officers, Trustees, employees, and independent contractors as Additional Insureds.

C. Contractor's insurance policies must

(1) include a waiver of subrogation in favor of SCSB,

(2) with respect to required liability policies, provide cross liability coverage as would be achieved under the standard ISO separation of insured clause;

(3) stipulate that with the exception of property insurance, the Contractor's policies of insurance shall be considered as primary insurance and any similar policy maintained by SCSB shall be considered as excess and non-contributory;

(4) designate SCSB as an additional insured (excepting Contractor's Workers' Compensation and Professional Liability (if applicable) policies) using ISO endorsement forms set forth below.

(5) provide coverage to SCSB for any and all bodily injury and property damage claims, costs and expenses arising out of or in any way relating to work or operations performed under this Agreement, including but not limited to bodily injury claims by employees of Contractor, regardless of whether Contractor's negligence, acts or omissions caused, contributed to or are alleged to have caused or contributed to the injury, damage or loss for which the claim is made

D. Contractor's failure to maintain the aforementioned insurance at any time required by this Agreement is a material breach of its obligations under this Agreement. In the event of any such breach, Contractor shall be liable to SCSB for any and all costs, liabilities, damages, penalties or expenses (including but not limited to attorneys fees, court and settlement expenses) sustained by Devereux in the handling, adjustment, defense and/or settlement of any claim that would otherwise be covered by such insurance.

E. Contractor shall provide SCSB with thirty (30) days' advanced written notice of the cancellation, non-renewal or material adverse change to the specified coverage and limits.

F. Prior to the commencement of any work, Contractor shall provide the SCSB Finance Director or his/her designee with Certificates of Insurance and relevant endorsements for all policies set forth above evidencing that Contractor and all sub- contractors, sub-consultants, independent contractors and any other person/entity performing duties under this Agreement on Contractor's behalf, have insurance coverage within the limits specified in this Agreement and have named SCSB as an additional insured [excepting Contractor's Workers' Compensation and Professional Liability (if applicable) policies] as described above.

G. Contractor shall monitor the compliance of sub-contracting parties with these insurance requirements, including maintaining Certificates of Insurance throughout the term of the contract. In the event Contractor fails to obtain the required certificates of insurance from the Subcontractor and a claim is made or suffered, the Contractor shall indemnify, defend and hold harmless SCSB from any and all claims for which the required insurance would have provided coverage. This indemnity obligation is in addition to any other indemnity obligation provided in the Contract.

11.1.5.2 <u>Minimum Coverage Limits.</u>

A. Contractor's requirements. Contractor shall obtain and maintain at all times during the course of this Agreement the following insurance and minimum limits:

(1) Workers' Compensation as required in compliance with the limits established by all applicable State and Federal law in which the work is to be performed and Employer's Liability Insurance with minimum limits of \$500,000 bodily injury for each employee, \$500,000 Disease Policy limit and \$500,000 Disease limit for each employee.

(2) Commercial General Liability Insurance on an "occurrence" basis including coverage for Premises and Operations, Products and Completed Operations, Personal Injury and Advertising Injury, Broad Form Property Damage, Independent Contractors, Broad Form Blanket Contractual Liability, "All Risk" Legal Liability, Coverage for Explosion, Collapse and Underground Property Damage (XCU), and Medical Payments. The minimum Limits of Liability required shall be:

Limit Per Occurrence	\$1,000,000
Personal Injury/Advertising Injury	\$1,000,000
Policy General Aggregate	\$2,000,000 with a "Per Project
	Aggregate Endorsement"
Product/Completed Operations	\$2,000,000
Medical Payments	\$10,000 each person
"All Risk" Legal Liability	\$100,000

Contractor's Commercial General Liability must include completed operations coverage and must be maintained for two (2) years from the day the work has been completed or the date of the last payment, whichever is later. Additional Insured coverage during the project, and for an additional two-year period for products/completed operations, shall be provided under ISO additional insured endorsement CG 20 10 or CG 20 33 **AND** CG 20 37 or substitute form(s) providing equivalent coverage.

(3) Automobile Liability Insurance covering any owned, hired or non-owned vehicle or other vehicle used in the performance of services hereunder in the amount of \$1,000,000 combined single limit per occurrence and including any statutorily mandated "No-Fault" Personal Injury Protection, medical payments or Uninsured/Underinsured Motorist coverage.

(4) Umbrella Liability Insurance shall provide following form coverage in excess of the above mentioned automobile, employers' and general and professional liability (if applicable) policies. Contractor's Umbrella policy shall be at least as broad in coverage as the primary layer policies and will contain no exclusion not on the primary layer policies. Minimum coverage limit required is:

_____\$5.0 million per occurrence and in the aggregate for those contractors involved in Excavation, Site Work, Blasting, Demolition, Roofing or any other operation involving work at heights in excess of 20 feet, or any work involving the hiring of a general contractor and/ or construction manager for the construction of a new building or renovation of an existing building with a total value in excess of \$250,000.

____\$1.0 million per occurrence and in the aggregate for all other operations.

(5) Payment and Performance Bonds in an amount equal to 100% of the contract value are required for all projects of \$1.0 million or more. Performance and Payment Bonds may be required on other projects, subject to the judgment of SCSB's CFO. A letter from a surety evidencing the Contracting Party's ability to secure such bonds is required for any project greater than \$250,000 but less than \$1.0 million.

B. Subcontractor's requirements. Subcontractors shall be required to obtain and maintain at all times all insurances and minimums limits listed in Section II A(1) - (4) above.

C. Additional Insured Endorsement. All policies set forth above must be maintained for two (2) years from the day the work has been completed. Additional Insured coverage during the project,

and for the additional two year period for products/completed operations, shall be provided under ISO additional insured endorsement CG 20 10 or CG 20 33 **AND** CG 20 37 or substitute form(s) providing equivalent coverage.

D. The insurance requirements and other provisions of this Agreement shall not limit the Contractor's indemnification obligations set forth in elsewhere in this Agreement.

ARTICLE 11.3 PROPERTY INSURANCE:

- 11.3.1.4.1 Although the Owner pays the Contractor for materials stored on site, it is the responsibility of the contractor to protect these materials from theft.
- 11.3.3 (related to loss of use insurance), second sentence will be amended to read, "The Owner waives all rights of action against the Contractor for loss of use of the Owner's property, including consequential damages due to fire or other hazards, however caused, <u>unless such loss is determined to be due to the negligence of the</u> <u>Contractor, subcontractor, sub-subcontractor or any other party providing services</u> <u>on behalf of the Contractor."</u>
- 11.3.5 (related to property insurance), first sentence will be amended to read, "If during the Project construction period the Owner insures properties, real or personal or both, at or adjacent to the site by property insurance under policies separate from those insuring the Project, or if after final payment property insurance it to be provided on the completed Project through a policy or policies other than those insuring the project during the construction period, the Owner shall waive all rights in accordance with the terms of Section 11.3.7 for damages caused by fire or other causes of loss covered by this separate property insurance, to the extent of such insurance, <u>unless such loss is determined to be due to the negligence of the Contractor, subcontractor, sub-subcontractor or any other party providing services on behalf of the Contractor."</u>
- 11.3.7 (related to waivers of subrogation), first sentence will be amended to read, "The Owner and the Contractor waive all rights against (1) each other and any of their subcontractors, sub-subcontractors, agents, employees, each of the other, and (2) the Architect, Architect's consultants, separate contractors described in Article 6, if any, and any of their subcontractors, sub-subcontractors, agents and employees, for damages caused by fire or other causes of loss to the extent covered by property insurance obtained pursuant to this Section 11.3 or other property insurance applicable to the Work, except such rights as they have to proceeds of such insurance held by the Owner, as fiduciary, <u>unless such loss is determined to be due to the negligence of the Contractor, subcontractor, sub-subcontractor or any other party providing services on behalf of the Contractor."</u>
- 11.3.9 (related to owner's bond upon occurrence of insured loss), first sentence shall be amended to read, "If required in writing by a party in interest, the Owner as fiduciary shall, upon occurrence of an insured loss, give bond for proper performance of the Owner's duties, at the expense of that party in interest."

ARTICLE 11.4 PERFORMANCE BOND AND PAYMENT BOND:

11.4.1 Delete the existing paragraph and insert the following: The Contractor shall furnish Performance Bonds and Labor & Material Payment Bonds at least equal to the Contract price as security for the faithful performance and payment of all Contractor's obligation under the Contract. These bonds shall identify the Owner as the beneficiary; and, shall remain in effect until one (1) year after the date of final payment, except as otherwise provided by law. Contractor shall also furnish such other bonds as are required by the Supplementary Conditions. All bonds shall be in the forms prescribed by the bidding documents or Supplementary Conditions and be executed by such sureties as (a) are licensed to conduct business in the State of Florida and (b) are named in the current list of "Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and as Acceptable Reinsuring Companies" as published in Circular 570 (amended) by the Audit Staff Bureau of Accounts, U.S. Treasury Department. All bonds signed by an agent must be accompanied by a certified copy of authority to act.

- 11.4.1.1 If the surety of any bond furnished by Contractor is declared bankrupt or becomes insolvent or its right to do business is terminated in Florida. Contractor shall, within five (5) days thereafter, substitute another bond and surety, both of which shall be acceptable to Owner.
- 11.4.1.2 All surety companies are subject to approval and may be rejected by the Owner without cause, in the same manner that bids may be rejected.

ARTICLE 13 - MISCELLANEOUS PROVISIONS

- 13.1.1 If any covenant, condition or provision contained in the Contract Documents is held to be invalid by any court of competent jurisdiction, such invalidity shall not affect the validity of any other covenant, condition or provision therein contained.
- 13.5.7 Inspections or tests not identified in the Contract Documents, determined by Contractor to be of his/her benefit and ordered by Contractor, shall be paid for by the Contractor.
- 13.5.8 If a proposed substitution requires investigation, testing or approval to determine its suitability for incorporation into the Work, the testing of the proposed substitution shall be determined by the Architect. Contractor shall bear all costs of such investigations or tests, including the Architect's additional services made necessary by such substitutions.

ARTICLE 14 - TERMINATION OR SUSPENSION OF THE CONTRACT

14.1.2.1 Nothing in 14.1.2 shall authorize payment to Contractor for anticipated profits.

ARTICLE 15 - CLAIMS AND DISPUTES

- 15.1.6 (related to claims for consequential damages) deleted this sub paragraph.
- 15.2.1 (related to claims referred to initial decision maker), third sentence will be amended, in part, to read, "Except for those Claims excluded by this Section 15.2.1, an initial decision shall be required as a condition precedent to mediation binding dispute resolution of any Claim..."
- 15.2.1.1 Any claim for extension of time or damages for delay or acceleration shall be made in writing to the Architect not more than ten (10) days from the commencement of the delay or acceleration; otherwise, it shall be waived. In the case of a continuing delay, only one claim is necessary.

- 15.2.5 (related to rendering the initial decision), last sentence will be amended to read, "The initial decision shall be final and binding on the parties but subject to mediation and, if the parties fail to resolve their dispute through mediation, to binding dispute resolution."
- 15.2.6 (related to mediation of initial decision) deleted this sub-paragraph.
- 15.2.6.1 (related to demand for mediation after initial decision) deleted this sub-paragraph.
- 15.3 (related to mediation), including 15.3.1-15.3.3, deleted this sub-paragraph.
- 15.4 (related to arbitration), including 15.4.1, 15.4.1.1 and 15.4.2-15.4.3 deleted this sub-paragraph.

END OF SECTION 00 73 00

SECTION 00 90 10 - PROJECT FORMS

INSTRUCTIONS:

The forms and certificates listed below are to be used by the Contractor for submissions for contractual and administrative requirements specified herein.

Requirements and instructions on the forms may constitute extensions of, or additions to, the contractual conditions of the contract and the general requirements of the specifications.

Prepare all forms as required with all blank spaces filled in, in ink or typewritten.

PROJECT FORM LISTING:

TITLE	DOCUMENT NUMBER
Architect's Supplemental Instructions	AIA Doc. G710
Change Order	OEF Form 425
Contractor's Affidavit of Payment of Debts and Claims	AIA Doc. G706
Contractor's Affidavit of Release of Liens	AIA Doc. G706A
Consent of Surety Company to Final Payment	AIA Doc. G707
Proposal Request	AIA Doc. G709
Request for Inspection and Occupancy Certificate	OEF Form 110
Certificate of Final Inspection	OEF Form 209
Request for Information	SBBC Form
Project Close-Out Check List	SBBC Form
Project Substantial Completion Check List	SBBC Form
Project Final Close-Out Check List	SBBBC Form

END OF SECTION 00 90 10

SECTION 01 10 00 - SUMMARY OF THE WORK

PART 1 - GENERAL

RELATED DOCUMENTS:

Work of Contract can be summarized by reference to the Contract, General Conditions & Supplementary Conditions, specification sections as listed in the "Index of Specification Sections" bound herewith, drawings as listed in the Drawings and addenda and modifications to the contract documents issued subsequent to the initial printing of this project manual, and including but not necessarily limited to printed matter referenced by any of these.

<u>General:</u> The work of this contract includes the construction of Additions & Remodeling of Select Areas at Suwannee Primary School.

<u>Abbreviated Written Summary:</u> The work includes the provision and installation of all materials and equipment shown on contract drawings and/or specified in the contract specifications unless otherwise noted.

The <u>work</u> includes limited site development, utilities and improvements. This also includes preparation of site areas for new building slabs.

The <u>work</u> includes adherence to the Contractual & General Requirements as identified in the Contract.

The work includes adherence to the Florida Building Code (FBC) 2010 edition.

The <u>work</u> includes coordination of the contractor's planned construction activities with the district's Project Manager as assigned to the project, as well as any persons identified by the district's Project Manager.

The <u>work</u> requires adherence to that identified in the Subsurface Soils Investigation Report and findings.

The new <u>structures</u> include reinforced masonry bearing and non-bearing wall system on concrete footings. The roof structure is steel joists and metal decking.

The <u>exterior finishes</u> include an SBS roof membrane on rigid insulation. The exterior face of the walls shall have a face brick or stucco coating. Existing precast fascias will be relocated at the additions.

The <u>Interior finishes</u> includes ceilings of suspended acoustical panels, painted and textured gypsum wallboard on furring or steel stud framing. Floors are specified to be covered with carpet, ceramic tile, vinyl tile, or urethane paint. Interior doors are all solid core, as specified in the documents.

The <u>Plumbing System</u> includes toilet fixtures, work sinks, condensate and rain water collection, as well as the various piping systems for sanitary sewer and domestic water distribution.

The Plumbing System is further defined under respective Division 22 sections herein.

The HVAC system includes DX systems with AHU's, VAV's with ducted supply and return air.

The HVAC system is further defined under respective Division 23 sections herein.

The <u>Electrical System</u> includes power for convenience and theatre systems, lighting for ordinary illumination and theatre production and wiring for various theatre communication systems.

The Electrical System is further defined under respective Division 26 and 28 sections herein.

The <u>Communications System</u> includes features and infrastructure to support the campus communication system(s) and is further defined under various sections in Division 27.

PART 2 - PRODUCTS

SCHEDULE:

A project time schedule is identified within the bid documents and in other locations of this specification book.

PART 3 - EXECUTION

CONSTRUCTION SUPERVISION

The Contractor shall provide a full time Project Manager or Construction Superintendent. The Project Manager or Superintendent shall not be a subcontractor or tradesman engaged to perform as such on these projects. No work shall be performed by the Contractor or his subcontractors, at the site, unless either of these individuals is on site.

END OF SECTION 01 10 00

SECTION 01 31 00 - SCHEDULES, REPORTS, PAYMENTS

PART 1 - GENERAL

RELATED DOCUMENTS:

Drawings and general provisions of contract, including General and Supplementary Conditions and other Division-1 Specifications sections, apply to work of this section.

COORDINATION:

Coordinate both the listing and timing of reports and other activities required by provisions of this section and other sections, so as to provide consistency and logical coordination between the reports. Maintain coordination and correlation between separate reports by updating at monthly or shorter time intervals. Make appropriate distribution of each report and updated report to all parties involved in the work including the Architect/Engineer and Owner. In particular, provide close coordination of the progress schedule, schedule of values, listing of subcontracts, schedule of submittals, progress reports, and payment requests.

EXISTING CONDITIONS REPORTING:

Contractor shall immediately after notice to proceed, prepare a listing and "photo" report of the adjacent conditions of existing structure(s), <u>prior to start of any construction work.</u> A copy of the photos and report shall be reviewed with and submitted to the architect and owner before demolition begins. Any items/fixtures missing which were to remain or be repaired/restored are to be identified in this report. Any structural cracking or damage to existing structures shall also be reported. Concealed adverse conditions, which could not be observed until demolition begins must be reported immediately as discovered/uncovered. Any and all claims by the contractor without substantiation by said reports and photos will be denied.

CONSTRUCTION PROGRESS SCHEDULE:

<u>Chart Schedule:</u> The form to be used for reporting progress schedules shall be as approved or provided by the Architect. Secure critical time commitments for performing major elements of the work. Within 20 days of the date established for "commencement of the work", submit a completed progress schedule, in accordance with the form instructions.

<u>CPM Scheduling</u>: CPM scheduling is required per the SBBC Contractual & General Conditions. For specific requirements refer to those documents.

<u>Distribution:</u> Following the initial submittal to and response by the Architect/Engineer, print and distribute progress schedules to the Architect/Engineer and Owner (3 copies minimum).

<u>Schedule Updating:</u> Update schedule as required to maintain accurate current information and at least monthly. Minimally, submit three (3) copies minimum with the monthly application for payment.

SUBMITTAL SCHEDULE:

<u>General:</u> Immediately after acceptance of the fully developed progress schedule, prepare a complete schedule of work-related submittals. Correlate this submittal schedule with the listing of principal subcontractors, as required by the General Conditions, and with Section 01 32 00 SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.
SPECIAL REPORTS:

General: Submit special reports directly to the Owner within one day of an occurrence. Submit a copy of the report to the Architect and other entities that are affected by the occurrence.

Reporting Unusual Events: When an event of an unusual and significant nature occurs at the site, prepare and submit a special report. List chain of events, persons participating, response by the Contractor's personnel, an evaluation of the results or effects and similar pertinent information. Advise the Owner in advance when such events are known or predictable.

Reporting Accidents: Prepare and submit reports of significant accidents, at site and anywhere else work is in progress. Record and document data and actions. For this purpose, a significant accident is defined to include events where personal injury is sustained, or property loss of substance is sustained, or where the event posed a significant threat of loss or personal injury.

PROGRESS MEETINGS, REPORTING:

<u>General:</u> In addition to specific coordination and pre-installation meetings for each element of work, and other regular project meetings held for other purposes, hold general progress meetings each month with time coordinated with preparation of the payment requests. Review each entity's present and future needs including interface requirements, time, sequences, deliveries, access, site utilization, temporary facilities and services, hours of work, hazard and risks, housekeeping, change orders, and documentation of information for payment requests. Discuss whether each element of current work is ahead of schedule, on time, or behind schedule in relation with updated progress schedule. Determine how behind-schedule work will be expedited, and secure commitments from entities involved in doing so. Discuss whether schedule revisions are required to ensure that current work and subsequent work will be completed within Contract Time. Review everything of significance which could affect progress of the work.

<u>Initial Progress Meeting</u>: Schedule initial progress meeting, recognized as "Pre-Construction Conference", for a date not more than 10 days after date of commencement of the work. Use it as an organizational meeting, and review responsibilities and personnel assignments.

<u>Reporting:</u> Within 3 days after each progress meeting date, distribute copies of minutes-of-themeeting to each entity present and to others who should have been present. Include brief summary (in narrative form) of progress of the work since previous meeting and report.

<u>Schedule Updating</u>: Immediately following each progress meeting, where revisions to progress schedule have been made or recognized, revise progress schedule. Reissue revised schedule concurrently with report of each meeting.

<u>Daily Reports</u>: Prepare a daily report, recording the following information concerning events at the site; and submit duplicate copies to Architect/Engineer at regular intervals <u>not exceeding</u> <u>weekly intervals</u>:

List of subcontractors at the site List of separate contractors at the site Approximate count of personnel at the site High/low temperatures, general weather conditions Accidents (refer to accident reports) Meetings and significant decisions Unusual events (refer to special reports) Stoppages, delays, shortages, losses Meter readings and similar recordings Emergency procedures, field orders Orders/requests by governing authorities Change orders received, implemented Services connected, disconnected Equipment system tests and start-ups Partial completions, occupancies Substantial completions approved

SCHEDULE OF VALUES:

<u>General:</u> Prepare the schedule of values, as required by the General Conditions, in conjunction with the preparation of the progress schedule. Coordinate preparation of schedule of values and progress schedule. Correlate line items with other administrative schedules and the forms required for the work, including the progress schedule, payment request form, listing of subcontractors, schedule of allowances, schedule of alternatives, listing of products and principal suppliers and fabricators, and the schedule of submittals. Provide breakdown of the Contract Sum, by specification section, in sufficient detail to facilitate continued evaluation of payment requests and progress reports. Break down principal subcontract amounts into several line items. Round off to the nearest whole dollar, but with the total equal the Contract Sum. Submit for review and approval by A/E prior to first application submittal.

PAYMENT REQUESTS:

<u>General:</u> Except as otherwise indicated, the progress payment cycle is to be regular. Each application must be consistent with previous applications and payments. Certain applications for payment, such as the initial application, the application at substantial completion, and the final payment application involve additional requirements.

<u>Waivers of Lien:</u> Submit waivers of lien, per the Contractual & General Conditions, from every entity (including Contractor) who could lawfully and possibly file a lien in excess of \$200 arising out of the Contract, at intervals identified within those documents. Submit partial waivers for the amount requested, prior to deduction or retainage, on each item. When the application shows completion of an item, submit final or full waivers. The Owner reserves the right to designate which entities involved in the work must submit waivers.

<u>Payment Application Times:</u> The "date" for each progress payment application is as indicated in Owner-Contractor Agreement or, if none is indicated therein, it is the 25th day of each month. The period of construction work covered by each payment request is period indicated in Owner-Contractor Agreement or, if none is indicated therein, it is the 25th day of previous month or day following end of previous period to 24th day of present month.

<u>Application Preparation:</u> Except as otherwise indicated, complete every entry provided for on the form, including notarization and execution by authorized persons. Incomplete applications will be returned by Architect/Engineer without action. Entries must match current data of schedule of values and progress schedule and report. Listing must include amounts of change orders issued prior to last day of the "period of construction" covered by application.

Payment will be for work installed in place in a correct and operable manner. Payment for material stored at the project site will not be considered in the application for payment process.

<u>Initial Payment Application</u>: The principal administrative actions and submittals which must precede or coincide with submittal of contractor's first payment application can be summarized as follows, but not necessarily by way of limitation submit at least three (3) copies of each unless noted elsewhere to be more:

Listing of subcontractors and principal suppliers and fabricators

Schedule of values

Progress schedule

Schedule of submittals

Listing of Contractor's staff assignments and principal consultants

Copies of acquired building permits and similar authorizations and licenses from governing authorities for current performance of the work

Performance and/or payment bonds

Evidence satisfactory to Owner that Contractor's insurance coverage have been secured

Data needed to acquire Owner's insurance coverage

Typical Monthly Payment Application:

Provide at least three (3) copies of the following items by transmittal listing each.

- Application For Payment, properly numbered
- Updated Schedule of Values
- Updated Progress Schedule
- Waivers of Lien
- Stored Material invoices

<u>Application at Time of Substantial Completion:</u> Following issuance of Architect's or Engineer's "certificate of substantial completion", and as applicable, a payment application may be prepared allowing 100% completion of the work, if it is 100% completed, minus the retainage; and, submitted by Contractor. The principal administrative actions and submittals which must proceed or coincide with such special applications are summarized under Section 01 77 00 - PROJECT CLOSE-OUT.

<u>Final Payment Application</u>: The administrative actions and submittals which must precede or coincide with submittal of contractor's final payment application are also summarized under Section 01 77 00 - PROJECT CLOSE-OUT.

<u>Application Transmittal:</u> Submit 3 originally executed copies of each payment application. Transmit each copy with a transmittal form listing those attachments, and recording appropriate information related to application in a manner acceptable to Architect/Engineer. Transmit to Architect/Engineer by means ensuring receipt within 24 hours.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 01 31 00

SECTION 01 33 00 - SHOP DRAWINGS, PRODUCT DATA AND SAMPLES

PART 1 - GENERAL

RELATED DOCUMENTS:

Drawing and general provisions of contract, including General and Supplementary Conditions and other Division 1 Specifications Sections, apply to work of this section. Pay special attention to Section 01 60 00, Products and Substitutions.

DESCRIPTION OF REQUIREMENTS:

<u>General:</u> This section specifies procedural requirements for non-administrative submittals including shop drawings, product data, samples and other miscellaneous work-related submittals. Shop drawings, product data, samples and other work-related submittals are required to amplify, expand and coordinate the information contained in the Contract Documents.

<u>Shop drawings</u> are technical drawings and data that have been specially prepared for this project, including but not limited to the following items:

- Coordination drawings
- Fabrication and installation drawings
- Schedules
- Design mix formulas
- Contractor's engineering calculations
- Specialty engineering calculations and drawings.

Standard information prepared without specific reference to a project is not considered to be shop drawings.

<u>Product data</u> includes standard printed information on manufactured products that has not been specially-prepared for this project, including but not limited to the following items:

- Manufacturer's product specifications and installation instructions
- Standard color charts
- Catalog cuts
- Printed performance curves
- Operational range diagrams
- Mill reports
- Standard product operating and maintenance manuals

Samples are physical examples of work, including but not limited to the following items:

- Partial sections of manufactured or fabricated work
- Small cuts or containers of materials
- Complete units of repetitively-used materials
- Swatches showing color, texture and pattern
- Color range sets
- Units of work to be used for independent inspection and testing

<u>Mock-ups</u> are special forms of samples, which are too large or otherwise inconvenient for handling in the manner specified for transmittal of sample submittals.

<u>Miscellaneous submittals</u> are work-related, non-administrative submittals that do not fit in the three previous categories; including, but not limited to the following:

- Specially prepared and standard printed warranties
- Maintenance agreements
- Workmanship bonds
- Project photographs
- Testing and certification reports
- Record drawings
- Field measurement data
- Operating and maintenance manuals
- Keys and other security protection devices
- Maintenance tools and spare parts
- Overrun stock

SUBMITTAL PROCEDURES:

<u>Coordination:</u> Coordinate the preparation and processing of submittals with the performance of the work. Coordinate each separate submittal with other submittals and related activities such as testing, purchasing, fabrication, delivery and similar activities that require sequential activity.

<u>Scheduling:</u> In each appropriate administrative submittal, such as the progress schedule, show the principal work-related submittals and time requirements for coordination of submittal activity with related work.

<u>Coordination of Submittal Times:</u> Prepare and transmit each submittal to the Architect/Engineer within **45 days** of the date of the notice to proceed. Coordinate the submittal of different units of interrelated work so that one submittal will not be delayed by the Architect/Engineer's need to review a related submittal. The Architect/Engineer reserves the right to withhold action on any submittal requiring coordination with other submittals until related submittals are also received.

Contractor's Review: Before submittal of items for review, the Contractor shall check and verify all pertinent field dimensions, make sure that all submitted items are properly coordinated and conform to the drawing and specifications, noting in colored pencil (any color except red) any modifications necessary to bring them into conformity. Shop drawings shall indicate the location of the different items shown on same, or make reference to the sheet number of the contract specifications to which they refer, and shall further indicate compliance with the referenced technical society or organization specifications. It shall be the Contractor's responsibility to see that shop drawings are submitted in logical groups to permit a complete review. Individual components which depend upon the proper selection of other components of a system are not to be submitted separately. In the event an item is submitted independently, to expedite procurement or for other reasons, and it is later discovered to be a poor selection due to the influence of items which are submitted for review in a different submission, the Contractor shall have the full responsibility for taking corrective action as directed by the Architect and at no additional cost to the Owner. Partial or incomplete submittals will be returned without review. The Contractor shall certify that he has verified the correctness, completeness and adequacy of all items submitted by suitable stamp and his signature.

Shop drawings submitted without Contractor's certification, and shop drawings which are not complete, may be returned for proper submission.

<u>Review Time:</u> Allow sufficient time so that the installation will not be delayed as a result of the time required to properly process submittals, including time for resubmittal, if necessary. Advise the Architect/Engineer on each submittal, as to whether processing time is critical to the progress of the work and if the work would be expedited if processing time could be shortened.

Allow two weeks (10 work days) from receipt by the Architect/Engineer's for initial processing of each submittal. Allow a longer time period where processing must be delayed for coordination

with subsequent or concurrent submittals. The Architect/Engineer will advise the Contractor when it is determined that a submittal being processed must be delayed for coordination.

Allow one week (5 work days) from receipt by the Architect for reprocessing each submittal.

No extension of time will be authorized because of the Contractor's failure to transmit submittals to the Architect/Engineer sufficiently in advance of the work.

Submittal Preparation: Mark each submittal with a permanent label for identification.

<u>Submittal Transmittal:</u> Package each submittal appropriately for transmittal and handling. Transmit each submittal from the Contractor to the Architect/Engineer, and to other destinations as indicated, by use of a transmittal form. <u>Submittals received from sources other than the</u> <u>Contractor will not be reviewed.</u>

Shop drawing delivery and pick up at the Architect's office is the responsibility of the Contractor.

Architect will provide only a review comment sheet to contractor as the review.

Architect will only ship, only submittals back to the Contractor at the Contractor's cost. Contractor's shipping account number must be provided prior to shipment. If the submittal is electronic and of a suitable file size to be easily e-mailed, that is the best.

Provide on the form places for the following information:

- Project name
- Date
- To:
- From:
- Names of subcontractor, manufacturer and supplier
- References
- Specification section number and type of submittal
- Submittal purpose and description
- Submittal and transmittal distribution record
- Signature of transmitter
- Contractor's certification stating that the information submitted complies with the requirements of the Contract Documents, with a place for the Contractor's signature

<u>Submittal Log:</u> Prepare a submittal log indicating submittal type, extent of all anticipated submittals and chronological disposition of each. Submit initial log showing anticipated submittals for review and acceptance by Architect. Special attention shall be given to those submittals requiring color selection or long lead items.

SPECIFIC SUBMITTAL REQUIREMENTS:

<u>SHOP DRAWINGS:</u> Information required on shop drawings includes, dimensions, identification of specific products and materials which are included in the work compliance with specified standards and notations of coordination requirements with other work. Provide special notation of dimensions that have been established by field measurement. <u>Highlight, encircle or otherwise indicate deviations from the contract documents on the shop drawings.</u>

Refer to all Sections for additional general requirements applicable to shop drawings.

Do not permit shop drawing copies without an appropriate final "Action" marking by the Architect/Engineer to be used in connection with the work.

Or, submit a .pdf file of newly prepared information, drawn to accurate scale. Indicate the name of the firm that prepared each shop drawing and provide appropriate project identification in the title block. Submit three (3) signed and sealed sets of shop drawings and data for construction materials and systems specified to be pre-engineered or engineered by others than the architect and engineers-of-record for this work.

Do not reproduce contract documents or copy standard printed information as the basis of shop drawings.

Preparation: Submit newly prepared information, drawn to accurate scale on sheets not less than 8 1/2" x 11" and the maximum sheet size shall not exceed 24" x 36". Indicate the name of the firm that prepared each shop drawing and provide appropriate project identification in the title block.

Do not reproduce contract documents or copy standard printed information as the basis of shop drawings.

<u>PRODUCT DATA</u>; General information required specifically as product data includes manufacturer's standard printed recommendations for application and use, compliance with recognized standards of trade associations and testing agencies, and the application of their labels and seals (if any), special notation of dimensions which have been verified by way of field measurement, and special coordination requirements for interfacing the material, product or system with other work.

Preparation: Collect required product data into a single submittal for each specification section of work. Mark each copy to show which choices and options are applicable to the project.

Where product data must be specially prepared for required products, materials or systems, because standard printed data is not suitable for use, submit data as "Shop Drawings" and not as "Product Data".

Submittals: Product data submittal is required for information and record and to determine that the products, materials and systems comply with the provisions of the contract documents. Therefore, the initial submittal is also the final submittal, except where the Architect/Engineer observes that there is non-compliance with the provisions of the contract documents and returns the submittal promptly to the Contractor marked with the appropriate "Action".

Except as otherwise indicated in individual sections of these specifications, submit 5 copies of each required submittal. The Architect/Engineer will retain 2 - 3 copies, and will return the others marked with "Action" and corrections or modifications as required. Otherwise, the contractor may submit electronic pdf file(s). When a pdf is submitted, the Architect will forward a marked pdf.

Do not submit product data or allow its use on the project, until compliance with the requirements of the contract documents has been confirmed by the Contractor.

Do not proceed with installation of materials, products and systems until a copy of product data applicable to the installation is in the possession of the installer.

<u>SAMPLES</u>: Submit samples for the Architect/Engineer's visual review of general generic kind, color, pattern, and texture, and for a final check of the coordination of these characteristics with other related elements of the work. Samples are also submitted for quality control comparison of these characteristics between the final sample submittal and the actual work as it is delivered and installed.

Documentation required specifically for sample submittals includes a generic description of the sample, the sample source or the product name or manufacturer, compliance with governing

regulations and recognized standards. In addition, indicate limitations in terms of availability, sizes, delivery time, and similar limiting characteristics.

Preparation: Where possible, provide samples that are physically identical with the proposed material or product to be incorporated into the work; provide full scale, fully fabricated samples cured and finished in the manner specified. Where variations in color, pattern, or texture are inherent in the material or product represented by the sample, submit multiple units of the samples (not less than 3 different units), which show the approximate limits of variations. Where samples are specified for the Architect/Engineer's selection of color, texture or pattern, submit a full set of available choices for the material or product. Mount, display, or package samples in the manner specified to facilitate the review of indicated qualities. Prepare samples to match the Architect/Engineer's sample where so indicated. The Architect/Engineer shall retain the samples throughout the life of the work as evidence to the acceptable standard for the work.

Distribution of Samples: Maintain the submittal sets of samples, if returned by the Architect/Engineer, at the project site, available for quality control comparisons throughout the course of performing the work. Prepare and distribute additional sets of samples to subcontractors, suppliers, fabricators, manufacturers, installers, governing authorities, and others as required for proper performance of the work. Show final distribution on transmittal forms.

Mock-up and similar samples specified in individual work sections are special types of samples. Comply with sample submittal requirements to the fullest extent possible. Process transmittal forms to provide a record of activity.

COLOR SELECTION:

Be advised that the Architect shall retain all shop drawings, product and samples until he has received all items requiring color selection. Once <u>all</u> are received, he shall prepare a Color Schedule for the Owner's review. Once approved by the Owner, submittals with the Color Schedule shall be transmitted to the Contractor for his action. In the meantime, the submittals shall not be finally approved by the Architect until approval of the Color Schedule is given by the Owner. There is time involved with this process; therefore, the Contractor is encouraged to provide all submittals requiring color selection as soon after the Notice-to-Proceed as possible.

MISCELLANEOUS SUBMITTALS:

Inspection and Test Reports: Classify each inspection and test report as being either "shop drawings" or "product data" depending on whether the report is specially prepared for the project, or a standard publication of workmanship control testing at the point of production. Process inspection and test reports accordingly.

Warranties: Provide proposed warranty data at early submittals with product data. Refer to section "Project Closeout" for specific general requirements on warranties, product bonds, workmanship bonds and maintenance agreements relative to closeout.

Standards: Where submittal of a copy of standards is indicated, and except where copies of standards are specified as an integral part of a "Product Data" submittal, submit a single copy of standards for the Architect/Engineer's use. Where workmanship, whether at the project site or elsewhere is governed by a standard, furnish additional copies of the standard to fabricators, installers and others involved in the performance of the work.

Closeout Submittals: Refer to section "Project Closeout" and to individual sections of these specifications for specific submittal requirements of project closeout information, materials, tools, extra stock, and similar items.

Record Documents: Refer to section "Project Closeout" and other sections of these specifications for submittal of record documents.

Operating and Maintenance Data: Refer to "Project Closeout" and other sections of these specifications for submittal of this data.

Materials and Tools: Refer to "Project Closeout" and other individual sections of these specifications for required quantities of spare parts, extra and overrun stock, maintenance tools and devices, keys, and similar physical units to be submitted.

ARCHITECT/ENGINEER'S ACTION:

Action Stamp: The Architect/Engineer will stamp each submittal to be returned with a uniform, self explanatory action stamp, appropriately marked and executed to indicate whether the submittal returned is for unrestricted use, final-but-restricted use (as marked), must be revised and resubmitted (use not permitted) or without action (as explained on the transmittal form).

Final Unrestricted Release: Where the submittals are marked as follows, the work covered by the submittal may proceed provided it complies with the requirements of the contract documents; acceptance of the work will depend upon that compliance.

"No Exceptions Taken"

Returned for Resubmittal: When the submittal is marked as follows, do not proceed with the work covered by the submittal, including purchasing, fabrication, delivery, or other activity. Revise the submittal or prepare a new submittal in activity. Revise the submittal or prepare a new submittal in activity. Revise the submittal or prepare a new submittal in activity. Revise the submittal or prepare a new submittal in activity. Revise the submittal or prepare a new submittal in accordance with the Architect's/Engineer's notations stating the reasons for returning the submittals with the following marking to be used at the project site, or elsewhere where work is in progress.

"Revise and Resubmit" "Rejected, Comments Attached"

> PART 2 - PRODUCTS (Not Applicable) PART 3 - EXECUTION (Not Applicable)

END OF SECTION 01 33 00

SECTION 01 40 00 - QUALITY CONTROL SERVICES

PART 1 - GENERAL

DESCRIPTION OF REQUIREMENTS:

<u>Definitions:</u> The requirements of this section relate primarily to customized fabrication and installation procedures, rather than the production of standard products. Quality control services include inspections, tests and related actions, including reports, performed by independent agencies and governing authorities, as well as those contracted directly by the Contractor. **Refer to specific sections throughout the project specifications for the required testing.**

Requirements for the Contractor to provide quality control services, as required by the Architect/Engineer, the Owner, governing authorities or other authorized entities are not limited by the provisions of this section.

The contract enforcement activities performed directly by the Architect/Engineer (design consultants) or owner's independent representative are not a quality control service. Should the Architect/Engineer or owner's independent representative identify defective or non-conforming work or products and be required to inspect the deficiency more than once to confirm if corrections have been made, his services for reinspection shall be an extra to the Owner at his current contracted hourly rates and such charges shall be deducted, by change order, from the construction contract.

RESPONSIBILITIES:

<u>Owner Responsibilities:</u> Except where they are specifically indicated as being the Contractor's responsibility, or where they are to be provided by another identified entity such as testing for standard products; initial inspections, tests and similar quality control services specified to be performed by independent agencies are the Owner's responsibility. The Owner will employ and pay for the services of an independent agency, testing laboratory or other qualified firm to perform, such services.

<u>Retest Responsibility:</u> Where results of required inspections, tests or similar services prove unsatisfactory and do not indicate compliance of related work with the requirements of the contract documents; then, retests by the initial testing firm are the responsibility of the Contractor, regardless of whether the original test was the Contractor's responsibility. Retesting of work revised or replaced by the Contractor is the Contractor's responsibility and the Architect will make the decision for the extent of retesting to be performed.

Testing or inspections of field assembled work is envisioned as a verification on behalf of the Owner that the work complies with the contract requirements. Such inspection(s) are not provided as a replacement for the Contractor's own quality control efforts. The Contractor shall have performed his own quality control checks before notifying the testing agency of a time for their verification. Costs associated to lengthy initial inspections or reinspections, or when required as a result of poor quality control by the Contractor will be borne by the Contractor.

<u>Responsibility for Associated Services:</u> The Contractor is required to cooperate with the independent agency performing required inspections, tests and similar services. Provide such auxiliary services as are reasonably requested. The Contractor shall notify the testing agency sufficiently in advance of operations to permit assignment of personnel. These auxiliary services include but are not necessarily limited to the following:

- Providing access to the work.
- Taking samples or assistance with taking samples.
- Delivery of samples to test laboratories.

- Delivery and protection of samples and test equipment at the project site.

<u>Coordination</u>: The Contractor and each independent agency engaged to perform inspections, tests and similar services for the project shall coordinate the sequence of their activities so as to accommodate required services with a minimum of delay in the progress of the work. In addition the Contractor and each independent testing agency shall coordinate their work so as to avoid the necessity of removing and replacing work to accommodate inspections and tests. The Contractor is responsible for scheduling times for inspections, tests, taking of samples and similar activities.

SUBMITTALS:

<u>General:</u> Refer to Division-1 section on "Submittals" for the general requirements on submittals. Submit a certified written report of each inspection, test or similar service, <u>directly to the</u> <u>Architect/Engineer</u>, in duplicate. If the Contractor is responsible for the service, submit a certified written report of each inspection, test or similar service through the Contractor, in duplicate. Submit additional copies of each written report directly to the governing authority, when the authority so directs.

<u>Report Data:</u> Written reports of each inspection, test or similar service shall include, but not be limited to the following:

- Name of testing agency or test laboratory.
- Dates and locations of samples and tests or inspections.
- Names of individuals making the inspection or test.
- Designation of the work and test method.
- Complete inspection or test data.
- Test results.
- Interpretations of test results.
- Notation of significant ambient conditions at the time of sample-taking and testing.
- Comments or professional opinion as to whether inspected or tested work complies with requirements of the contract documents.
- Recommendations on retesting, if applicable.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

REPAIR AND PROTECTION:

General: Upon completion of inspection, testing, sample-taking and similar services performed on the work, repair damaged work and restore substrates and finishes to eliminate deficiencies, including deficiencies in the visual qualities of exposed finishes. Comply with the contract document requirements for Cutting and Patching. Protect work exposed by or for quality control service activities, and protect repaired work. Repair and protection is the Contractor's responsibility, regardless of the assignment of responsibility for inspection, testing or similar services.

END OF SECTION 01 40 00

SECTION 01 41 00 - PROJECT COORDINATION

PART 1 - GENERAL

DESCRIPTION OF WORK:

Minimum administrative and supervisory requirements necessary for coordination of work on the project include but are not necessarily limited to the following:

Coordination drawings Coordination and meetings Surveys and records or reports Special reports Project safety General installation provisions Cleaning and protection

COORDINATION DRAWINGS AND MEETINGS:

Coordination Drawings: The contractor's staff or a designated subcontractor (usually the HVAC subcontractor) shall prepare coordination drawings where work by separate entities requires fabrication of products and materials which must accurately interface above ceilings, within walls or specialties exposed to view. Coordination drawings shall indicate how work by separate contractors or as shown by separate shop drawings will interface, and shall indicate sequence for installation. Comply with all requirements of the "Submittals" section.

All items which will impact the visual integrity shall be specifically reviewed with the architect. The submittal drawings must be specific and include all components, anchors, etc.

Weekly Coordination Meetings: Hold weekly general project coordination meetings at regularly scheduled times convenient for all parties involved. These meetings are in addition to specific meetings held for other purposes, such as regular project meetings and special pre-installation meetings. Request representation at each meeting by every contractor currently involved in coordination or planning for the work of the entire project. Conduct meetings in a manner which will resolve coordination problems. Record results of the meeting and distribute copies to everyone in attendance and to others affected by decisions or actions resulting from each meeting.

SURVEYS AND RECORDS/REPORTS:

General: Working from lines and levels established by the property survey, establish and maintain benchmarks and other dependable markers. Establish benchmarks and markers to set lines and level for work at each story of construction and elsewhere as needed to properly locate each element of the project. Calculate and measure required dimensions as shown within recognized tolerances. Drawings shall not be scaled to determine dimensions. Advise entities performing work, of marked lines and levels provided for their use.

Surveyor: Engage a Land Surveyor or Professional Engineer experienced and specializing in land survey work, who is registered in the State where the project is located, to perform those services specified in this article.

Survey Procedures: Before proceeding with the layout of actual work, verify the layout information shown on the drawings, in relation to the property survey and existing bench marks. As work proceeds, check every major element for line, level and plumb. Maintain a surveyor's log or record book of such checks; make the log or record book available for the Architect or Engineer's reference. Record deviations from required lines and levels, and advise the Architect

or Engineer promptly upon detection of deviations that exceed indicated or recognized tolerances. Record deviations which are accepted, and not corrected, on record drawings.

Final Property Survey: Before substantial completion, prepare a final property survey and submit per Section 01 32 00 and 01 77 00.

SPECIAL REPORTS:

General: Submit special reports per Section 01 31 00, directly to the Owner within one day of an occurrence. Submit a copy of the report to the Architect and other entities that are affected by the occurrence.

PROJECT SAFETY:

The Contractor and his subcontractor and their subcontractors shall perform all work in accordance with current federal safety standard as established by O.S.H.A. Likewise, the work environment shall be set up and operated in a manner to meet all current federal safety standards as established by O.S.H.A.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

GENERAL INSTALLATION PROVISIONS:

Existing Conditions: All projects have existing conditions whether it be just a site or a building undertaking renovation and/or additions. In any case, within 10 days of the Notice-to-Proceed with the work, the Contractor shall initiate an 'in depth' inspection and record and file with the Owner the existing conditions of all site features, facility features and equipment which are scheduled to remain and be a part of the completed site, building, or operation. The record-of-existing-conditions may be in the form of video tape and photographs of sufficient quantity, size and detail so as to see all items. For equipment or fixtures which are to remain and be functional at the close of the contract, whether renovation, reconditioned or not, the Contractor shall prepare a report which clearly and specifically identifies the function of the individual items at the time of inspection. If no documentation is submitted, the Contractor shall replace or repair existing items at the Owner's directions.

If the Contractor observes conditions with site, building or equipment which are contrary to instructions of the contract documents, he shall notify the district's Project Manager within 48 hours of discovery. All site features, building features and equipment conditions shall become accepted by the Contractor as they exist if not recorded in the manner identified above.

<u>Pre-Installation Conferences:</u> Hold a pre-installation meeting at the project site well before installation of each unit of work which requires coordination with other work. Installer and representatives of the manufacturers and fabricators who are involved in or affected by that unit of work, and with its coordination or integration with other work that has preceded or will follow shall attend this meeting. Advise the Architect of scheduled meeting dates.

Record significant discussions of each conference, and record agreements and disagreements, along with the final plan of action. Distribute the record of meeting promptly to everyone concerned, including the Owner and Architect.

Do not proceed with the work if the pre-installation conference can not be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the work and reconvene pre-installation conference at the earliest feasible date. <u>Installer's Inspection of Conditions:</u> Require the Installer of each major unit of work to inspect the substrate to receive work and conditions under which the work is to performed. The Installer shall report all unsatisfactory conditions in writing to the Contractor. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to the Installer.

<u>Manufacturer's Instructions:</u> Where installations include manufactured products, comply with the manufacturer's applicable instructions and recommendations for installation, to the extent that these instructions and recommendations are more explicit or more stringent than requirements indicated in the contract documents.

Inspect each item of material or equipment immediately prior to installation. Reject damaged and defective items.

<u>Provide attachment</u> and connection devices and methods for securing work. Secure work true to line and level, and within recognized industry tolerances. Allow expansion and building movement. Provide uniform joint width in exposed work. Arrange joints in exposed work to obtain the best visual effect. Refer questionable visual-effect choices to the Architect for final decision.

<u>Recheck measurements</u> and dimensions of the work, as an integral step of starting each installation. The contractor is solely responsible for assuring the project is built to accurate, true and correct dimensions. Any discrepancies in the documents must be referred to the Architect for confirmation or acceptance prior to fabrication or construction.

<u>Install each unit-of-work</u> during weather conditions and project status which will ensure the best possible results in coordination with the entire work. Isolate each unit of work from incompatible work as necessary to prevent deterioration.

<u>Coordinate enclosure</u> of the work with required inspections and tests, so as to minimize the necessity of uncovering work for the purpose.

<u>Mounting Heights:</u> Where mounting heights are not indicated, mount individual units of work at industry recognized standard mounting heights for the particular application indicated. Refer questionable mounting height choices to the Architect for final decision.

EXPOSURES OF WORK:

Limiting Exposures of Work: Supervise performance of the work in such a manner and by such means which will ensure that none of the work, whether completed or in progress, will be subjected to harmful, dangerous, damaging or otherwise deleterious exposure during the construction period. Such exposures include, where applicable, but not by way of limitation of the following:

Excessive static or dynamic loading Excessive internal or external pressures Excessively high or low temperatures Excessively high or low humidity Water Solvents Chemicals Light Puncture Abrasion Heavy traffic Soiling Insect infestation Combustion Improper lubrication, unusual wear Incompatible interface Destructive testing Misalignment Excessive weathering Unprotected storage Improper shipping or handling Theft Vandalism

CLEANING AND PROTECTION:

<u>General:</u> During handling and installation of work at the project site, clean and protect work in progress and adjoining work on the basis of continuous maintenance. Apply protective covering on installed work where it is required to ensure freedom from damage or deterioration at time of substantial completion.

Clean and perform maintenance on installed work as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

END OF SECTION 01 41 00

SECTION 01 42 00 - DEFINITIONS AND STANDARDS

PART 1 - GENERAL

RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division -1 Specification sections, apply to work of this section.

DESCRIPTION OF REQUIREMENTS:

<u>General:</u> This section specifies procedural and administrative requirements for compliance with governing regulations and codes and other standards imposed upon the Work. These requirements include obtaining permits, licenses, inspections, releases and similar documentation, as well as payments, statements and similar requirements associated with regulations, codes and standards.

The term, "Regulations", is defined to include laws, statutes, ordinances and lawful orders issued by governing authorities, as well as those rules, conventions and agreements within the construction industry which effectively control the performance of the work regardless of whether they are lawfully imposed by governing authority or not.

<u>Governing Regulations</u>: Refer to General and Supplementary Conditions for requirements related to compliance with governing regulations.

DEFINITIONS:

<u>Approve/Accept:</u> Where used in conjunction with the Architect's/Engineer's response to submittals, requests, applications, inquiries, reports and claims by the Contractor, the meaning of the term "approved" will be held to limitations of the Architect's/Engineer's responsibilities and duties as specified in General and Supplementary Conditions. In no case will the Architect/Engineer's approval or acceptance be interpreted as a release of the Contractor from responsibilities to fulfill requirements of contract documents.

<u>Architect:</u> The use of the term, Architect-of-Record, within the usual architectural specifications and drawings is consistent with the Architect who signs and seals the documents. For Divisions 2, 15 and 16 it shall collectively refer to the Architect-of-Record, the Engineers-of-Record for the various disciplines and the Owner's project representatives.

<u>Directed, Requested, Etc.</u>: Where not otherwise explained, terms such as "directed", "requested", "authorized", "selected", "approved", "required", "accepted", and "permitted" mean "directed by the Architect/Engineer", "requested by the Architect/Engineer", and similar phrases. However, no such implied meaning will be interpreted to extend the Architect's/Engineer's responsibility into the Contractor's area of construction supervision or safety administrative efforts.

<u>Furnish:</u> Except as otherwise defined in greater detail, the term "furnish" is used to mean "supply and deliver to the project site, ready for unloading, unpacking, assembly, installation, and similar operations" as applicable in each instance.

<u>General Explanation:</u> A substantial amount of specification language consists of definitions of terms found in other contract documents, including drawings. (Drawings are recognized as being diagrammatic in nature and not completely descriptive of the requirements indicated thereon). Certain terms used in contract documents are defined in this article. Definitions and explanations contained in this section are not necessarily either complete or exclusive, but are general for the

Work to the extent that they are not stated more explicitly in another element of the contract documents.

<u>General Requirements</u>: The provisions or requirements of other Division -1 sections apply to entire work of the Contract and, where so indicated, to other elements which are included in the project.

<u>Indicated:</u> The term, "indicated", is a cross-reference to graphic representations, notes or schedules on the drawings, to other paragraphs or schedules in the specifications, and to similar means of recording requirements in contract documents. Where terms such as "shown", "noted", "scheduled", and specified" are used in lieu of "indicated", it is for the purpose of helping the reader locate the cross-reference, and no limitation of location is intended except as specifically noted.

<u>Install:</u> Except as otherwise defined in greater detail, the term "install" is used to describe operations at project site including the actual "unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning and similar operations", as applicable in each instance.

<u>Installer:</u> The term "installer" is defined as "the entity" (person or firm) engaged by the Contractor, its subcontractor or sub-subcontractor for performance of a particular unit of work at the project site, including installation, erection, application and similar required operations. It is a requirement that installers are experienced in the operations they are engaged to perform.

<u>Project Site:</u> The term, "project site", is defined as the space available to the Contractor for performance of the Work, either exclusively or in conjunction with others performing other work as part of the project. The extent of the project site is shown on the drawings, and may or may not be identical with the description of the land upon which the project is to be build.

<u>Provide:</u> Except as otherwise defined in greater detail, the term "provide" means "to furnish and install, complete and ready for intended use", as applicable in each instance.

<u>Testing Laboratories:</u> The term "testing laboratory" is defined as an independent entity engaged to perform specific inspections or tests of the work, either at the project site or elsewhere, and to report, and (if required) interpret results of those inspections or tests.

DRAWINGS AND SPECIFICATIONS:

The organization of the Specifications into divisions, sections and articles and the arrangement of drawings is for clarity only and shall not control the Contractor in dividing the work among subcontractors or in establishing the extent of work to be performed by any trade. The Contractor may subcontract the work in such divisions as he sees fit and he is ultimately responsible for furnishing all work shown on the drawings and/or in the specifications.

In the event of inconsistencies between parts of the Contract Documents or between the Contract Documents and applicable standards, codes and ordinances, the Contractor shall: (1) provide the better quality and/or greater quantity of work; or (2) comply with the more stringent requirement: either or both in accordance with the Architect's interpretation. Technical specifications take priority over general specifications and detail drawings take precedence over general drawings. Any work shown on one drawing shall be construed to be shown in all drawings and the Contractor will coordinate the work and the drawings. If any portion of the Contract Document shall be in conflict with any other portion, the various documents comprising the Contract Documents shall govern in the following order of precedence: The Owner-Contractor Agreement; Modifications; Addenda; and Supplementary Conditions; the General Conditions; the Specifications; the Drawings; as between schedules and information given on Drawings, the schedules shall govern; as between figures given on Drawings and the scaled

measurements, the figures shall govern; as between large-scale drawings and small scale drawings, the larger scale shall govern. Any such conflict or inconsistency between or in the drawings shall be submitted to the Architect whose decision thereon shall be final and conclusive.

SPECIFICATION FORMAT AND CONTENT EXPLANATION:

<u>General:</u> This article is provided to help the user of these specifications more readily understand the format, language, implied requirements and similar conventions of content. None of the following explanations shall be interpreted to modify the substance of the contract requirements.

<u>Production Methods:</u> Portions of these specifications have been produced by the Architect/Engineer's standard method of editing master specifications; they may contain minor deviations from traditional writing formats. Such deviations are a natural result of this production technique, and no other meaning shall be implied.

<u>Specification Format:</u> These specifications are organized based upon the Construction Specifications Institute's 33-Division format. The organization of these specifications into Divisions, Sections or Trade Headings conforms generally to no recognized industry practice.

<u>Specification Content:</u> This project specification has been produced employing certain conventions in the use of language as well as conventions regarding the intended meaning of certain terms, words, and phrases when used in particular situations or circumstances. These conventions are explained as follows:

In certain circumstances, the language of the specifications and other contract documents is of the abbreviated type. It implies words and meanings that will be appropriately interpreted. Singular words will be interpreted as plural and plural words will be interpreted as singular where applicable and where the full context of the contract documents so indicates.

<u>Imperative Language</u> is used generally in the specifications. Requirements expressed imperatively are to be performed by the Contractor. At certain locations in the text, for clarity, contrasting subjective language is used to describe responsibilities which must be fulfilled indirectly by the Contractor, or by others when so noted.

<u>Methods of Specifying:</u> The techniques or methods of specifying requirements varies throughout the text. The method used for specifying one element of the Work has no bearing on requirements for another element of the Work. The methods of specifying may include the following, or any combination of the following:

<u>Assignment of Specialists:</u> In certain circumstances, the specification text requires or implies that specific elements of the Work are to be assigned to specialists who must be engaged to perform that element of the Work. Such assignments are special requirements over which the Contractor has no choice or option. Such assignments are intended to establish which party or entity involved in a specific element of the Work is considered as being sufficiently experienced in the indicated construction processes or operations to be recognized as "expert" in those processes or operations. Nevertheless, the ultimate responsibility for fulfilling all contract requirements remains with the Contractor.

These requirements should not be interpreted to conflict with the enforcement of building codes and similar regulations governing the work. They are also not intended to interfere with local trade union jurisdictional settlements and similar conventions.

<u>Trades:</u> The use of certain titles such as "carpentry" in the specification text, is not intended to imply that the Work must be performed by accredited or unionized individuals of a corresponding generic name, such as "carpenter". It also is not exclusively to work by tradespersons of that corresponding generic name.

INDUSTRY STANDARDS:

<u>Applicability of Standards:</u> Except where more explicit or more stringent requirements are written into the contract documents, applicable construction industry standards have the same force and effect as if bound into or copied directly into the contract documents. Such industry standards are made a part of the contract documents by reference. Individual specification sections indicate which codes and standards the Contractor must keep available at the project site for reference.

<u>Referenced Standards:</u> (standards referenced directly in the contract documents) take precedence over non-referenced standards that are recognized in the industry for applicability to the Work.

<u>Un-referenced Standards</u>: Except as otherwise limited by the contract documents, un-referenced standards recognized in the construction industry are defined as having direct applicability to the Work and will be enforced for the performance of the Work. The decision as to whether an industry code or standard is applicable to the Work, or as to which of several standards are applicable, is the sole responsibility of the Architect/Engineer.

<u>Publication Dates:</u> Except as otherwise indicated, where compliance with an industry standard is required, comply with standard in effect or as recognized as governing by code authorities, as of date of contract documents.

<u>Updated Standards</u>: At the request of the Architect/Engineer, Contractor or governing authority, submit a change order proposal where an applicable industry code or standard has been revised and reissued after the date of the contract documents and before the performance of the work affected. The Architect/Engineer will decide whether to issue the change order to proceed with the updated standard.

<u>Conflicting Requirements:</u> Where compliance with two or more standards is specified, and where these standards establish different or conflicting requirements for minimum quantities or quality levels, the most stringent requirement will be enforced, unless the contract documents specifically indicate a less stringent requirement. Refer requirements that are different, but apparently equal, and uncertainties as to which quality level is more stringent to the Architect/Engineer for a decision before proceeding.

<u>Copies of Standards</u>: The contract documents require that each entity performing work be experienced in that part of the work being performed. Each entity is also required to be familiar with industry standards applicable to that part of the work. Copies of applicable standards are not bound with the contract documents.

Where copies of standards are needed for proper performance of the Work, the Contractor is required to obtain such copies directly from the publication source.

Although certain copies of standards needed for enforcement of the requirements may be required submittals, the Architect/Engineer reserves the right to require the Contractor to submit additional copies of these standards as necessary for enforcement of the requirements.

<u>Abbreviations and Names:</u> Trade association names and titles of general standards are frequently abbreviated. Where acronyms of abbreviations are used in the specifications or other contract documents they are defined to mean the recognized name of the trade association, standards generating organization, governing authority or other entity applicable to the context of the text provision. Refer to the "Encyclopedia of Associations", published by Gale Research Co., available in most libraries.

<u>Abbreviations and Names:</u> Trade association names and titles of general standards are frequently abbreviated. The following acronyms or abbreviations as referenced in contract documents are defined to mean the associated names. Both names and addresses are subject to change, and are believed to be, but are not assured to be, accurate and up-to-date as of date of contract documents:

AA	Aluminum Association 900 19th St. N.W., Suite 300 Washington, DC 20006	(202) 862-5100
AABC	Associated Air Balance Council 1518 K Street, NW, Suite 503 Washington, DC 20005	(202) 737-0202
AAMA	American Architectural Manufacturer's Association 1540 E. Dundee Road, Suite 310 Palatine, IL 60067-8321	(708) 202-1350
AATCC	American Association of Textile Chemists and Colorists P. O. Box 12215 Research Triangle Park, NC 27709-2215	(919) 549-8141
ACI	American Concrete Institute P. O. Box 9094 Farmington Hills, MI 48333	(313) 532-2600
ACIL	American Council of Independent Laboratories 1629 K Street, NW, Suite 400 Washington, DC 20006	(202) 887-5872
ACS	Acoustical Society of America 500 Sunnyside Blvd. Woodbury, NY 11797	(516) 576-2360
ADC	Air Diffusion Council 11 S. LaSalle St., #1400 Chicago, IL 60603	(312) 201-0101
AGA	American Gas Association 1515 Wilson Blvd. Arlington, VA 22209-2470	(703) 841-8400
АНА	American Hardboard Association 1210 W. Northwest Hwy. Palatine, IL 60067	(847) 934-8800
AIA	American Institute of Architects 1735 New York Ave., NW Washington, DC 20006	(202) 626-7300
A.I.A.	American Insurance Association 1130 Connecticut Ave., N.W., Suite 1000 Washington, DC 20036	(202) 828-7100
AISC	American Institute of Steel Construction 1 E. Wacker Dr., #3100	

	Chicago, IL 60601-2001	(312) 670-2400
AISI	American Iron and Steel Institute 1101 17th St., N.W., Suite 1300 Washington, DC 20036	(202) 452-7100
AMCA	Air Movement and Control Association 30 W. University Drive Arlington Heights, IL 60004	(847) 394-0150
ANSI	American National Standards Institute 11 W. 42nd St., 13 th Floor New York, NY 10036	(212) 642-4900
APA	American Plywood Association P. O. Box 11700 Tacoma, WA 98411	(253) 565-6600
ARI	Air Conditioning and Refrigeration Institute 4301 N. Fairfax Dr., Suite 425 Arlington, VA 22203	(703) 524-8800
ARMA	Asphalt Roofing Manufacturers Association 4041 Powder HIII Road, Suite 404 Calverton, MD 20705	(301) 231-9050
ASC	Adhesive and Sealant Council 1627 K St., N.W., Suite 1000 Washington, DC 20006-1707	(202) 452-1500
ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. 1791 Tullie Circle, NE Atlanta, GA 30329-2305	(800) 527-4723 (404) 636-8400
ASME	American Society of Mechanical Engineers 345 East 47th Street New York, NY 10017	(800) THE-ASME (212) 705-7722
ASPE	American Society of Plumbing Engineers 3617 Thousand Oaks Blvd., Suite 210 Westlake Village, CA 91362-3649	(805) 495-7120
ASSE	American Society of Sanitary Engineering 28901 Clemens Road, #100 Bay Village, OH 44140	(216) 835-3040
ASTM	American Society for Testing & Materials 100 Barr Harbor Dr. W. Conshohecken,PA 19428-2959	(610) 832-9500
AWI	Architectural Woodwork Institute 1952 Isaac Newton Sq. Reston, VA 20190	(703) 222-1100
AWPA	American Wood-Preservers' Association	

	P. O. Box 286 Woodstock, MD 21163-0286	(410) 465-3169
AWPI	American Wood Preservers' Institute 1945 Old Gallows Road, Suite 150 Vienna, VA 22182	(800) 356-AWPI (703) 893-4005
AWS	American Welding Society 550 Le Jeune Road, NW Miami, FL 33126	(800) 443-9353
AWWA	American Water Works Association 6666 W. Quincy Ave. Denver, CO 80235	(303) 794-7711
BHMA	Builders' Hardware Manufacturers Assn. 355 Lexington Ave., 17th floor New Yourk, NY 10017	(212) 661-4261
CAUS	Color Association of the United States 409 W. 44th St. New York, NY 10036	(212) 582-6884
CAGI	Compressed Air and Gas Institute 1300 Sumner Avenue Cleveland, OH 44115-2851	(216) 241-7333
CISPI	Cast Iron Soil Pipe Institute 5959 Shallowford Road, #419 Chattanooga, TN 37421	(423) 892-0137
CRSI	Concrete Reinforcing Steel Institute 933 N. Plum Grove Road Schaumburg, IL 60173	(847) 517-1200
СТІ	Ceramic Tile Institute of America, Inc. 12061 W. Jefferson Culver City, CA 90230-6219	(310) 574-7800
DHI	Door and Hardware Institute 14170 Newbrook Drive Chantilly, VA 22021-2223	(703) 222-2010
FPDA	Fluid Power Distributors Assn. P. O. Box 1420 Cherry Hill, NJ 08034	(609) 795-6133
GANA	Glass Association of North America 3310 S. W. Harrison St. Topeka, KS 66611-2279	(913) 266-7013
FMER	Factory Mutual Engineering and Research 1151 Boston-Providence Turnpike Norwood, MA 02062	(781) 762-4300
FTI	Facing Tile Institute	

	P. O. Box 8880 Canton, OH 44711	(216) 488-1211
GA	Gypsum Association 810 First Street, N.E. Suite 510 Washington, DC 20002	(202) 289-5440
HEI	Heat Exchange Institute 1300 Sumner Avenue Cleveland, OH 44115	(216) 241-7333
ICEA	Insulated Cable Engineers Assn, Inc. P. O. Box 440 South Yarmouth, MA 02664	(508) 394-4424
IEc	International Electrotechnical Commission 11 W. 42nd St., 13 th Floor New York, NY 10036	(212) 642-4900
IEEE	Institute of Electrical and Electronic Engineers U.S. Activities Board 1828 L St., N.W., Suite 1202 Washington, DC 20036-5104	(202) 785-0017
ILI	Indiana Limestone Institute of America Stone City Bank Building; Suite 400 Bedford, IN 47421	(812) 275-4426
MIA	Marble Institute of America 30 Eden Alley, Suite 201 Columbus, OH 43215	(614) 228-6194
MCA	Metal Construction Association 11 S. LaSalle Street; Suite 1400 Chicago, IL 60603	(312) 201-0193
MSS	Manufacturers Standardization Society of the Valve and Fittings Industry 127 Park Street, NE Vienna, VA 22180	(703) 281-6613
NAAMM	National Association of Architectural Metal Manufacturers 8 S. Michigan Ave., Suite 1000 Chicago, IL 60603	s (312) 456-5590
NCMA	National Concrete Masonry Assn. 2302 Horse Pen Road Herndon, VA 20171	(703) 713-1900
NEC	National Electric Code (by NFPA)	
NECA	National Electrical Contractors Assn. 3 Bethesda Metro Ctr., Suite 1100 Bethesda, MD 20814	(301) 657-3110
NEMA	National Electrical Manufacturers Assn.	

	1300 N. 17th St., Suite 1847 Rosslyn, VA 22209	(703) 841-3200
NPA	National Particleboard Assn. 18928 Premiere Court Gaithersburg, MD 20879	(301) 670-0604
NPCA	National Paint and Coating Assn. 1500 Rhode Island Ave., NW Washington, DC 20005	(202) 462-6272
NRCA	National Roofing Contractors Assn. 10255 W. Higgins Road, Suite 600 Rosemont, II 60018	(847) 299-9070
NSFI	National Sanitation Foundation Inc. P. O. Box 130140 Ann Arbor, MI 48113-0140	(313) 769-8010
PPCI	Precast/Prestressed Concrete Institute 175 W. Jackson Blvd. Chicago, IL 60604	(312) 786-0300
PDI	Plumbing and Drainage Institute c/o W. C. Whitehead 45 Bristol Drive, Suite 101 Easton, MA 02375	(508) 230-3516
PEI	Porcelain Enamel Institute P. O. Box 158541 Nashville, TN 37215	(615) 385-5357
RFCI	Resilient Floor Covering Institute 966 Hungerford Drive; Suite 12-B Rockville, MD 20850	(301) 340-8580
RMA	Rubber Manufacturers Assn. 1400 K Street, NW, Suite 900 Washington, DC 20005	(202) 682-4800
SDI	Steel Deck Institute P. O. Box 9506 Canton, OH 44711	(330) 493-7886
S.D.I.	Steel Door Institute 30200 Detroit Road Cleveland, OH 44145	(216) 899-0010
SIGMA	Sealed Insulating Glass Manufacturers Assn. 401 N. Michigan Ave. Chicago, IL 60611-4267	(312) 644-6610
SJI	Steel Joist Institute 1205 48th Street, North; Suite A Myrtle Beach, SC 29577-5424	(803) 449-0487

SMACNA	Sheet Metal and Air Conditioning Contractors' National Assn. 4201 Lafavette Ctr. Dr.	
	Chantilly, VA 22021	(703) 803-2980
SPC	Southern Pine Council P. O. Box 641700 Kenner, LA 70064-1700	(504) 443-4464
SSPC	Steel Structures Painting Council 40 24th St. Pittsburgh, PA 15222	(412) 281-2331
ТСА	Tile Council of American, Inc. P. O. Box 1787 Clemson, SC 29633-1787	(864) 646-8453
UL	Underwriters Laboratories, Inc. 333 Pfingsten Road Northbrook, IL 60062	(708) 272-8800
WRI	Wire Reinforcement Institute 203 Loudoun St., S.W. Leesburg, VA 22075	(703) 779-2339
WSC	Water Systems Council 800 Roosevelt Rd, Suite 20, Building C Glen Ellyn, II 60137	(708) 545-1762
W.W.P.A.	Woven Wire Products Assn. 2462 Hickory Glen Dr. Bloomfield Hills, MI 48304	(810) 258-5756

SUBMITTALS:

Certificates: For the Owner's records, submit copies of certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, and similar documents, correspondence and records established in conjunction with compliance with standards and regulations bearing upon performance of the work.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 01 42 00

SECTION 01 60 00 - PRODUCTS AND SUBSTITUTIONS

PART 1 - GENERAL

DESCRIPTION OF REQUIREMENTS:

<u>Substitutions:</u> The Contractor's requests for changes of products, materials, equipment and methods of construction required by the contract documents are considered requests for "substitutions", and are subject to the requirements specified herein.

The Architect or Engineer's reference to "or equal" products or equipment; and, a contractor's submittal of a proposed "equal" product is considered a "substitution", and is subject to the regirements of this section.

In certain specifications sections, it may be indicated that substitute or alternative product will be considered prior to bid date. Beyond that time limit, no substitution is to be made; and, the Architect-Engineer is not obligated to accept or approve a proposed substitution. The following are not considered substitutions:

Substitutions requested during the bidding period, which have been accepted, in writing, prior to the "Bid Date", are included in the contract documents and are not subject to the requirements for substitutions as herein specified.

Specified Contractor options on products and construction methods included in the contract documents are choices available to the Contractor and are not subject to the requirements for substitutions as herein specified provided all requirements for a product performance as specified are met.

<u>Standards:</u> Refer to the products specified for the project, and for acronyms used in the text of the specification sections.

Where a proposed substitution involves the work of more than one prime contractor, each prime contractor involved shall cooperate and coordinate the work with each other prime contractor involved, so as to provide uniformity and consistency and to assure the compatibility of products.

QUALITY ASSURANCE:

Source Limitations: To the fullest extent possible, provide products of the same generic kind, from a single source, for each unit of work.

When it is discovered that specified products are available only from sources that do not or cannot produce an adequate quantity to complete project requirements in a timely manner, consult with the Architect/Engineer for a determination of what product qualities, such as visual, structural, durability, or compatibility, that are most important. When the Architect/Engineer's determination has been made, select products from those sources that produce products that possess the most important qualities, to the fullest extent possible.

Compatibility of Options: Compatibility of products is a basic requirement of product selection. When the Contractor is given the option of selecting between two or more products for use on the project, the product selected must be compatible with other products previously selected, even if the products previously selected were also Contractor options. The complete compatibility between the various choices available to the Contractor is not assured by the various requirements of the Contract documents, but must be provided by the Contractor.

SUBMITTALS:

Substitution Request Submittal:

<u>Requests for Substitutions:</u> Submit 3 copies of each request for substitution. In each request identify the product or fabrication or installation method to be replaced by the substitution; include related specification section and drawing numbers, and complete documentation showing compliance with the requirements for substitutions. Include the following information, as appropriate, with each request.

Provide complete product data, drawings and descriptions of products, and fabrication and installation procedures.

Provide samples where applicable or requested.

Provide a detailed comparison of the significant qualities of the proposed substitution with those of the work originally specified. Significant qualities include elements such as size, weight, durability, performance and visual effect where applicable.

Provide complete coordination information. Include all changes required in other elements of the work to accommodate the substitution, including work performed by the Owner and separate Contractors.

Provide a statement indicating the effect the substitution will have on the work schedule in comparison to the schedule without approval of the proposed substitution. Include information regarding the effect of the proposed substitution on the Contract Time.

Provide certification by the Contractor to the effect that, in the Contractor's opinion, after thorough evaluation, the proposed substitution will result in work that in every significant respect is equal-to or better than the work required by the Contract documents, and that it will perform adequately in the application indicated.

Include in this certification, the Contractor's waiver of rights to additional payment or time, which may subsequently be necessary because of the failure of the substitution to perform adequately.

<u>Architect/Engineer's Action:</u> Within one week of receipt of the Contractor's request for substitution, the Architect/Engineer will request additional information or documentation as may be needed for evaluation of the request. Within 2 weeks of receipt of the request, or within one week of receipt of the requested additional information or documentation, which ever is later, the Architect/Engineer will notify the Contractor of either the acceptance of rejection of the proposed substitution.

Excessive or repeated requests/submittals for substitutions solely for the benefit of the Contractor, or substitutions which are being requested based on false information (i.e.: no longer made available) are unacceptable and extra work for the Architect/ Engineer. The Contractor shall bear the cost for same, which will be deducted from the construction contract via a change order; the basis of which cost shall be the Architect's contracted hourly rate plus any expenses. The owner will in turn pay the Architect all amounts so deducted.

PART 2 - PRODUCTS

GENERAL PRODUCT COMPLIANCE:

<u>General:</u> Requirements for individual products are indicated in the contract documents; compliance with these requirements is in itself a contract requirement. These requirements may

be specified in any one of several different specifying methods, or in any combination of these methods. These methods include the following:

Proprietary Descriptive Performance Compliance with Reference Standards.

Compliance with codes, compliance with graphic details, allowances, and similar provisions of the contract documents also have a bearing on the selection process.

<u>Procedures for Selecting Products:</u> Contractor's options in selecting products are limited by requirements of the contract documents and governing regulations. They are not controlled by industry traditions or procedures experienced by the Contractor on previous construction projects. Required procedures include but are not limited to the following for the various indicated methods of specifying:

<u>Proprietary Specification Requirements:</u> Where the specifications identify one or more manufacturers as acceptable, but limit the contractor to same except by approval prior to bid, or by approval in accordance with this section; the contractor shall provide that product(s) by the manufacturers listed unless approval prior to bids has been incorporated, in writing, into the contract documents. Likewise, if the specifications indicate one or more contractors as a basis for design but allow others as "equals", the contractor shall receive approval of the "equals" prior to bids.

<u>Non-Proprietary Specification Requirements:</u> Where the specifications name products or manufacturers that are available and may be incorporated in the Work, but do not restrict the Contractor to the use of these products only, the Contractor may at his option, use any available product that complies with contract requirements.

<u>Descriptive Specification Requirements:</u> Where the specifications describe a product or assembly generically, in detail, listing the exact characteristics required, but without use of a brand or trade name, provide products or assemblies that provide the characteristics indicated and otherwise comply with contract requirements.

<u>Performance Specification Requirements:</u> Where the specifications require compliance with indicated performance requirements, provide products that comply with the specific performance requirements indicated, and that are recommended by the manufacturer for the application indicated. The manufacturer's recommendations may be contained in published product literature, or by the manufacturer's individual certification of performance. General overall performance of a product is implied where the product is specified for specific performances.

<u>Compliance with Standards, Codes and Regulations:</u> Where the specifications require only compliance with an imposed standard, code or regulation, the Contractor has the option of selecting a product that complies with specification requirements, including the standards, codes and regulations.

<u>Visual Matching:</u> Where matching an established sample is required, the final judgment of whether a product proposed by the Contractor matches the sample satisfactorily will be determined by the Architect. Where there is no product available within the specified product category that matches the sample satisfactorily and also complies with other specified requirements, comply with the provisions of the contract documents concerning "substitutions" for the selection of a matching product in another product category, or for non-compliance with specified requirements.

<u>Visual Selection</u>: Except as otherwise indicated, where specified product requirements include the phrase "...as selected from the manufacturer's standard colors, patterns, textures..." or similar phrases, the Contractor has the option of selecting the product and manufacturer, provided the selection complies with other specified requirements. The Architect is subsequently responsible for selecting the color, pattern and texture from the product line selected by the Contractor.

<u>Producer's Statement of Applicability:</u> Where individual specification sections indicate products that require a "Statement of Applicability" from the manufacturer or other producer, submit a written-certified statement from the producer stating that the producer has reviewed the proposed application of the product on the project. This statement shall state that the producer agrees with or does not object to the Architect/Engineer's specification and the Contractor's selection of the product for use in the Work. The statement shall also state that the proposed application of the project is suitable and proper.

SUBSTITUTIONS:

<u>Conditions</u>: Contractor's request for substitution will be received and considered when extensive revisions to the contract documents are not required, when the proposed changes are in keeping with the general intent of the contract documents, when the request is timely, fully documented and properly submitted, and when one or more of the following conditions is satisfied, all as judged by the Architect/Engineer; otherwise the requests will be returned without action except to record non-compliance with these requirements.

The Architect/Engineer will consider a request for substitution where the request is directly related to an "or equal" clause or similar language in the contract documents.

The Architect/Engineer will consider a request for substitution where the specified product or method cannot be provided within the Contract Time. However, the request will not be considered if the product or method can not be provided as a result of the Contractor's failure to pursue the work promptly or to coordinate the various activities properly.

The Architect/Engineer will consider a request for substitution where the specified product or method cannot receive necessary approval by a governing authority, and the requested substitution can be approved.

The Architect/Engineer will consider a request for a substitution where a substantial advantage is offered the Owner, in terms of cost, time, energy conservation or other considerations of merit after deducting offsetting responsibilities the Owner may be required to bear. These additional responsibilities may include such considerations as additional compensation to the Architect/Engineer for redesign and evaluation services, the contractor(s), and similar considerations.

The Architect/Engineer will consider a request for substitution when the specified product or method cannot be provided in a manner which is compatible with other materials of the work, and where the Contractor certifies that the substitution will overcome the incompatibility.

The Architect/Engineer will consider a request for substitution when the specified product or method can not be properly coordinated with other materials in the work, and where the Contractor certifies that the proposed substitution can be properly coordinated.

The Architect/Engineer will consider a request for substitution when the specified product or method can not receive a warranty as required by the contract documents and where the contractor certifies that the proposed substitution receive the required warranty.

<u>Work-Related Submittals:</u> Contractor's submittal of and the Architect's/Engineer's acceptance of shop drawings, product data or samples which relate to work not complying with requirements of

the contract documents, does not constitute an acceptable or valid request for a substitution, nor approval thereof.

GENERAL PRODUCT REQUIREMENTS:

General: Provide products that comply with the requirements of the contract documents and that are undamaged and, unless otherwise indicated, unused at the time of installation. Provide products that are complete with all accessories, trim, finish, safety guards and other devices and details needed for a complete installation and for the intended use and effect.

Continued Availability: Where, because of the nature of its application, the Owner is likely to need replacement parts or additional amounts of a product at a later date, either for maintenance and repair or replacement, provide standard, domestically produced products for which the manufacturer has published assurances that the products and its parts are likely to be available to the Owner at a later date.

PART 3 - EXECUTION

INSTALLATION OF PRODUCTS:

General: Except as otherwise indicated in individual sections of these specifications, comply with the manufacturer's instructions and recommendations for installation of the products in the applications indicated. Anchor each product securely in place, accurately located and aligned with other work. Clean exposed surfaces and protect surfaces as necessary to ensure freedom from damage and deterioration at time of acceptance.

END OF SECTION 01 60 00

SECTION 01 60 01 - ZERO TOLERANCE HAZARDOUS MATERIALS STATEMENT

PART 1 - GENERAL

Attached hereto is a "Zero Tolerance Hazardous Materials Statement". It is a statement regarding all products and materials that are to be incorporated into the work. The General Contractor is advised to secure similar statements from all suppliers and subcontractors and submit same along with his statement at project closeout.

END OF SECTION 01 60 01

"ZERO TOLERANCE STATEMENT"

All materials are to be 100% FREE OF ASBESTOS and no LEAD BASE PAINT MATERIALS shall be used in the construction of this project. In the event that such material is discovered either during construction, or following completion of construction and close-out of the construction contract, it will be the responsibility of this contractor to pay all costs incurred to remove and replace those materials, including repair or replacement of all adjacent materials which are affected by the abatement process.

ATTEST:			
	(Contractor)		
BV			
	(Signature)		(Date)
	(Name and Title 1	Typed/Printed)	
BUSINESS A	DDRESS:		
Subscribed ar	ad sworn to before me		
		(Typed Name)	
this	day of	, 20	
Signature			
My Commissio	on Expires	, 20	

SECTION 01 77 00 - PROJECT CLOSE-OUT

PART 1 - GENERAL

DESCRIPTION OF REQUIREMENTS:

<u>Definitions:</u> Project close-out is the term used to describe certain collective project requirements, indicating completion of the Work items that are to be fulfilled near the end of the Contract time in preparation for occupancy and final acceptance of the Work by the Owner, as well as final payment to the Contractor and the normal termination of the Contract.

Specific requirements for individual units of work are included in the appropriate sections in Divisions 2 through 16.

Time of close-out is directly related to "Substantial Completion." For this project, the time of close-out will be a single time/date for the entire Work.

PREREQUISITES FOR SUBSTANTIAL COMPLETION:

<u>General:</u> Complete the following before requesting the Owner's or Architect/Engineer's inspection for certification of substantial completion, for the entire Work. Portions of the Work may be reviewed for acceptance as being fit for occupancy per the schedule. Substantial completion of the entire project will be considered only when all portions are substantially complete.

In the progress payment request that coincides with, or is the first request following, the date substantial completion is claimed for the entire work, show either 100% completion for the Work claimed as "substantially complete", or list incomplete items, the value of incomplete work, and reasons for the Work being incomplete.

Submit supporting documentation for review prior to the anticipated substantial completion date as indicated below and elsewhere in the contract documents. Supporting documentation for portions of the entire work that are substantially completed may include parts of the documentation as determined by the Architect.

Submit certified copy of final property survey in accordance with Section 01 41 00, Project Coordination, at least one month prior to the anticipated substantial completion date.

Submit all operational and maintenance instruction manuals and the final test and balance report(s) at least one month prior to substantial completion.

Provide operational and maintenance instructions and training to all Owner-designated personnel at least one week prior to the anticipated substantial completion date.

Failure to provide proper/complete final survey, test and balance report(s), and operations and maintenance manuals and subsequent training may delay substantial completion and will delay the actual warranty start date. The General Contractor and his subcontractors will provide all maintenance until the manuals and training are accepted.

Advise Owner of pending insurance change-over requirements.

Submit special warranties, workmanship/maintenance bonds, maintenance agreements, final certifications, special test certifications and similar documents.

Complete final cleaning-up requirements, including touch-up painting of marred surfaces.

Make final change out to permanent door locks leaving only specific doors with construction keying for access by the Contractor to complete the punchlist as acceptable to the Architect.

Touch-up and otherwise repair and restore marred exposed finishes.

<u>Inspection Procedures:</u> Upon receipt of the Contractor's written request for inspection, the Architect/Engineer will either proceed with inspection or advise the Contractor of unfilled prerequisites.

Following the initial inspection, the Architect/Engineer will either prepare the certificate of substantial completion, or will advise the Contractor of work which must be performed before the certificate will be issued. The Architect/Engineer will repeat the inspection one time for those areas determined as incomplete when requested and when assured that the Work has been completed. <u>Contractor shall bear all the costs of the Architect's and Engineer's reinspections at</u> the hourly rates stipulated in the Owner/Architect Agreement.

Results of the completed inspection will form the initial "punchlist" for final acceptance.

PREREQUISITES FOR FINAL ACCEPTANCE:

<u>General:</u> Complete the following before requesting the Architect/Engineer's final inspection for certification of final acceptance, and final payment as required by the General Conditions. List known exceptions, if any, in the request.

Submit the final payment request with final releases and supporting documentation not previously submitted and accepted. Include certificates of insurance for products and completed operations where required.

Submit an updated final statement, accounting for all additional changes to the Contract Sum.

Submit a certified copy of the Architect/Engineer's and local authority(ies)' final punchlist of itemized work to be completed or corrected, signed, dated and notarized by the Contractor and stating that each item has been completed or otherwise resolved for acceptance and has been endorsed and dated by the Architect/Engineer.

Submit consent of surety.

Submit a final liquidated damages settlement statement, acceptable to the Owner.

Submit evidence of final, continuing insurance coverage complying with insurance requirements.

Submit all as-built drawings, record drawings, specifications and shop drawings as required, clearly marked to indicate installed conditions.

Deliver tools, spare parts, extra stock of material and similar physical items to the owner and obtain a written receipt for each. Copy Architect with receipt.

<u>Reinspection Procedure:</u> The Owner's representative or Architect/Engineer will reinspect the Work upon receipt of the Contractor's written notice that the work, including punchlist items resulting from earlier inspections, has been completed, except for these items whose completion has been delayed because of circumstances that are acceptable to the Architect/Engineer.

Upon completion of reinspection, the Architect/Engineer will either prepare a certificate of final acceptance, or will advise the Contractor of work that is incomplete of obligations that have not been fulfilled, but are required for final acceptance.

If necessary, the reinspection procedure will be repeated and such cost as are currently paid the Architect on an hourly basis will be deducted from the Contractor's final payment request to reimburse the Architect for additional services.

RECORD DOCUMENT SUBMITTALS:

<u>General:</u> Specific requirements for record documents are indicated in the individual sections of these specifications. Other requirements are indicated in the General Conditions. General submittal requirements are indicated in the various "submittals" sections.

Do not use record documents for construction purposes; protect from deterioration and loss in a secure, fire-resistive location; provide access to record documents for the Architect/Engineer's reference during normal working hours.

<u>Record Drawings</u>: Maintain a record set of blue or black line white-prints of contract drawings and shop drawings in a clean, undamaged condition. Mark-up the set of record documents to show the actual installation where the installed work varies from the work as originally shown. Mark whichever drawing is most capable of showing the actual "field" condition fully and accurately; however, where shop drawings are used for mark-up, record a cross-reference at the corresponding location on the working drawings. <u>Give particular attention to concealed work that</u> would be difficult to measure and record at a later date.

Mark record sets on at least a monthly basis with red erasable pencil and, where feasible, use other colors to distinguish between variations in separate categories of work. Review with architect, engineer and owner's representatives before or at each pay request. The pay request will be delayed until drawings are updated.

Mark-up new information which is known to be important to the Owner (i.e.: underground utilities, electrical circuitry or any concealed work), that is not shown on either contract drawings or shop drawings.

Note related change order numbers where applicable.

Organize record drawing sheets into manageable sets, bind with durable paper cover sheets, and print suitable titles, dates and other identification on the cover of each set.

Additionally, make an electronic copy (scan) in pdf after final review with the architect, engineer and owner.

<u>Record Specifications:</u> Maintain one complete copy of the Project Manual, including specifications and addenda, and one copy of other written construction documents such as change orders and similar modifications issued in printed form during construction. Mark these documents to show substantial variations in the actual work performed in comparison with the text of the specifications and modifications as issued. Give particular attention to substitutions, selection of options and similar information on work where it is concealed or cannot otherwise be readily discerned at a later date by direct observation. Note related record drawing information and product data, where applicable.

Upon completion of the Work, submit record specifications to the Architect/Engineer for the Owner's records.

<u>Miscellaneous Record Submittals:</u> Refer to other sections of these specifications for requirements of miscellaneous record keeping and submittals in connection with the actual performance of the Work. Immediately prior to the date or date of final completion, complete miscellaneous records and place in good order, properly identified and bound or filed, ready for continued use and reference. Submit to Architect/Engineer for the Owner's records.

<u>Operations and Maintenance Manuals:</u> Organize operating and maintenance data into suitable sets of manageable size. Bind data into individual binders properly identified and indexed. Bind each set of data in a heavy duty 2 inch, 3 ring, vinyl covered binder, with pocket folders for folded sheet information. Mark the appropriate identification on both front and spine of each binder. Provide three (3) copies with original warranties, guarantees, and manufacturer's instruction booklets/data.

Organize the manuals into sections which correspond to that of the specifications (i.e.: Division 2, 3 and etc.). Subsections for each division shall be further broken into sections as noted below and as approved by the Architect.

- Copies of warranties manufacturer's and Contractor's/installer's.
- Written review of instruction/training procedures and all manufacturer's operational data
- Emergency instructions
- Cleaning procedures (manufacturer's)
- Inspection procedures
- Recommended "turn-around" cycles
- Spare parts listing
- Wiring diagrams
- All shop drawings and product data

Also include an electronic (scanned) pdf copy on a CD/DVD, in each manual, of all of the above.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

CLOSE-OUT PROCEDURES:

<u>General Operating and Maintenance Instructions:</u> Arrange for each installer of operating equipment and other work that requires regular or continuing maintenance, to meet at the site with the owner's personnel to provide necessary basic instruction in the proper operation and maintenance of the entire Work. Where installers are not experienced in the required procedures, include instruction by the manufacturer's representatives. Provide meeting minutes of meetings and submit copies to the Owners and Architect.

As part of this instruction, provide a detailed review of the following items:

- Maintenance manuals
- Record documents
- Spare parts and materials
- Tools
- Lubricants
- Fuels
- Identification systems
- Control sequences
- Hazards
- Cleaning
- Warranties, bonds, maintenance agreements and similar continuing commitments

As part of this instruction for operating equipment, demonstrate the following procedures:

- Emergency operations
- Noise and vibration adjustments
- Safety procedures
- Economy and efficiency adjustments
- Effective energy utilization

FINAL CLEANING:

<u>General:</u> Special cleaning requirements for specific units of Work are included in the appropriate sections of Divisions 2 through 16. General cleaning during the regular progress of the Work is required by the General Conditions and is included under section "Temporary Facilities".

<u>Cleaning:</u> Provide final cleaning of the Work at the time indicated. Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit of work to the condition expected from a normal, commercial building cleaning and maintenance program. Comply with the manufacturer's instructions for operations.

Complete the following cleaning operations before requesting the Architect/Engineer's inspection for certification of substantial completion.

Remove labels which are not required as permanent labels.

Clean transparent materials, including mirrors and glass in doors and windows, to a polished condition. Remove putty and other substances which are noticeable as vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials.

Clean exposed exterior and interior hard-surfaced finishes to a dust-free condition, free of dust, stains, films and similar noticeable distracting substances. Restore reflective surfaces to their original reflective condition. Leave concrete floors broom clean. Vacuum carpeted surfaces, strip, seal and wax all vinyl flooring using procedures, equipment and products equal to that which the Owners use on their other properties.

Clean the project site, including landscape development areas of rubbish, litter and other foreign substances. Sweep paved areas to a broom clean condition if disturbed during construction; remove stains, spills and other foreign deposits. Rake grounds that are neither paved nor planted, to a smooth even-textured surface.

Clean floor surfaces per Section 01 77 10, Floor Care.

<u>Compliance:</u> Comply with safety standards and governing regulations for cleaning operations. Do not burn waste materials at site. Do not bury debris or excess materials on Owner's property. Do not discharge volatile or other harmful or dangerous materials into drainage systems. Remove waste materials from the site and dispose of in a lawful manner.

Where extra materials of value remaining after completion of associated work have become Owner's property, dispose of these materials to the Owner's best advantage as directed.

END OF SECTION 01 77 00

SECTION 02 10 00 - SUBSURFACE INVESTIGATION

PART 1 - GENERAL

RELATED DOCUMENTS:

A subsurface investigation has not been performed for this new effort. It is assumed that soils are adequate within the area where the additions are shown. However, the contractor shall engage a soils engineer prior to the start of work to confirm the soils are adequate. A copy of the report shall be forwarded to the Owner and Architect immediately upon completion.

END OF SECTION 02 10 00

SECTION 02 28 00 - TERMITE CONTROL

PART 1 - GENERAL

SCOPE OF WORK:

Provide soil treatment for termite control as herein specified.

SUBMITTALS:

In accordance with Section 01 33 00, Submittals, submit copies of applicator's license, product data and certification for the work of this section.

QUALITY ASSURANCE:

Comply with Section 1816 of the Florida Building Code for the use of a "soil applied pesticide".

In addition to requirements of these specifications, comply with manufacturer's instructions and recommendations for work, including preparation of substrate and application.

Engage a license professional pest control operator, for application of soil treatment solution.

Use only termiticides which bear a Federal registration number of the U.S. Environmental Protection Agency.

JOB CONDITIONS:

<u>Restrictions:</u> Do not apply soil treatment solution until excavating, filling and grading operations are completed, except as otherwise required in construction operations.

To insure penetration, do not apply soil treatment to frozen or excessively wet soils or during inclement weather. Comply with handling and application instructions of soil toxicant manufacturer.

SPECIFIC PRODUCT WARRANTY:

<u>Furnish written warranty</u> certifying that applied soil termiticide treatment will prevent infestation of subterranean termites and, that if subterranean termite activity is discovered during the 5 year warranty period, Contractor will re-treat soil and repair or replace damage caused by termite infestation to maximum value of \$100,000.00.

Provide warranty for a period of <u>5 years from date of treatment</u>, including, <u>at no additional cost</u>, yearly maintenance and inspections.

PART 2 - PRODUCTS

SOIL TREATMENT SOLUTION:

Use emulsible concentrate termiticide for dilution with water, specially formulated to prevent termite infestation. Provide a working solution of one of the following (or equal) chemical elements and concentrations.

<u>Chloropyrifos</u>, ("Dursban TC"); 1.0% in water emulsion.

Permathrin, ("Dragnet", "Torpedo"); 0.5% in water emulsion.

Other solutions may be used as recommended by Applicator if acceptable by EPA, local governing authorities and to the Architect. Use only soil treatment solutions which are not injurious to planting.

PART 3 - EXECUTION

GENERAL:

Advise Owner's representative of schedule for application of solution. A <u>minimum of</u> 48 hours notice will be required. <u>Do not</u> proceed without Owner's representative present to observe; otherwise, a second application will be required.

APPLICATION:

<u>Surface Preparation:</u> Remove foreign matter which could decrease effectiveness of treatment on areas to be treated. Loosen, rake, and level soil to be treated, except previously compacted areas under slabs and foundations. Termiticide may be applied before placement of compacted fill underslabs, if acceptable with treatment product manufacturer.

Application: Locations as follows.

<u>Under slab-on-grade</u>, including all building structures, adjacent patios, walks and stoops, treat soil before concrete slabs are placed.

<u>Critical Areas</u>; use additional chemical solution to soil critical areas under slabs, including entire inside perimeter inside of foundation walls, along both sides of interior partition walls which penetrate slab, around plumbing pipes and electric conduit penetrating slab, and around interior column footers.

<u>Building Outside Edge;</u> of trench around the perimeter, for each foot of depth from grade to footing, along outside edge of building. Mix chemical solution with the soil as it is being replaced in trench.

<u>At hollow masonry foundations</u> or grade beams, treat all voids with solution, poured directly into the hollow spaces.

At expansion joints, control joints, and areas where slabs will be penetrated.

<u>Reapply soil treatment</u> solution to areas disturbed by subsequent excavation, landscape grading, or other construction activities following application.

END OF SECTION 02 28 00

SECTION 024116 - STRUCTURE DEMOLITION

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. Demolition and removal of buildings.
 - 2. Abandoning in-place and removing below-grade construction.
 - 3. Disconnecting, capping or sealing, and abandoning in-place or removing site utilities.
 - 4. Salvaging items for reuse by Owner.
- B. Related Sections:
 - 1. Division 01 Section "Summary" for use of the premises and phasing requirements.
 - 2. Division 01 Section "Construction Progress Documentation" for preconstruction photographs taken before building demolition.
 - 3. Division 02 Section "Selective Structure Demolition" for partial demolition of buildings, structures, and site improvements.
 - 4. Division 23 Sections for demolishing or relocating site mechanical items.
 - 5. Division 31 Section "Site Clearing" for site clearing and removal of above- and belowgrade site improvements not part of building demolition.
 - 6. Division 33 Section "Common Work Results for Utilities" for shutting off, disconnecting, removing, and sealing or capping utilities.

1.3 DEFINITIONS

- A. Remove: Detach items from existing construction and legally dispose of them off-site unless indicated to be removed and salvaged.
- B. Remove and Salvage: Carefully detach from existing construction, in a manner to prevent damage, and deliver to Owner. Include fasteners or brackets needed for reattachment elsewhere.

1.4 MATERIALS OWNERSHIP

A. Unless otherwise indicated, demolition waste becomes property of Contractor.

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

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified refrigerant recovery technician.
- B. Proposed Protection Measures: Submit informational report, including Drawings, that indicates the measures proposed for protecting individuals and property, for environmental protection , for dust control and , for noise control. Indicate proposed locations and construction of barriers.
 - 1. Adjacent Buildings: Detail special measures proposed to protect adjacent buildings to remain including means of egress from those buildings.
- C. Schedule of Building Demolition Activities: Indicate the following:
 - 1. Detailed sequence of demolition work, with starting and ending dates for each activity.
 - 2. Temporary interruption of utility services.
 - 3. Shutoff and capping or re-routing of utility services.
- D. Inventory: Submit a list of items to be removed and salvaged and deliver to Owner prior to start of demolition.
- E. Predemolition Photographs: Show existing conditions of adjoining construction and site improvements, including finish surfaces, that might be misconstrued as damage caused by demolition operations. Comply with Division 01 Section "Photographic Documentation."Submit before the Work begins.
- F. Landfill Records: Indicate receipt and acceptance of hazardous wastes by a landfill facility licensed to accept hazardous wastes.
- G. 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 governing EPA notification regulations before beginning demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.
- C. Standards: Comply with ANSI/ASSE A10.6 and NFPA 241.

STRUCTURE DEMOLITION

- D. Pre-demolition Conference: Conduct conference at Project site.
 - 1. Inspect and discuss condition of construction to be demolished.
 - 2. Review structural load limitations of existing structures.
 - 3. Review and finalize building demolition schedule and verify availability of demolition personnel, equipment, and facilities needed to make progress and avoid delays.
 - 4. Review and finalize protection requirements.
 - 5. Review procedures for noise control and dust control.
 - 6. Review procedures for protection of adjacent buildings.
 - 7. Review items to be salvaged and returned to Owner.

1.7 PROJECT CONDITIONS

- A. Buildings to be demolished will be vacated and their use discontinued before start of the Work.
- B. Buildings immediately adjacent to demolition area will be occupied. Conduct building demolition so operations of occupied buildings will not be disrupted.
 - 1. Provide not less than 72 hours' notice of activities that will affect operations of adjacent occupied buildings.
 - 2. Maintain access to existing walkways, exits, and other facilities used by occupants of adjacent buildings.
 - a. Do not close or obstruct walkways, exits, or other facilities used by occupants of adjacent buildings without written permission from authorities having jurisdiction.
- C. Owner assumes no responsibility for buildings and structures to be demolished.
 - 1. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.
- D. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.
 - 1. Hazardous materials will be removed by Owner before start of the Work.
 - 2. If materials suspected of containing hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Hazardous materials will be removed by Owner under a separate contract.
- E. Hazardous Materials: Hazardous materials are present in buildings and structures to be demolished. A report on the presence of hazardous materials is on file for review and use. Examine report to become aware of locations where hazardous materials are present.
 - 1. Hazardous material remediation is specified elsewhere in the Contract Documents.
 - 2. Do not disturb hazardous materials or items suspected of containing hazardous materials except under procedures specified elsewhere in the Contract Documents.
 - 3. Owner will provide material safety data sheets for materials that are known to be present in buildings and structures to be demolished because of building operations or processes performed there.

F. On-site storage or sale of removed items or materials is not permitted.

1.8 COORDINATION

A. Arrange demolition schedule so as not to interfere with operations of adjacent occupied buildings.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. Satisfactory Soils: Comply with requirements in Division 31 Section "Earth Moving."

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that utilities have been disconnected and capped before starting demolition operations.
- B. Review Project Record Documents of existing construction provided by Owner. Owner does not guarantee that existing conditions are same as those indicated in Project Record Documents.
- C. Inventory and record the condition of items to be removed and salvaged. Provide photographs of conditions that might be misconstrued as damage caused by salvage operations. Comply with Division 01 Section "Photographic Documentation."
- D. Perform an engineering survey of condition of building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during building demolition operations.
 - 1. Steel Tendons: Locate tensioned steel tendons and include recommendations for detensioning.
- E. Verify that hazardous materials have been remediated before proceeding with building demolition operations.

3.2 PREPARATION

- A. Refrigerant: Remove refrigerant from mechanical equipment according to 40 CFR 82 and regulations of authorities having jurisdiction before starting demolition.
- B. Existing Utilities: Locate, identify, disconnect, and seal or cap off indicated utilities serving buildings and structures to be demolished.
 - 1. Owner will arrange to shut off indicated utilities when requested by Contractor.
 - 2. Arrange to shut off indicated utilities with utility companies.

- 3. If removal, relocation, or abandonment of utility services will affect adjacent occupied buildings, then provide temporary utilities that bypass buildings and structures to be demolished and that maintain continuity of service to other buildings and structures.
- 4. Cut off pipe or conduit a minimum of 24 inches below grade. Cap, valve, or plug and seal remaining portion of pipe or conduit after bypassing according to requirements of authorities having jurisdiction.
- C. Existing Utilities: See Divisions 22 and 26 Sections for shutting off, disconnecting, removing, and sealing or capping utilities. Do not start demolition work until utility disconnecting and sealing have been completed and verified in writing.
- D. Temporary Shoring: Provide and maintain interior and exterior shoring, bracing, or structural support to preserve stability and prevent unexpected movement or collapse of construction being demolished.
 - 1. Strengthen or add new supports when required during progress of demolition.
- E. Salvaged Items: Comply with the following:
 - 1. Clean salvaged items of dirt and demolition debris.
 - 2. Pack or crate items after cleaning. Identify contents of containers.
 - 3. Store items in a secure area until delivery to Owner.
 - 4. Transport items to storage area designated by Owner.
 - 5. Protect items from damage during transport and storage.

3.3 **PROTECTION**

- A. Existing Facilities: Protect adjacent walkways, loading docks, building entries, and other building facilities during demolition operations. Maintain exits from existing buildings.
- B. Existing Utilities: Maintain utility services to remain and protect from damage during demolition operations.
 - 1. Do not interrupt existing utilities serving adjacent occupied or operating facilities unless authorized in writing by Owner and authorities having jurisdiction.
 - 2. Provide temporary services during interruptions to existing utilities, as acceptable to Owner and authorities having jurisdiction.
 - a. Provide at least 72 hours' notice to occupants of affected buildings if shutdown of service is required during changeover.
- C. Temporary Protection: Erect temporary protection, such as walks, fences, railings, canopies, and covered passageways, where required by authorities having jurisdiction and as indicated. Comply with requirements in Division 01 Section "Temporary Facilities And Controls."
 - 1. Protect adjacent buildings and facilities from damage due to demolition activities.
 - 2. Protect existing site improvements, appurtenances, and landscaping to remain.
 - 3. Erect a plainly visible fence around drip line of individual trees or around perimeter drip line of groups of trees to remain.

- 4. Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
- 5. Provide protection to ensure safe passage of people around building demolition area and to and from occupied portions of adjacent buildings and structures.
- 6. Protect walls, windows, roofs, and other adjacent exterior construction that are to remain and that are exposed to building demolition operations.
- 7. Erect and maintain dustproof partitions and temporary enclosures to limit dust, noise, and dirt migration to occupied portions of adjacent buildings.
- D. Remove temporary barriers and protections where hazards no longer exist. Where open excavations or other hazardous conditions remain, leave temporary barriers and protections in place.

3.4 DEMOLITION, GENERAL

- A. General: Demolish indicated buildings completely. Use methods required to complete the Work within limitations of governing regulations and as follows:
 - 1. Do not use cutting torches until work area is cleared of flammable materials. Maintain portable fire-suppression devices during flame-cutting operations.
 - 2. Maintain fire watch during and for at least 4 hours after flame cutting operations.
 - 3. Maintain adequate ventilation when using cutting torches.
 - 4. Locate building demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
- B. Engineering Surveys: During demolition, perform surveys to detect hazards that may result from building demolition activities.
- C. Site Access and Temporary Controls: Conduct building demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
 - 1. Do not close or obstruct streets, walks, walkways, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.
 - 2. Use water mist and other suitable methods to limit spread of dust and dirt. Comply with governing environmental-protection regulations. Do not use water when it may damage adjacent construction or create hazardous or objectionable conditions, such as ice, flooding, and pollution.
- D. Explosives: Use of explosives is not permitted.

3.5 DEMOLITION BY MECHANICAL MEANS

A. Proceed with demolition of structural framing members systematically, from higher to lower level. Complete building demolition operations above each floor or tier before disturbing supporting members on the next lower level.

- B. Remove debris from elevated portions of the building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.
 - 1. Remove structural framing members and lower to ground by method suitable to minimize ground impact and dust generation.
- C. Salvage: Items to be removed and salvaged are indicated on Drawings.
- D. Below-Grade Construction: Abandon foundation walls and other below-grade construction. Cut below-grade construction flush with grade.
- E. Below-Grade Construction: Demolish foundation walls and other below-grade construction that are within footprint of new construction and extending 5 feet outside footprint indicated for new construction. Abandon below-grade construction outside this area.
 - 1. As shown, or required, remove below-grade construction, including basements, foundation walls, and footings, to at least 6 inches below grade.
- F. Below-Grade Construction: Demolish foundation walls and other below-grade construction.
 - 1. Remove below-grade construction, including basements, foundation walls, and footings, to at least 6 inches below grade.
- G. Existing Utilities: Abandon existing utilities and below-grade utility structures. Cut utilities flush with grade.
- H. Existing Utilities: Demolish existing utilities and below-grade utility structures that are within 5 feet outside footprint indicated for new construction. Abandon utilities outside this area.
 - 1. Fill abandoned utility structures with satisfactory soil materials according to backfill requirements in Division 31 Section "Earth Moving."
 - 2. Piping: Disconnect piping at unions, flanges, valves, or fittings.
 - 3. Wiring Ducts: Disassemble into unit lengths and remove plug-in and disconnecting devices.
- I. Existing Utilities: Demolish and remove existing utilities and below-grade utility structures.
 - 1. Piping: Disconnect piping at unions, flanges, valves, or fittings.
 - 2. Wiring Ducts: Disassemble into unit lengths and remove plug-in and disconnecting devices.

3.6 DEMOLITION BY EXPLOSIVES

- A. Explosives: Perform explosive demolition according to governing regulations.
 - 1. Obtain written permission from authorities having jurisdiction before bringing explosives to, or using explosives on, Project site.
 - 2. Do not damage adjacent structures, property, or site improvements when using explosives.
- B. Comply with recommendation in specialty explosives consultant's report.

3.7 SITE RESTORATION

- A. Below-Grade Areas: Rough grade below-grade areas ready for further excavation or new construction.
- B. Below-Grade Areas: Completely fill below-grade areas and voids resulting from building demolition operations with satisfactory soil materials according to backfill requirements in Division 31 Section "Earth Moving."
- C. Site Grading: Uniformly rough grade area of demolished construction to a smooth surface, free from irregular surface changes. Provide a smooth transition between adjacent existing grades and new grades.

3.8 REPAIRS

A. Promptly repair damage to adjacent buildings caused by demolition operations.

3.9 DISPOSAL OF DEMOLISHED MATERIALS

- A. Remove demolition waste materials from Project site and legally dispose of them in an EPAapproved landfill acceptable to authorities having jurisdiction. See Division 01 Section "Construction Waste Management and Disposal" for recycling and disposal of demolition waste.
 - 1. Do not allow demolished materials to accumulate on-site.
 - 2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
- B. Do not burn demolished materials.

3.10 CLEANING

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

END OF SECTION 024116

SECTION 033000 - CAST-IN-PLACE CONCRETE

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 cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes, for the following:
 - 1. Footings.
 - 2. Foundation walls.
 - 3. Slabs-on-grade.
 - 4. Suspended slabs.
 - 5. Concrete toppings.
 - 6. Building frame members.
 - 7. Building walls.
- B. Related Sections:
 - 1. Division 03 Section "Architectural Concrete" for general building applications of specially finished formed concrete.
 - 2. Division 03 Section "Concrete Topping" for emery- and iron-aggregate concrete floor toppings.
 - 3. Division 31 Section "Earth Moving" for drainage fill under slabs-on-grade.
 - 4. Division 32 Section "Concrete Paving" for concrete pavement and walks.
 - 5. Division 32 Section "Decorative Concrete Paving" for decorative concrete pavement and walks.

1.3 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash and other pozzolans, ground granulated blast-furnace slag, and silica fume; subject to compliance with requirements.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

- 1. Indicate amounts of mixing water to be withheld for later addition at Project site.
- C. Steel Reinforcement Shop Drawings: Placing drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement.
- D. Formwork Shop Drawings: Prepared by or under the supervision of a qualified professional engineer detailing fabrication, assembly, and support of formwork.
 - 1. Shoring and Re-shoring: Indicate proposed schedule and sequence of stripping formwork, shoring removal, and re-shoring installation and removal.
- E. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.
 - 1. Location of construction joints is subject to approval of the Architect.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer manufacturer and testing agency.
- B. Welding certificates.
- C. Material Certificates: For each of the following, signed by manufacturers:
 - 1. Cementitious materials.
 - 2. Admixtures.
 - 3. Form materials and form-release agents.
 - 4. Steel reinforcement and accessories.
 - 5. Fiber reinforcement.
 - 6. Waterstops.
 - 7. Curing compounds.
 - 8. Floor and slab treatments.
 - 9. Bonding agents.
 - 10. Adhesives.
 - 11. Vapor retarders.
 - 12. Semi-rigid joint filler.
 - 13. Joint-filler strips.
 - 14. Repair materials.
- D. Material Test Reports: For the following, from a qualified testing agency, indicating compliance with requirements:
 - 1. Aggregates.
- E. Floor surface flatness and levelness measurements indicating compliance with specified tolerances.
- F. Field quality-control reports.

G. Minutes of preinstallation conference.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer who employs on Project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician.
- B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.
 - 1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."
- C. Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.
 - 1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.
 - 2. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician - Grade I. Testing Agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician -Grade II.
- D. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from single source, and obtain admixtures from single source from single manufacturer.
- E. Welding Qualifications: Qualify procedures and personnel according to AWS D1.4/D 1.4M, "Structural Welding Code Reinforcing Steel."
- F. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:
 - 1. ACI 301, "Specifications for Structural Concrete," Sections 1 through 5.
 - 2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."
- G. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.
- H. Pre-installation Conference: Conduct conference at Project site.
 - 1. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:
 - a. Contractor's superintendent.
 - b. Independent testing agency responsible for concrete design mixtures.
 - c. Ready-mix concrete manufacturer.

- d. Concrete subcontractor.
- e. Special concrete finish subcontractor.

1.7 DELIVERY, STORAGE, AND HANDLING

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

PART 2 - PRODUCTS

2.1 FORM-FACING MATERIALS

- A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.
 - 1. Plywood, metal, or other approved panel materials.
 - 2. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:
 - a. High-density overlay, Class 1 or better.
 - b. Medium-density overlay, Class 1 or better; mill-release agent treated and edge sealed.
 - c. Structural 1, B-B or better; mill oiled and edge sealed.
 - d. B-B (Concrete Form), Class 1 or better; mill oiled and edge sealed.
- B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.
- C. Forms for Cylindrical Columns, Pedestals, and Supports: Metal, glass-fiber-reinforced plastic, paper, or fiber tubes that will produce surfaces with gradual or abrupt irregularities not exceeding specified formwork surface class. Provide units with sufficient wall thickness to resist plastic concrete loads without detrimental deformation.
- D. Pan-Type Forms: Glass-fiber-reinforced plastic or formed steel, stiffened to resist plastic concrete loads without detrimental deformation.
- E. Void Forms: Biodegradable paper surface, treated for moisture resistance, structurally sufficient to support weight of plastic concrete and other superimposed loads.
- F. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch, minimum.
- G. Rustication Strips: Wood, metal, PVC, or rubber strips, kerfed for ease of form removal.
- H. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

- 1. Formulate form-release agent with rust inhibitor for steel form-facing materials.
- I. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
 - 1. Furnish units that will leave no corrodible metal closer than 1 inch to the plane of exposed concrete surface.
 - 2. Furnish ties that, when removed, will leave holes no larger than 1 inch in diameter in concrete surface.
 - 3. Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.

2.2 STEEL REINFORCEMENT

- A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60, deformed.
- B. Low-Alloy-Steel Reinforcing Bars: ASTM A 706/A 706M, deformed.
- C. Steel Bar Mats: ASTM A 184/A 184M, fabricated from ASTM A 615/A 615M, Grade 60, deformed bars, assembled with clips.
- D. Plain-Steel Wire: ASTM A 82/A 82M, as drawn.
- E. Deformed-Steel Wire: ASTM A 496/A 496M.
- F. Plain-Steel Welded Wire Reinforcement: ASTM A 185/A 185M, plain, fabricated from asdrawn steel wire into flat sheets.
- G. Deformed-Steel Welded Wire Reinforcement: ASTM A 497/A 497M, flat sheet.

2.3 REINFORCEMENT ACCESSORIES

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

2.4 CONCRETE MATERIALS

A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:

- 1. Portland Cement: ASTM C 150, Type II, gray. Supplement with the following:
 - a. Fly Ash: ASTM C 618, Class F or C.
 - b. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.
- 2. Blended Hydraulic Cement: ASTM C 595 cement.
- B. Silica Fume: ASTM C 1240, amorphous silica.
- C. Normal-Weight Aggregates: ASTM C 33, coarse aggregate or better, graded. Provide aggregates from a single source.
 - 1. Maximum Coarse-Aggregate Size: per plans.
 - 2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
- D. Water: ASTM C 94/C 94M and potable.

2.5 ADMIXTURES

- A. Air-Entraining Admixture: ASTM C 260.
- B. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.
 - 1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
 - 2. Retarding Admixture: ASTM C 494/C 494M, Type B.
 - 3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
 - 4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
 - 5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
 - 6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.
- C. Set-Accelerating Corrosion-Inhibiting Admixture: Commercially formulated, anodic inhibitor or mixed cathodic and anodic inhibitor; capable of forming a protective barrier and minimizing chloride reactions with steel reinforcement in concrete and complying with ASTM C 494/C 494M, Type C.
 - 1. Products: Subject to compliance with requirements, provide the following available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Axim Italcementi Group, Inc.; CATEXOL CN-CI.
 - b. BASF Construction Chemicals Building Systems; Rheocrete CNI.
 - c. Euclid Chemical Company (The), an RPM company;.
 - d. Grace Construction Products, W. R. Grace & Co.; DCI.
 - e. Sika Corporation; Sika CNI.

- D. Non-Set-Accelerating Corrosion-Inhibiting Admixture: Commercially formulated, non-setaccelerating, anodic inhibitor or mixed cathodic and anodic inhibitor; capable of forming a protective barrier and minimizing chloride reactions with steel reinforcement in concrete.
 - 1. Products: Subject to compliance with requirements, provide the following available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. BASF Construction Chemicals Building Systems; Rheocrete 222+.
 - b. Cortec Corporation; MCI.
 - c. Grace Construction Products, W. R. Grace & Co.; DCI-S.
 - d. Sika Corporation; FerroGard 901.

2.6 VAPOR RETARDERS

- A. Sheet Vapor Retarder: ASTM E 1745, Class B. Include manufacturer's recommended adhesive or pressure-sensitive tape.
 - 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. Fortifiber Building Systems Group; Moistop Ultra 6.
 - b. Raven Industries Inc.; Griffolyn 10 mil Green.
 - c. Stego Industries, LLC; Stego Wrap, 10 mil Class A.
- B. Granular Fill: Clean mixture of crushed stone or crushed or uncrushed gravel; ASTM D 448, Size 57, with 100 percent passing a 1-1/2-inch sieve and 0 to 5 percent passing a No. 8 sieve.
- C. Fine-Graded Granular Material: Clean mixture of crushed stone, crushed gravel, and manufactured or natural sand; ASTM D 448, Size 10, with 100 percent passing a 3/8-inch sieve, 10 to 30 percent passing a No. 100 sieve, and at least 5 percent passing No. 200 sieve; complying with deleterious substance limits of ASTM C 33 for fine aggregates.

2.7 CURING MATERIALS

- A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.
 - 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. Axim Italcementi Group, Inc.; CATEXOL CimFilm.
 - b. BASF Construction Chemicals Building Systems; Confilm.
 - c. ChemMasters; SprayFilm.
 - d. Conspec by Dayton Superior; Aquafilm.
 - e. Dayton Superior Corporation; Sure Film (J-74).
 - f. Edoco by Dayton Superior; BurkeFilm.
 - g. Euclid Chemical Company (The), an RPM company; Eucobar.
 - h. Kaufman Products, Inc.; Vapor-Aid.

- i. Lambert Corporation; LAMBCO Skin.
- j. L&M Construction Chemicals, Inc.; E-CON.
- k. Meadows, W. R., Inc.; EVAPRE.
- 1. Metalcrete Industries; Waterhold.
- m. Nox-Crete Products Group; MONOFILM.
- n. Sika Corporation; SikaFilm.
- o. SpecChem, LLC; Spec Film.
- p. Symons by Dayton Superior; Finishing Aid.
- q. TK Products, Division of Sierra Corporation; TK-2120 TRI-FILM.
- r. Unitex; PRO-FILM.
- s. Vexcon Chemicals, Inc.; Certi-Vex Envio Set.
- B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. when dry.
- C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
- D. Water: Potable.
- E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, dissipating.
 - 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. Anti-Hydro International, Inc.; AH Curing Compound #2 DR WB.
 - b. BASF Construction Chemicals Building Systems; Kure 200.
 - c. ChemMasters; Safe-Cure Clear.
 - d. Conspec by Dayton Superior; W.B. Resin Cure.
 - e. Dayton Superior Corporation; Day-Chem Rez Cure (J-11-W).
 - f. Edoco by Dayton Superior; Res X Cure WB.
 - g. Euclid Chemical Company (The), an RPM company; Kurez W VOX; TAMMSCURE WB 30C.
 - h. Kaufman Products, Inc.; Thinfilm 420.
 - i. Lambert Corporation; AQUA KURE CLEAR.
 - j. L&M Construction Chemicals, Inc.; L&M Cure R.
 - k. Meadows, W. R., Inc.; 1100-CLEAR.
 - 1. Nox-Crete Products Group; Resin Cure E.
 - m. Right Pointe; Clear Water Resin.
 - n. SpecChem, LLC; Spec Rez Clear.
 - o. Symons by Dayton Superior; Resi-Chem Clear.
 - p. TK Products, Division of Sierra Corporation; TK-2519 DC WB.
 - q. Vexcon Chemicals, Inc.; Certi-Vex Enviocure 100.
- F. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, non-dissipating, certified by curing compound manufacturer to not interfere with bonding of floor covering.
 - 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. Anti-Hydro International, Inc.; AH Clear Cure WB.
- b. BASF Construction Chemicals Building Systems; Kure-N-Seal WB.
- c. ChemMasters; Safe-Cure & Seal 20.
- d. Conspec by Dayton Superior; Cure and Seal WB.
- e. Cresset Chemical Company; Crete-Trete 309-VOC Cure & Seal.
- f. Dayton Superior Corporation; Safe Cure and Seal (J-18).
- g. Edoco by Dayton Superior; Spartan Cote WB II.
- h. Euclid Chemical Company (The), an RPM company; Aqua Cure VOX; Clearseal WB 150.
- i. Kaufman Products, Inc.; Cure & Seal 309 Emulsion.
- j. Lambert Corporation; Glazecote Sealer-20.
- k. L&M Construction Chemicals, Inc.; Dress & Seal WB.
- 1. Meadows, W. R., Inc.; Vocomp-20.
- m. Metalcrete Industries; Metcure.
- n. Nox-Crete Products Group; Cure & Seal 150E.
- o. Symons by Dayton Superior; Cure & Seal 18 Percent E.
- p. TK Products, Division of Sierra Corporation; TK-2519 WB.
- q. Vexcon Chemicals, Inc.; Starseal 309.
- G. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, 18 to 25 percent solids, nondissipating, certified by curing compound manufacturer to not interfere with bonding of floor covering.
 - 1. 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 Construction Chemicals Building Systems; Kure-N-Seal W.
 - b. ChemMasters; Safe-Cure Clear.
 - c. Conspec by Dayton Superior; High Seal.
 - d. Dayton Superior Corporation; Safe Cure and Seal (J-19).
 - e. Edoco by Dayton Superior; Spartan Cote WB II 20 Percent.
 - f. Euclid Chemical Company (The), an RPM company; Diamond Clear VOX; Clearseal WB STD.
 - g. Kaufman Products, Inc.; SureCure Emulsion.
 - h. Lambert Corporation; Glazecote Sealer-20.
 - i. L&M Construction Chemicals, Inc.; Dress & Seal WB.
 - j. Meadows, W. R., Inc.; Vocomp-20.
 - k. Metalcrete Industries; Metcure 0800.
 - 1. Nox-Crete Products Group; Cure & Seal 200E.
 - m. Symons by Dayton Superior; Cure & Seal 18 Percent E.
 - n. Vexcon Chemicals, Inc.; Starseal 0800.
- H. Clear, Solvent-Borne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.
 - 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 Construction Chemicals Building Systems; Kure-N-Seal 25 LV.
 - b. ChemMasters; Spray-Cure & Seal Plus.
 - c. Conspec by Dayton Superior; Sealcure 1315.

- d. Dayton Superior Corporation; Day-Chem Cure and Seal (J-22UV).
- e. Edoco by Dayton Superior; Cureseal 1315.
- f. Euclid Chemical Company (The), an RPM company; Super Diamond Clear; LusterSeal 300.
- g. Kaufman Products, Inc.; Sure Cure 25.
- h. Lambert Corporation; UV Super Seal.
- i. L&M Construction Chemicals, Inc.; Lumiseal Plus.
- j. Meadows, W. R., Inc.; CS-309/30.
- k. Metalcrete Industries; Seal N Kure 30.
- 1. Right Pointe; Right Sheen 30.
- m. Vexcon Chemicals, Inc.; Certi-Vex AC 1315.
- 2. VOC Content: Curing and sealing compounds shall have a VOC content of 200 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- I. Clear, Waterborne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.
 - 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 Construction Chemicals Building Systems; Kure 1315.
 - b. ChemMasters; Polyseal WB.
 - c. Conspec by Dayton Superior; Sealcure 1315 WB.
 - d. Edoco by Dayton Superior; Cureseal 1315 WB.
 - e. Euclid Chemical Company (The), an RPM company; Super Diamond Clear VOX; LusterSeal WB 300.
 - f. Kaufman Products, Inc.; Sure Cure 25 Emulsion.
 - g. Lambert Corporation; UV Safe Seal.
 - h. L&M Construction Chemicals, Inc.; Lumiseal WB Plus.
 - i. Meadows, W. R., Inc.; Vocomp-30.
 - j. Metalcrete Industries; Metcure 30.
 - k. Right Pointe; Right Sheen WB30.
 - 1. Symons by Dayton Superior; Cure & Seal 31 Percent E.
 - m. Vexcon Chemicals, Inc.; Vexcon Starseal 1315.
 - 2. VOC Content: Curing and sealing compounds shall have a VOC content of 200 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.8 RELATED MATERIALS

- A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber or ASTM D 1752, cork or self-expanding cork.
- B. Semirigid Joint Filler: Two-component, semirigid, 100 percent solids, epoxy resin with a Type A shore durometer hardness of 80 per ASTM D 2240.
- C. Bonding Agent: ASTM C 1059/C 1059M, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

- D. Reglets: Fabricate reglets of not less than 0.022-inch- thick, galvanized-steel sheet. Temporarily fill or cover face opening of reglet to prevent intrusion of concrete or debris.
- E. Dovetail Anchor Slots: Hot-dip galvanized-steel sheet, not less than 0.034 inch thick, with bent tab anchors. Temporarily fill or cover face opening of slots to prevent intrusion of concrete or debris.

2.9 REPAIR MATERIALS

- A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch and that can be feathered at edges to match adjacent floor elevations.
 - 1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
 - 2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
 - 3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by underlayment manufacturer.
 - 4. Compressive Strength: Not less than 4100 psi at 28 days when tested according to ASTM C 109/C 109M.
- B. Repair Overlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/4 inch and that can be filled in over a scarified surface to match adjacent floor elevations.
 - 1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
 - 2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.
 - 3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by topping manufacturer.
 - 4. Compressive Strength: Not less than 5000 psi at 28 days when tested according to ASTM C 109/C 109M.

2.10 CONCRETE MIXTURES, GENERAL

- A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.
 - 1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.
- B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:
 - 1. Fly Ash: 25 percent.
 - 2. Combined Fly Ash and Pozzolan: 25 percent.
 - 3. Ground Granulated Blast-Furnace Slag: 50 percent.

- 4. Combined Fly Ash or Pozzolan and Ground Granulated Blast-Furnace Slag: 50 percent portland cement minimum, with fly ash or pozzolan not exceeding 25 percent.
- 5. Silica Fume: 10 percent.
- 6. Combined Fly Ash, Pozzolans, and Silica Fume: 35 percent with fly ash or pozzolans not exceeding 25 percent and silica fume not exceeding 10 percent.
- Combined Fly Ash or Pozzolans, Ground Granulated Blast-Furnace Slag, and Silica Fume: 50 percent with fly ash or pozzolans not exceeding 25 percent and silica fume not exceeding 10 percent.
- C. Limit water-soluble, chloride-ion content in hardened concrete to 0.06 percent by weight of cement.
- D. Admixtures: Use admixtures according to manufacturer's written instructions.
 - 1. Use water-reducing high-range water-reducing or plasticizing admixture in concrete, as required, for placement and workability.
 - 2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
 - 3. Use water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs and parking structure slabs, concrete required to be watertight, and concrete with a water-cementitious materials ratio below 0.50.
 - 4. Use corrosion-inhibiting admixture in concrete mixtures where indicated.
- E. Color Pigment: Add color pigment to concrete mixture according to manufacturer's written instructions and to result in hardened concrete color consistent with approved mockup.

2.11 CONCRETE MIXTURES FOR BUILDING ELEMENTS

- A. Proportion normal-weight concrete mixture as indicated on design drawings:
 - 1. Minimum Compressive Strength.
 - 2. Maximum Water-Cementitious Materials Ratio.
 - 3. Slump Limit.
 - 4. Air Content: 5.5 percent, plus or minus 1.5 percent at point of delivery for 1-1/2-inch nominal maximum aggregate size.
 - 5. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 1-inch nominal maximum aggregate size.

2.12 FABRICATING REINFORCEMENT

A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.13 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M and ASTM C 1116/C 1116M, and furnish batch ticket information.

- 1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.
- B. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M. Mix concrete materials in appropriate drum-type batch machine mixer.
 - 1. For mixer capacity of 1 cu. yd. or smaller, continue mixing at least 1-1/2 minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released.
 - 2. For mixer capacity larger than 1 cu. yd., increase mixing time by 15 seconds for each additional 1 cu. yd..
 - 3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mixture type, mixture time, quantity, and amount of water added. Record approximate location of final deposit in structure.

PART 3 - EXECUTION

3.1 FORMWORK

- A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.
- B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.
- C. Limit concrete surface irregularities, designated by ACI 347 as abrupt or gradual, as follows:
 - 1. Class B, 1/4 inch for rough-formed finished surfaces.
- D. Construct forms tight enough to prevent loss of concrete mortar.
- E. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.
 - 1. Install keyways, reglets, recesses, and the like, for easy removal.
 - 2. Do not use rust-stained steel form-facing material.
- F. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.
- G. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.
- H. Chamfer exterior corners and edges of permanently exposed concrete.

- I. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.
- J. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.
- K. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.
- L. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.2 EMBEDDED ITEMS

- A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 1. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC's "Code of Standard Practice for Steel Buildings and Bridges."
 - 2. Install reglets to receive waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.
 - 3. Install dovetail anchor slots in concrete structures as indicated.

3.3 REMOVING AND REUSING FORMS

- A. General: Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F for 24 hours after placing concrete. Concrete has to be hard enough to not be damaged by form-removal operations and curing and protection operations need to be maintained.
 - 1. Leave formwork for beam soffits, joists, slabs, and other structural elements that supports weight of concrete in place until concrete has achieved at least 70 percent of its 28-day design compressive strength.
 - 2. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.
- B. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-release agent.
- C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

3.4 SHORES AND RESHORES

- A. Comply with ACI 318 and ACI 301 for design, installation, and removal of shoring and reshoring.
 - 1. Do not remove shoring or reshoring until measurement of slab tolerances is complete.
- B. In multistory construction, extend shoring or reshoring over a sufficient number of stories to distribute loads in such a manner that no floor or member will be excessively loaded or will induce tensile stress in concrete members without sufficient steel reinforcement.
- C. Plan sequence of removal of shores and reshore to avoid damage to concrete. Locate and provide adequate reshoring to support construction without excessive stress or deflection.

3.5 VAPOR RETARDERS

- A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder according to ASTM E 1643 and manufacturer's written instructions.
 - 1. Lap joints 6 inches and seal with manufacturer's recommended tape.
- B. Bituminous Vapor Retarders: Place, protect, and repair bituminous vapor retarder according to manufacturer's written instructions.
- C. Granular Course: Cover vapor retarder with granular fill, moisten, and compact with mechanical equipment to elevation tolerances of plus 0 inch or minus 3/4 inch.
 - 1. Place and compact a 1/2-inch- thick layer of fine-graded granular material over granular fill.

3.6 STEEL REINFORCEMENT

- A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.
 - 1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that would reduce bond to concrete.
- C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.
 - 1. Weld reinforcing bars according to AWS D1.4/D 1.4M, where indicated.
- D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.
- E. Install welded wire reinforcement in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset

laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.

- F. Epoxy-Coated Reinforcement: Repair cut and damaged epoxy coatings with epoxy repair coating according to ASTM D 3963/D 3963M. Use epoxy-coated steel wire ties to fasten epoxy-coated steel reinforcement.
- G. Zinc-Coated Reinforcement: Repair cut and damaged zinc coatings with zinc repair material according to ASTM A 780. Use galvanized steel wire ties to fasten zinc-coated steel reinforcement.

3.7 JOINTS

- A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.
- B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
 - 1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.
 - 2. Form keyed joints as indicated. Embed keys at least 1-1/2 inches into concrete.
 - 3. Locate joints for beams, slabs, joists, and girders in the middle third of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
 - 4. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
 - 5. Space vertical joints in walls as indicated. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.
 - 6. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
 - 7. Use epoxy-bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
- C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness as follows:
 - 1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
 - 2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.
- D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.

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

3.8 WATERSTOPS

- A. Flexible Waterstops: Install in construction joints and at other joints indicated to form a continuous diaphragm. Install in longest lengths practicable. Support and protect exposed waterstops during progress of the Work. Field fabricate joints in waterstops according to manufacturer's written instructions.
- B. Self-Expanding Strip Waterstops: Install in construction joints and at other locations indicated, according to manufacturer's written instructions, adhesive bonding, mechanically fastening, and firmly pressing into place. Install in longest lengths practicable.

3.9 CONCRETE PLACEMENT

- A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.
- B. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Architect.
- C. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301.
 - 1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.
- D. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.
 - 1. Deposit concrete in horizontal layers of depth to not exceed formwork design pressures and in a manner to avoid inclined construction joints.
 - 2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.
 - 3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time

necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.

- E. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.
 - 1. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
 - 2. Maintain reinforcement in position on chairs during concrete placement.
 - 3. Screed slab surfaces with a straightedge and strike off to correct elevations.
 - 4. Slope surfaces uniformly to drains where required.
 - 5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.
- F. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
 - 1. When average high and low temperature is expected to fall below 40 deg F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
 - 2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
 - 3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.
- G. Hot-Weather Placement: Comply with ACI 301 and as follows:
 - 1. Maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
 - 2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

3.10 FINISHING FORMED SURFACES

- A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
- B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
 - 1. Apply to concrete surfaces exposed to public view, to receive a rubbed finish, or to be covered with a coating or covering material applied directly to concrete.

- C. Rubbed Finish: Apply the following to smooth-formed finished as-cast concrete where indicated:
 - 1. Smooth-Rubbed Finish: Not later than one day after form removal, moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.
 - 2. Grout-Cleaned Finish: Wet concrete surfaces and apply grout of a consistency of thick paint to coat surfaces and fill small holes. Mix one part portland cement to one and one-half parts fine sand with a 1:1 mixture of bonding admixture and water. Add white portland cement in amounts determined by trial patches so color of dry grout will match adjacent surfaces. Scrub grout into voids and remove excess grout. When grout whitens, rub surface with clean burlap and keep surface damp by fog spray for at least 36 hours.
 - 3. Cork-Floated Finish: Wet concrete surfaces and apply a stiff grout. Mix one part portland cement and one part fine sand with a 1:1 mixture of bonding agent and water. Add white portland cement in amounts determined by trial patches so color of dry grout will match adjacent surfaces. Compress grout into voids by grinding surface. In a swirling motion, finish surface with a cork float.
- D. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.11 FINISHING FLOORS AND SLABS

- A. General: Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
- B. Scratch Finish: While still plastic, texture concrete surface that has been screeded and bull-floated or darbied. Use stiff brushes, brooms, or rakes to produce a profile amplitude of 1/4 inch in one direction.
 - 1. Apply scratch finish to surfaces to receive concrete floor toppings.
- C. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture.
 - 1. Apply float finish to surfaces to be covered with fluid-applied or sheet waterproofing, built-up or membrane roofing, or sand-bed terrazzo.
- D. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and re-straighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.

- 1. Apply a trowel finish to surfaces to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system.
- 2. Finish surfaces to the following tolerances, according to ASTM E 1155, for a randomly trafficked floor surface:
 - a. Specified overall values of flatness, F(F) 25; and of levelness, F(L) 20; with minimum local values of flatness, F(F) 17; and of levelness, F(L) 15.
 - b. Specified overall values of flatness, F(F) 35; and of levelness, F(L) 25; with minimum local values of flatness, F(F) 24; and of levelness, F(L) 17; for slabs-on-grade.
 - c. Specified overall values of flatness, F(F) 30; and of levelness, F(L) 20; with minimum local values of flatness, F(F) 24; and of levelness, F(L) 15; for suspended slabs.
 - d. Specified overall values of flatness, F(F) 45; and of levelness, F(L) 35; with minimum local values of flatness, F(F) 30; and of levelness, F(L) 24.
- 3. Finish and measure surface so gap at any point between concrete surface and an unleveled, freestanding, 10-ft.- long straightedge resting on two high spots and placed anywhere on the surface does not exceed 1/4 inch.
- E. Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces indicated. While concrete is still plastic, slightly scarify surface with a fine broom.
 - 1. Comply with flatness and levelness tolerances for trowel-finished floor surfaces.
- F. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, ramps, and elsewhere as indicated.
 - 1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.

3.12 MISCELLANEOUS CONCRETE ITEMS

- A. Filling In: Fill in holes and openings left in concrete structures after work of other trades is in place unless otherwise indicated. Mix, place, and cure concrete, as specified, to blend with inplace construction. Provide other miscellaneous concrete filling indicated or required to complete the Work.
- B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.
- C. Equipment Bases and Foundations: Provide machine and equipment bases and foundations as shown on Drawings. Set anchor bolts for machines and equipment at correct elevations, complying with diagrams or templates from manufacturer furnishing machines and equipment.

D. Steel Pan Stairs: Provide concrete fill for steel pan stair treads, landings, and associated items. Cast-in inserts and accessories as shown on Drawings. Screed, tamp, and trowel finish concrete surfaces.

3.13 CONCRETE PROTECTING AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 for hot-weather protection during curing.
- B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.
- C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for the remainder of the curing period.
- D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.
- E. Cure concrete according to ACI 308.1, by one or a combination of the following methods:
 - 1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
 - a. Water.
 - b. Continuous water-fog spray.
 - c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.
 - 2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
 - a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.
 - b. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.
 - c. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer certifies will not interfere with bonding of floor covering used on Project.
 - 3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall

within three hours after initial application. Maintain continuity of coating and repair damage during curing period.

- a. Removal: After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer unless manufacturer certifies curing compound will not interfere with bonding of floor covering used on Project.
- 4. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

3.14 JOINT FILLING

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

3.15 CONCRETE SURFACE REPAIRS

- A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.
- B. Patching Mortar: Mix dry-pack patching mortar, consisting of one part portland cement to two and one-half parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.
- C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.
 - 1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch in any dimension to solid concrete. Limit cut depth to 3/4 inch. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
 - 2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar will match surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match

before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.

- 3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Architect.
- D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.
 - 1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
 - 2. After concrete has cured at least 14 days, correct high areas by grinding.
 - 3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
 - 4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.
 - 5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
 - 6. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a 3/4-inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
 - 7. Repair random cracks and single holes 1 inch or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.
- E. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.
- F. Repair materials and installation not specified above may be used, subject to Architect's approval.

3.16 FIELD QUALITY CONTROL

A. Testing and Inspecting: Owner will engage a qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.

- B. Testing and Inspecting: Engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.
- C. Inspections:
 - 1. Steel reinforcement placement.
 - 2. Steel reinforcement welding.
 - 3. Headed bolts and studs.
 - 4. Verification of use of required design mixture.
 - 5. Concrete placement, including conveying and depositing.
 - 6. Curing procedures and maintenance of curing temperature.
 - 7. Verification of concrete strength before removal of shores and forms from beams and slabs.
- D. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:
 - 1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd., but less than 25 cu. yd., plus one set for each additional 50 cu. yd. or fraction thereof.
 - 2. Testing Frequency: Obtain at least one composite sample for each 100 cu. yd. or fraction thereof of each concrete mixture placed each day.
 - a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
 - 3. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
 - 4. Air Content: ASTM C 231, pressure method, for normal-weight concrete;one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
 - 5. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg F and below and when 80 deg F and above, and one test for each composite sample.
 - 6. Unit Weight: ASTM C 567, fresh unit weight of structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
 - 7. Compression Test Specimens: ASTM C 31/C 31M.
 - a. Cast and laboratory cure two sets of two standard cylinder specimens for each composite sample.
 - b. Cast and field cure two sets of two standard cylinder specimens for each composite sample.
 - 8. Compressive-Strength Tests: ASTM C 39/C 39M; test one set of two laboratory-cured specimens at 7 days and one set of two specimens at 28 days.
 - a. Test one set of two field-cured specimens at 7 days and one set of two specimens at 28 days.
- b. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.
- 9. When strength of field-cured cylinders is less than 85 percent of companion laboratorycured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
- 10. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.
- 11. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
- 12. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
- 13. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42/C 42M or by other methods as directed by Architect.
- 14. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
- 15. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.
- E. Measure floor and slab flatness and levelness according to ASTM E 1155 within 24 hours of finishing.

3.17 PROTECTION OF LIQUID FLOOR TREATMENTS

A. Protect liquid floor treatment from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by liquid floor treatments installer.

END OF SECTION 033000

SECTION 03 48 16 - PRECAST CONCRETE SPLASH BLOCK

PART 1 - GENERAL

SCOPE OF WORK:

The work includes the provision and installation of a precast concrete splash block where shown and decaled for on the construction drawings and specified herein.

SUBMITTALS:

In accordance with Specification Section 01 33 00, Submittals, furnish product data, concrete test reports, and other items as needed to determine compliance with the Construction Documents.

QUALITY ASSURANCE:

The splash blocks shall be provided by a manufacturer who shall show evidence of having manufactured similar items as a continuously operated business for at least three (3) years.

PART 2 - PRODUCTS

MATERIALS:

Concrete: Minimum 28 day compressive strength of 3,000 psi.

Admixtures: Provide admixtures for concrete that contain not more than 0.1 percent chloride ions.

WINDOW SPLASH BLOCK UNIT:

Model: Precast concrete splash block with an open trough end

Overall Size: Nominal 12" X 24" X 3" height at edge

FINISHES:

All exposed concrete surfaces shall have a hard smooth finish requiring no further finish work once installed and cleaned.

PART 3 - EXECUTION

INSTALLATION:

Generally, the units are located at the perimeter of the building.

The installation shall not damage existing material or building structures which are installed or scheduled to remain once the work in completed.

END OF SECTION 03 48 16

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SECTION 04 05 23 - VENEER MASONRY ACCESSORIES

PART 1 - GENERAL

Scope of work: This section includes accessories for veneer masonry work for the project.

Submittals: In accordance with Section 01 33 00, Submittals, provide product data on all accessories proposed for use in this work; and samples, where appropriate.

PART 2 - PRODUCTS

ACCEPTABLE MANUFACTURER:

Masonry accessories of the following manufacturers will be acceptable for use under this section:

Cumberland Corporation, Lox-All Dur-O-Wall Company Hohmann and Barnard, Inc. National Wire Products Corporation Heckmann Building Products, Inc. Masonry Reinforcing Corp. of America, Inc. Mortar Net, USA, Ltd.

CONCEALED FLASHING MATERIALS:

Thru wall Flashing: Fiber web 310 product consisting of 1 mil metal foil between two layers of mylar and bonded to a 20 X 10 fiberglass scrim.

Adhesive for Flashings: Of type recommended by manufacturer of flashing material for use indicated. When flashing does not extend thru wall, it shall also be anchored to sub wall at top edge with a metal termination bar and sealant strip.

MISCELLANEOUS MATERIALS:

Non-Metallic Expansion Joint Strips: Premolded, flexible cellular neoprene rubber filler strips complying with ASTM D 1056, Grade RE41E1, capable of compression up to 35%, of width and thickness indicated.

Premolded Control Joint Strips: Designed to fit standard sash block and to maintain lateral stability in masonry wall of polyvinyl chloride complying with ASTM D 2287, General Purpose Grade, Designation PVC-63506.

Bond Breaker Strips: Asphalt-saturated organic roofing felt complying with ASTM D 226, Type 1 (No. 15 asphalt felt).

Mortar Net: A high density polyethylene mesh designed to catch mortar at the base in cavity walls.

Weepholes: Medium density polyethylene, outside diameter 1/4" by 4" length.

Acidic Cleaner: "Sure Klean" Vana-Trol; ProSoCo, Inc. or approved equal.

Control Joint Seal: See Section 07 90 00, Exterior Sealants.

MASONRY JOINT REINFORCEMENT TIES AND ANCHOR DEVICES:

Materials: Comply with requirements indicated below for basic materials with requirements indicated under each form of joint reinforcement, tie and anchor for size and other characteristics:

Hot - Dip Galvanized Steel Wire: ASTM A 82 for uncoated wire and ASTM A 123, Class B-2 (1.5 oz. per sq. ft. of wire surface) for zinc coated applied after prefabrication into units.

Joint Reinforcement: Provide welded-wire units prefabricated with deformed continuous side rods and plain cross rods into straight lengths of not less than 10', with prefabricated corner and tee units and complying with requirements indicated below:

Wire Size for Side & Cross rods: 0.1483" diameter.

Width: Fabricate joint reinforcement in units with widths less than nominal width of walls and partitions as required to provide mortar coverage of not less than 5/8" on joint faces exposed to exterior and 1/2" elsewhere.

For single-wythe masonry provide ladder design type with perpendicular cross rods spaced not more than 16" o.c.

For cavity wall masonry construction having veneer masonry, provide ladder and eye type sections. Horizontal ladder will have extended wire eyelets which receive bent wire ties.

Bent-Wire Ties: Provide heavy galvanized individual prefabricated bent-wire with 0.1875" diameter wire hook to fit eyelets.

Length: Provide units of length indicated but no less than that required for embedment into each wythe of 1.5" for solid units and for embedment of tie end into face shells of hollow units, with less than 5/8" mortar cover on exterior face joints, 1/2" elsewhere.

Joint reinforcement for corners and intersecting walls shall be performed, welded shapes (L's at corner, T's at intersecting walls) constructed of the same materials and dimensions as the standard horizontal joint reinforcement.

Tie Shape for Hollow Masonry Units Laid with Cells Vertical: Rectangular with ends welded c lose and not less than 2" wide.

Flexible Anchors: Where flexible anchors are indicated for connecting masonry to structural framework, provide 2-piece anchors as described below which permit vertical and horizontal differential movement between wall and framework parallel to, but resist tension and compression forces perpendicular to, plane of wall.

For anchorage to steel framework provide manufacturer's standard anchors with crimped 1/4" diameter heavy galvanized wire anchor section sized to extend within 1"of masonry face.

Wire Size: 0.1875" diameter.

Masonry Veneer Anchors: Two-piece assemblies which permit vertical or horizontal differential movement between wall and framework parallel to, but resist tension and compression forces perpendicular to, plane of wall; consisting of wire tie section and metal anchor section for attachment to concrete masonry units and complying with the following requirements:

Wire Size: 0.1875" diameter. Wire Tie Shape: Rectangular Wire Tie Length: As indicated/required.

Dovetail slots: Furnish dovetail slots, with filler strips, of approximate slot size, fabricated from 0.0336" (22 gage) sheet metal.

Anchor Bolts: Provide steel bolts with hex nuts and flat washers complying with ASTM A 436, hotdip galvanized to comply with ASTM C 153, Class C, in sizes and configurations indicated.

STEEL LINTELS:

Steel lintel angles shall be A36 steel hot dip galvanized per G90 process of sizes as scheduled below:

Opening	Lintel Schedule	
	Lintel Angle Size:	
Up thru 4'0" 4'1" thru 5'0" 5'1" thru 6'0" 6'1" thru 8'0" 8'1" and up	3 1/2" x 3 1/2" x 1/4" 4" x 3 1/2" x 5/16" 5" x 3 1/2" x 5/16" 6" x 3 1/2" x 5/16" Anchor lintel to back-up support or provide back to	

PART 3 - EXECUTION

LOCATION AND SPACING:

Location and spacing for anchors, ties and reinforcement shall be as indicated on the drawings, as hereinafter specified, or in accordance with all conventional building codes and industry standards.

JOINT REINFORCEMENT:

Horizontal joint reinforcement in walls shall be installed in the first and second bed of concrete masonry units, 8" apart immediately above lintels and below sills at openings and extend 24" to each side. Elsewhere horizontal joint reinforcement for walls, corners, piers, and intersections shall be placed in bed joints at 16 inches on center vertically. Install prefabricated 'T' and 'L' sections at corners and intersections. All joint reinforcement shall be lapped 6" at sections.

Bond beams and lintels shall be reinforced as indicated on the drawings. Splices shall be staggered and lapped in accordance with ACI 318-71.

Core filler trays shall be placed continuous in the horizontal joint below block courses that are to be grouted full.

Wire mesh shall be installed against building sheathing where wall cavities are to be grouted full.

Install other masonry anchors and supports per the manufacturers standards in accordance with their written literature.

LINTELS:

Provide steel lintels at all regular brick masonry openings. Install with long leg vertical (LLV).

CONCEALED FLASHINGS:

Provide concealed flashing in masonry work at, or above, shelf angles, lintels, ledges and other obstruction to the downward flow of water in the wall so as to divert such water to the exterior. Prepare masonry surfaces smooth and free from projections which could puncture flashing.

Install thru wall masonry flashing in accordance with manufacturers written recommendations. Adhere flashing to substrate fully and securely and when flashing cannot penetrate substrate of cavity wall, it shall have a continuous metal termination bar at the top, anchored to the substrate support. Fully seal top of bar with sealant per section 07 90 00.

MISCELLANEOUS MATERIALS:

Install miscellaneous materials at locations as expected in accordance with the manufacturers written installation instructions.

Clean masonry with specified product in accordance with written instructions.

END OF SECTION 04 05 23

SECTION 04 21 13 - BRICK MASONRY

PART 1 - GENERAL

SCOPE OF WORK:

This work generally requires standard sized brick, to match existing brick, in all locations where brick masonry is required per drawings and specifications.

SUBMITTALS:

In accordance with Section 01 33 00, Submittals, provide product data, test data and samples of materials specified in this section for review by the Architect.

JOB CONDITIONS:

Weather: Do not install brick during wet and rainy weather or when freezing conditions are expected in the first 36 hours after installation.

PART 2 - PRODUCTS

GENERAL:

All brick veneer shall be composed of modular, face brick and solid brick masonry units. All brick shall be of the same manufacturer batch for color consistency.

Face brick shall be hard burned, free of distortion, warpage cracks or other imperfections and shall have good faces and edges. Spalled, chipped or cracked brick will be rejected.

Face brick units shall be sound and free of cracks, chips, breaks or other defects that would interfere with their proper setting or impair the strength or durability of construction.

Designation per ASTM C216:

- Type FBS, Grade MW
- Minimum Compressive Strength all units: 2500 psi
- Maximum Water Absorption by 5-h Boiling, 22%
- Maximum Saturation Coefficient 0.78

Dimensions: Size: match existing. Individual brick tolerances for dimensional variation, distortion, warpage shall not exceed those specified in the ASTM C216.

Color: Brick shall match the existing color.

Style: Match the existing texture.

Bond: Running 1/2 bond, rowlock, header, and soldier coursing to match existing detailing.

Joints: 3/8" wide typical; standard tooled round concave horizontal and vertical joints.

PART 3 - EXECUTION

GENERAL:

<u>Sample Panel</u>: Prior to delivery of all units and to proceeding with the masonry work of this section, the Contractor shall erect on the site a sample panel of the brick veneer construction for approval by the Architect.

Panel shall be 4 feet long by 3 feet high, of the proposed color range, texture, bond, mortar and workmanship.

Do not start work until Architect has accepted sample panel.

Use panel as standard of comparison for all masonry work built of same material.

Do not destroy or move panel until work is completed and accepted by Owner.

<u>Protection of Work</u>: Prevent grout, mortar or any other materials from staining face of masonry to be left exposed. Protect sills, ledges and off-sets from mortar drippings or other damage during construction. Wipe excess mortar or grout off masonry surfaces as work progresses.

During erection, cover top of wall with strong non-staining waterproof membrane at end of each day or shutdown and during inclement weather. Cover partially completed walls when work is not in progess.

Keep wall cavity clean by using wood cleaning strips the width of the cavity.

Placing: Set units plumb, true to line and with level courses accurately spaced.

If units are displaced after mortar has stiffened, remove, clean joints and units of mortar and replace with fresh mortar.

<u>Joining</u>: When joining fresh masonry to set or partially set on existing masonry construction, clean exposed surface of set masonry and remove loose mortar prior to laying fresh masonry.

If necessary to stop off a horizontal run of masonry, rack back one-half unit length in each course of brick with running bond.

Do not use toothing to join new masonry to set or partially set masonry when continuing a horizontal run.

No exposed closures of less than 1/3 masonry unit will be permitted.

<u>Cutting</u>: Cut and fit exposed masonry units with motor driven masonry saw as required for form corners, 45 degree angles, sills, returns, off-sets, etc. Cut and fit units in a manner to insure and maintain proper bond at all beds and joints.

Where electrical conduit, outlet and switch boxes occur in exposed masonry cut unit before items are installed.

Provide all required cuts for accessories and built-in items indicated. Verify size of opening before commencing work.

<u>Sealant Recesses</u>: Leave recesses at expansion joints and around outside perimeters of exterior doors, window frames and other wall openings of width not greater than 3/8", unless noted otherwise or to match expansion joint of substrate.

<u>Built-In Work</u>: Build work of other trades into masonry work, including flashings, grounds, blocking, inserts, anchors, wall plugs, and accessories as work progresses. Space and align built-in parts accurately. Exercise care not to displace other materials from proper position.

INSTALLING FACE BRICK:

<u>Preparation</u>: Wet brick with absorption rates in excess of 20 g./30 sq. in./min. determined by ASTM C67, latest edition, so that rate of absorption when laid does not exceed this amount.

Clean reinforcement; remove loose rust, and other coatings from reinforcement, ties, and all other inserts or accessories.

All brick masonry units shall be clean and free of dust, dirt or other foreign materials that may be detrimental to bonding.

Laying: All brickwork shall be plumb, level and true to line. Square corners shall be uniform.

All pattern work, bonds, or special details indicated on the drawings shall be accurately executed. Build walls to thicknesses indicated with modular units according to the details shown. Typically, provide 5/8" - 3/4" wall cavity between brick and insulation materials.

Line blocks shall be used whenever possible and at intervals not greater than every third course. When it is absolutely necessary to use a line pin, the hole in the joint shall be filled with mortar immediately when the pin is withdrawn.

All masonry shall be laid with horizontal joints level, and vertical joints and faces plumb and true. Vertical joints at every third course shall be accurately aligned.

Veneer Ties/Reinforcement: Provide as specified under section 04 05 23 Masonry Accessories.

Lintels: Provide as specified under section 04 05 23 Masonry Accessories.

<u>Joints and Bedding</u>: Mortar for all bed joints shall be bevelled. Bevelled bed joints shall be sloped toward the center of the wall in such a manner that the bed joint will be filled when the brick is finally brought to line. Furrowing of bed joints will not be permitted.

Fins of bed joint mortar that protrude into the wall cavity are to be avoided. If they occur, they shall be left in place, if not projecting more than the bed joint thickness. In no case shall they be cut off and dropped on to the grout below.

All head joints, regardless of thickness, shall be completely filled with mortar or grout.

All brick units shall be shoved into place and adjusted to final position while mortar is still plastic.

Both outer wythes of a brick wall shall be laid to a line. Bricks that are moved or shifted shall be relaid in fresh mortar.

Locate and fill vertical control or expansion joints, where selected by architect, if not detailed, at intervals of unbroken wall areas not greater than 20 feet.

When brick is used as facing for concrete masonry, the brick expansion joint need not match exactly the concrete masonry expansion joints.

Tooling: Tool exposed joints when "Thumb-Print" hard with appropriate jointer.

Tool exposed horizontal and vertical joints to provide standard concave join.

Trowel-point unexposed and below grade joints.

END OF SECTION 04 21 13

SECTION 042200 - CONCRETE UNIT MASONRY

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. Concrete masonry units.
 - 2. Mortar and grout.
 - 3. Steel reinforcing bars.
 - 4. Masonry joint reinforcement.
 - 5. Ties and anchors.
 - 6. Embedded flashing.
 - 7. Miscellaneous masonry accessories.
 - 8. Masonry-cell insulation.
- B. Related Sections:
 - 1. Division 03 Section "Cast-in-Place Concrete" for dovetail slots for masonry anchors.
 - 2. Division 04 Section "Cast Stone Masonry" for furnishing cast stone trim.
 - 3. Division 05 Section "Structural Steel Framing" for installing anchor sections of adjustable masonry anchors for connecting to structural-steel frame.
 - 4. Division 07 Section "Water Repellents" for water repellents applied to concrete unit masonry.
 - 5. Division 07 Section "Sheet Metal Flashing and Trim" for sheet metal flashing and for furnishing manufactured reglets installed in masonry joints.
 - 6. Division 09 Section "Stone Facing" for stone window stools.

1.3 DEFINITIONS

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

1.4 PERFORMANCE REQUIREMENTS

A. Provide structural unit masonry that develops indicated net-area compressive strengths at 28 days.

- 1. Determine net-area compressive strength of masonry from average net-area compressive strengths of masonry units and mortar types (unit-strength method) according to Tables 1 and 2 in ACI 530.1/ASCE 6/TMS 602.
- 2. Determine net-area compressive strength of masonry by testing masonry prisms according to ASTM C 1314.

1.5 PRECONSTRUCTION TESTING

- A. Preconstruction Testing Service: Owner will engage a qualified independent testing agency to perform preconstruction testing indicated below. Retesting of materials that fail to comply with specified requirements shall be done at Contractor's expense.
 - 1. Concrete Masonry Unit Test: For each type of unit required, according to ASTM C 140 for compressive strength.
 - 2. Mortar Test (Property Specification): For each mix required, according to ASTM C 109/C 109M for compressive strength, ASTM C 1506 for water retention, and ASTM C 91 for air content.
 - 3. Mortar Test (Property Specification): For each mix required, according to ASTM C 780 for compressive strength.
 - 4. Grout Test (Compressive Strength): For each mix required, according to ASTM C 1019.
 - 5. Prism Test: For each type of construction required, according to ASTM C 1314.

1.6 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. LEED Submittals:
 - 1. Product Certificates for Credit MR 5: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.
- C. Shop Drawings: For the following:
 - 1. Masonry Units: Show sizes, profiles, coursing, and locations of special shapes.
 - 2. Reinforcing Steel: Detail bending and placement of unit masonry reinforcing bars. Comply with ACI 315, "Details and Detailing of Concrete Reinforcement."
 - 3. Fabricated Flashing: Detail corner units, end-dam units, and other special applications.
- D. Samples for Initial Selection:
 - 1. Decorative CMUs, in the form of small-scale units.
 - 2. Pre-faced CMUs.
 - 3. Colored mortar.
 - 4. Weep holes/vents.

1.7 INFORMATIONAL SUBMITTALS

- A. List of Materials Used in Constructing Mockups: List generic product names together with manufacturers, manufacturers' product names, model numbers, lot numbers, batch numbers, source of supply, and other information as required to identify materials used. Include mix proportions for mortar and grout and source of aggregates.
 - 1. Submittal is for information only. Neither receipt of list nor approval of mockup constitutes approval of deviations from the Contract Documents unless such deviations are specifically brought to the attention of Architect and approved in writing.
- B. Qualification Data: For testing agency.
- C. Material Certificates: For each type and size of the following:
 - 1. Masonry units.
 - a. Include data on material properties, material test reports substantiating compliance with requirements.
 - b. For masonry units used in structural masonry, include data and calculations establishing average net-area compressive strength of units.
 - 2. Cementitious materials. Include brand, type, and name of manufacturer.
 - 3. Pre-blended, dry mortar mixes. Include description of type and proportions of ingredients.
 - 4. Grout mixes. Include description of type and proportions of ingredients.
 - 5. Reinforcing bars.
 - 6. Joint reinforcement.
 - 7. Anchors, ties, and metal accessories.
- D. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.
 - 1. Include test reports for mortar mixes required to comply with property specification. Test according to ASTM C 109/C 109M for compressive strength, ASTM C 1506 for water retention, and ASTM C 91 for air content.
 - 2. Include test reports, according to ASTM C 1019, for grout mixes required to comply with compressive strength requirement.
- E. Statement of Compressive Strength of Masonry: For each combination of masonry unit type and mortar type, provide statement of average net-area compressive strength of masonry units, mortar type, and resulting net-area compressive strength of masonry determined according to Tables 1 and 2 in ACI 530.1/ASCE 6/TMS 602.
- F. Cold-Weather and Hot-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with requirements.

1.8 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to ASTM C 1093 for testing indicated.

- B. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from single source from single manufacturer for each product required.
- C. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from single manufacturer for each cementitious component and from single source or producer for each aggregate.
- D. Masonry Standard: Comply with ACI 530.1/ASCE 6/TMS 602 unless modified by requirements in the Contract Documents.
- E. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."

1.9 DELIVERY, STORAGE, AND HANDLING

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

1.10 PROJECT CONDITIONS

- A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.
 - 1. Extend cover a minimum of 24 inches down both sides of walls and hold cover securely in place.
- B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least three days after building masonry walls or columns.
- C. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.

- 1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
- 2. Protect sills, ledges, and projections from mortar droppings.
- 3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
- 4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.
- D. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.
 - 1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and higher and will remain so until masonry has dried, but not less than 7 days after completing cleaning.
- E. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

PART 2 - PRODUCTS

2.1 MASONRY UNITS, GENERAL

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

2.2 CONCRETE MASONRY UNITS

- A. Shapes: Provide shapes indicated and as follows, with exposed surfaces matching exposed faces of adjacent units unless otherwise indicated.
 - 1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.
 - 2. Provide bullnose units for outside corners unless otherwise indicated.
- B. CMUs: ASTM C 90.
 - 1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 2150 psi.
 - 2. Density Classification: Normal weight.
 - 3. Size (Width): Manufactured to dimensions 3/8 inch less than nominal dimensions.

2.3 CONCRETE AND MASONRY LINTELS

- A. General: Provide one of the following:
- B. Concrete Lintels: ASTM C 1623, matching CMUs in color, texture, and density classification; and with reinforcing bars indicated. Provide lintels with net-area compressive strength not less than CMUs.
- C. Concrete Lintels: Precast or formed-in-place concrete lintels complying with requirements in Division 03 Section "Cast-in-Place Concrete," and with reinforcing bars indicated.
- D. Masonry Lintels: Prefabricated or built-in-place masonry lintels made from bond beam CMUs with reinforcing bars placed as indicated and filled with coarse grout. Cure precast lintels before handling and installing. Temporarily support built-in-place lintels until cured.

2.4 MORTAR AND GROUT MATERIALS

- A. Portland Cement: ASTM C 150, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.
- B. Hydrated Lime: ASTM C 207, Type S.
- C. Portland Cement-Lime Mix: Packaged blend of portland cement and hydrated lime containing no other ingredients.
- D. Masonry Cement: ASTM C 91.
 - 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. Capital Materials Corporation; Flamingo Color Masonry Cement.
 - b. Cemex S.A.B. de C.V.
 - c. Essroc, Italcementi Group.
 - d. Holcim (US) Inc..
 - e. Lafarge North America Inc..
 - f. Lehigh Cement Company.
 - g. National Cement Company, Inc.; Coosa Masonry Cement.
- E. Mortar Cement: ASTM C 1329.
 - 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. Lafarge North America Inc..
- F. Aggregate for Mortar: ASTM C 144.
 - 1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.

- 2. For joints less than 1/4 inch thick, use aggregate graded with 100 percent passing the No. 16 sieve.
- 3. White-Mortar Aggregates: Natural white sand or crushed white stone.
- 4. Colored-Mortar Aggregates: Natural sand or crushed stone of color necessary to produce required mortar color.
- G. Aggregate for Grout: ASTM C 404.
- H. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C 494/C 494M, Type C, and recommended by manufacturer for use in masonry mortar of composition indicated.
 - 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. Euclid Chemical Company (The); Accelguard 80.
 - b. Grace Construction Products, W. R. Grace & Co. Conn.; Morset.
 - c. Sonneborn Products, BASF Aktiengesellschaft; Trimix-NCA.
- I. Water: Potable.

2.5 REINFORCEMENT

- A. Uncoated Steel Reinforcing Bars: ASTM A 615/A 615M or ASTM A 996/A 996M, Grade 60.
- B. Masonry Joint Reinforcement, General: ASTM A 951/A 951M.
 - 1. Interior Walls: Hot-dip galvanized, carbon steel.
 - 2. Exterior Walls: Hot-dip galvanized, carbon steel.
 - 3. Wire Size for Side Rods: 0.148-inch diameter.
 - 4. Wire Size for Cross Rods: 0.148-inch diameter.
 - 5. Wire Size for Veneer Ties: 0.148-inch diameter.
 - 6. Spacing of Cross Rods, Tabs, and Cross Ties: Not more than 16 inches o.c.
 - 7. Provide in lengths of not less than 10 feet, with prefabricated corner and tee units.
- C. Masonry Joint Reinforcement for Single-Wythe Masonry: Either ladder or truss type with single pair of side rods.

2.6 TIES AND ANCHORS

- A. Materials: Provide ties and anchors specified in this article that are made from materials that comply with the following unless otherwise indicated.
 - 1. Mill-Galvanized, Carbon-Steel Wire: ASTM A 82/A 82M; with ASTM A 641/A 641M, Class 1 coating.
 - 2. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A 82/A 82M; with ASTM A 153/A 153M, Class B-2 coating.
 - 3. Stainless-Steel Wire: ASTM A 580/A 580M.
 - 4. Galvanized Steel Sheet: ASTM A 653/A 653M, Commercial Steel, G60 zinc coating.

- 5. Steel Sheet, Galvanized after Fabrication: ASTM A 1008/A 1008M, Commercial Steel, with ASTM A 153/A 153M, Class B coating.
- 6. Stainless-Steel Sheet: ASTM A 666.
- 7. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- 8. Stainless-Steel Bars: ASTM A 276 or ASTM A 666, Type 304.
- B. Adjustable Anchors for Connecting to Structural Steel Framing: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.
 - 1. Anchor Section for Welding to Steel Frame: Crimped 1/4-inch- diameter, hot-dip galvanized steel wire.
 - 2. Tie Section: Triangular-shaped wire tie, sized to extend within 1 inch of masonry face, made from 0.187-inch- diameter, hot-dip galvanized steel wire.
- C. Partition Top anchors: 0.105-inch- thick metal plate with 3/8-inch- diameter metal rod 6 inches long welded to plate and with closed-end plastic tube fitted over rod that allows rod to move in and out of tube. Fabricate from steel, hot-dip galvanized after fabrication.

2.7 MISCELLANEOUS ANCHORS

- A. Unit Type Inserts in Concrete: Cast-iron or malleable-iron wedge-type inserts.
- B. Dovetail Slots in Concrete: Furnish dovetail slots with filler strips, of slot size indicated, fabricated from 0.034-inch, galvanized steel sheet.
- C. Anchor Bolts: Headed steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers; hot-dip galvanized to comply with ASTM A 153/A 153M, Class C; of dimensions indicated.

2.8 EMBEDDED FLASHING MATERIALS

- A. Metal Flashing: Provide metal flashing complying with [SMACNA's "Architectural Sheet Metal Manual] [Division 07 Section "Sheet Metal Flashing and Trim]" and as follows:
 - 1. Stainless Steel: ASTM A 240/A 240M, Type 304, 0.016 inch thick.
 - 2. Copper: ASTM B 370, Temper H00, cold-rolled copper sheet, 16-oz./sq. ft. weight or 0.0216 inch thick or ASTM B 370, Temper H01, high-yield copper sheet, 12-oz./sq. ft. weight or 0.0162 inch thick.
 - 3. Fabricate continuous flashings in sections 96 inches long minimum, but not exceeding 12 feet. Provide splice plates at joints of formed, smooth metal flashing.
 - 4. Fabricate through-wall metal flashing embedded in masonry from [stainless steel] [copper], with ribs at 3-inch intervals along length of flashing to provide an integral mortar bond.
 - a. 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]:

- Cheney Flashing Company; [Cheney Flashing (Dovetail)] [or] [Cheney 3-Way Flashing (Sawtooth)].
- 2) Keystone Flashing Company, Inc.; Keystone 3-Way Interlocking Thruwall Flashing.
- 3) Sandell Manufacturing Co., Inc.; Mechanically Keyed Flashing.
- 4) <Insert manufacturer's name; product name or designation>.
- 5. Fabricate through-wall flashing with snaplock receiver on exterior face where indicated to receive counterflashing.
- 6. Fabricate through-wall flashing with drip edge [where] [unless otherwise] indicated. Fabricate by extending flashing 1/2 inch out from wall, with outer edge bent down 30 degrees[and hemmed].
- 7. Fabricate through-wall flashing with sealant stop [where] [unless otherwise] indicated. Fabricate by bending metal back on itself 3/4 inch at exterior face of wall and down into joint 1/4 inch to form a stop for retaining sealant backer rod.
- 8. Fabricate metal [**drip edges**] [**and**] [**sealant stops**] for ribbed metal flashing from plain metal flashing of same metal as ribbed flashing and extending at least 3 inches into wall with hemmed inner edge to receive ribbed flashing and form a hooked seam. Form hem on upper surface of metal so that completed seam will shed water.
- 9. Metal Drip Edge: Fabricate from stainless steel. Extend at least 3 inches into wall and 1/2 inch out from wall, with outer edge bent down 30 degrees[and hemmed].
- 10. Metal Sealant Stop: Fabricate from stainless steel. Extend at least 3 inches into wall and out to exterior face of wall. At exterior face of wall, bend metal back on itself for 3/4 inch and down into joint 1/4 inch to form a stop for retaining sealant backer rod.
- 11. Metal Expansion-Joint Strips: Fabricate from [stainless steel] [copper] to shapes indicated.
- B. Flexible Flashing: Use[**one of**] the following unless otherwise indicated:
 - 1. Copper-Laminated Flashing: [**5-oz./sq. ft.**] [**7-oz./sq. ft.**] copper sheet bonded between 2 layers of glass-fiber cloth. Use only where flashing is fully concealed in masonry.
 - a. 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]:
 - 1) Advanced Building Products Inc.; [Copper Fabric Flashing] [Copper Sealtite 2000].
 - 2) Dayton Superior Corporation, Dur-O-Wal Division; Copper Fabric Thru-Wall Flashing.
 - 3) Hohmann & Barnard, Inc.; H & B C-Fab Flashing.
 - 4) Phoenix Building Products; Type FCC-Fabric Covered Copper.
 - 5) Sandell Manufacturing Co., Inc.; Copper Fabric Flashing.
 - 6) York Manufacturing, Inc.; Multi-Flash 500.
 - 7) <Insert manufacturer's name; product name or designation>.
 - 2. Asphalt-Coated Copper Flashing: [5-oz./sq. ft.] [7-oz./sq. ft.] copper sheet coated with flexible asphalt. Use only where flashing is fully concealed in masonry.

- a. 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]:
 - 1) Advanced Building Products Inc.; Cop-R-Cote.
 - 2) Dayton Superior Corporation, Dur-O-Wal Division; Copper Coated Thru-Wall Flashing.
 - 3) Hohmann & Barnard, Inc.; H & B C-Coat Flashing.
 - 4) Phoenix Building Products; Type ACC-Asphalt Bituminous Coated.
 - 5) Sandell Manufacturing Co., Inc.; Coated Copper Flashing.
 - 6) <Insert manufacturer's name; product name or designation>.
- 3. Rubberized-Asphalt Flashing: Composite flashing product consisting of a pliable, adhesive rubberized-asphalt compound, bonded to a high-density, cross-laminated polyethylene film to produce an overall thickness of not less than [0.030 inch] [0.040 inch].
 - a. 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]:
 - 1) Advanced Building Products Inc.; Peel-N-Seal.
 - 2) Carlisle Coatings & Waterproofing; CCW-705-TWF Thru-Wall Flashing.
 - 3) Dayton Superior Corporation, Dur-O-Wal Division; Dur-O-Barrier Thru-Wall Flashing.
 - 4) Fiberweb, Clark Hammerbeam Corp.; Aquaflash 500.
 - 5) Grace Construction Products, W. R. Grace & Co. Conn.; Perm-A-Barrier Wall Flashing.
 - 6) Heckmann Building Products Inc.; No. 82 Rubberized-Asphalt Thru-Wall Flashing.
 - 7) Hohmann & Barnard, Inc.; Textroflash.
 - 8) W. R. Meadows, Inc.; Air-Shield Thru-Wall Flashing.
 - 9) Polyguard Products, Inc.; [Polyguard 300] [Polyguard 400].
 - 10) Sandell Manufacturing Co., Inc.; Sando-Seal.
 - 11) Williams Products, Inc.; Everlastic MF-40.
 - 12) <Insert manufacturer's name; product name or designation>.
 - b. Accessories: Provide preformed corners, end dams, other special shapes, and seaming materials produced by flashing manufacturer.
- 4. Elastomeric Thermoplastic Flashing: Composite flashing product consisting of a polyester-reinforced ethylene interpolymer alloy.
 - a. 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]:
 - 1) DuPont; Thru-Wall Flashing.
 - 2) Hohmann & Barnard, Inc.; Flex-Flash.
 - 3) Hyload, Inc.; Hyload Cloaked Flashing System.
 - 4) Mortar Net USA, Ltd.; Total Flash.

5) <Insert manufacturer's name; product name or designation>.

- b. Monolithic Sheet: Elastomeric thermoplastic flashing, 0.040 inch thick.
- c. Self-Adhesive Sheet: Elastomeric thermoplastic flashing, 0.025 inch thick, with a 0.015-inch- thick coating of adhesive.
- d. Self-Adhesive Sheet with Drip Edge: Elastomeric thermoplastic flashing, 0.025 inch thick, with a 0.015-inch- thick coating of rubberized-asphalt adhesive. Where flashing extends to face of masonry, rubberized-asphalt coating is held back approximately 1-1/2 inches from edge.
 - 1) Color: [Gray] [White] [Tan/buff] [Black].
- e. Accessories: Provide preformed corners, end dams, other special shapes, and seaming materials produced by flashing manufacturer.
- 5. EPDM Flashing: Sheet flashing product made from ethylene-propylene-diene terpolymer, complying with ASTM D 4637, 0.040 inch thick.
 - a. 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]:
 - 1) Carlisle Coatings & Waterproofing; Pre-Kleened EPDM Thru-Wall Flashing.
 - 2) Firestone Specialty Products; FlashGuard.
 - 3) Heckmann Building Products Inc.; No. 81 EPDM Thru-Wall Flashing.
 - 4) Hohmann & Barnard, Inc.; Epra-Max EPDM Thru-Wall Flashing.
 - 5) Sandell Manufacturing Co., Inc.; EPDM Flashing.
 - 6) <Insert manufacturer's name; product name or designation>.
- C. Application: Unless otherwise indicated, use the following:
 - 1. Where flashing is indicated to receive counterflashing, use metal flashing.
 - 2. Where flashing is indicated to be turned down at or beyond the wall face, use metal flashing.
 - 3. Where flashing is partly exposed and is indicated to terminate at the wall face, use metal flashing [with a drip edge] [with a sealant stop] [or flexible flashing with a metal drip edge] [or elastomeric thermoplastic flashing with drip edge] [or flexible flashing with a metal sealant stop].
 - 4. Where flashing is fully concealed, use [metal flashing] [or] [flexible flashing].
- D. Single-Wythe CMU Flashing System: System of CMU cell flashing pans and interlocking CMU web covers made from high-density polyethylene incorporating chemical stabilizers that prevent UV degradation. Cell flashing pans have integral weep spouts that are designed to be built into mortar bed joints and weep collected moisture to the exterior of CMU walls and that extend into the cell to prevent clogging with mortar.
 - 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. Mortar Net USA, Ltd.; Blok-Flash.
- b. <Insert manufacturer's name; product name or designation>.
- E. Solder and Sealants for Sheet Metal Flashings: [As specified in Division 07 Section "Sheet Metal Flashing and Trim."]
 - 1. Solder for Stainless Steel: ASTM B 32, Grade Sn60, with acid flux of type recommended by stainless-steel sheet manufacturer.
 - 2. Solder for Copper: ASTM B 32, Grade Sn50, 50 percent tin and 50 percent lead.
 - 3. Elastomeric Sealant: ASTM C 920, chemically curing [**urethane**] [**polysulfide**] [**silicone**] sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.
- F. Adhesives, Primers, and Seam Tapes for Flashings: Flashing manufacturer's standard products or products recommended by flashing manufacturer for bonding flashing sheets to each other and to substrates.

2.9 MISCELLANEOUS MASONRY ACCESSORIES

- A. Compressible Filler: Premolded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene urethane or PVC.
- B. Preformed Control-Joint Gaskets: Made from styrene-butadiene-rubber compound, complying with ASTM D 2000, Designation M2AA-805 and designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.
- C. Bond-Breaker Strips: Asphalt-saturated, organic roofing felt complying with ASTM D 226, Type I (No. 15 asphalt felt).
- D. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells and hold reinforcing bars in center of cells. Units are formed from 0.148-inch steel wire, hot-dip galvanized after fabrication. Provide units designed for number of bars indicated.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Dayton Superior Corporation, Dur-O-Wal Division; D/A 810, D/A 812 or D/A 817.
 - b. Heckmann Building Products Inc.; No. 376 Rebar Positioner.
 - c. Hohmann & Barnard, Inc.; #RB or #RB-Twin Rebar Positioner.
 - d. Wire-Bond; O-Ring or Double O-Ring Rebar Positioner.

2.10 MASONRY-CELL INSULATION

A. Loose-Granular Fill Insulation: Perlite complying with ASTM C 549, Type II (surface treated for water repellency and limited moisture absorption) or Type IV (surface treated for water repellency and to limit dust generation).

- B. Molded-Polystyrene Insulation Units: Rigid, cellular thermal insulation formed by the expansion of polystyrene-resin beads or granules in a closed mold to comply with ASTM C 578, Type I. Provide specially shaped units designed for installing in cores of masonry units.
 - 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. Concrete Block Insulating Systems; Korfil.
 - b. Shelter Enterprises Inc.; Omni Core.
 - c. <Insert manufacturer's name; product name or designation>.

2.11 MORTAR AND GROUT MIXES

- A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures unless otherwise indicated.
 - 1. Do not use calcium chloride in mortar or grout.
 - 2. Use portland cement-lime masonry cement or mortar cement mortar unless otherwise indicated.
 - 3. For exterior masonry, use portland cement-lime masonry cement or mortar cement mortar.
 - 4. For reinforced masonry, use portland cement-lime masonry cement or mortar cement mortar.
 - 5. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.
- B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.
- C. Mortar for Unit Masonry: Comply with ASTM C 270, Proportion Specification. Provide the following types of mortar for applications stated unless another type is indicated or needed to provide required compressive strength of masonry.
 - 1. For masonry below grade or in contact with earth, use Type M.
 - 2. For reinforced masonry, use Type S.
 - 3. For mortar parge coats, use Type S.
 - 4. For exterior, above-grade, load-bearing and non-load-bearing walls and parapet walls; for interior load-bearing walls; for interior non-load-bearing partitions; and for other applications where another type is not indicated, use Type N.
 - 5. For interior non-load-bearing partitions, Type O may be used instead of Type N.
- D. Grout for Unit Masonry: Comply with ASTM C 476.
 - 1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with Table 1.15.1 in ACI 530.1/ASCE 6/TMS 602 for dimensions of grout spaces and pour height.

- 2. Proportion grout in accordance with ASTM C 476, Table 1.
- 3. Provide grout with a slump of 8 to 11 inches as measured according to ASTM C 143/C 143M.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
 - 1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.
 - 2. Verify that foundations are within tolerances specified.
 - 3. Verify that reinforcing dowels are properly placed.
- B. Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping connections.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. Build chases and recesses to accommodate items specified in this and other Sections.
- B. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match the construction immediately adjacent to opening.
- C. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

3.3 TOLERANCES

- A. Dimensions and Locations of Elements:
 - 1. For dimensions in cross section or elevation do not vary by more than plus 1/2 inch or minus 1/4 inch.
 - 2. For location of elements in plan do not vary from that indicated by more than plus or minus 1/2 inch.
 - 3. For location of elements in elevation do not vary from that indicated by more than plus or minus 1/4 inch in a story height or 1/2 inch total.
- B. Lines and Levels:
 - 1. For bed joints and top surfaces of bearing walls do not vary from level by more than 1/4 inch in 10 feet, or 1/2 inch maximum.

- 2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.
- 3. For vertical lines and surfaces do not vary from plumb by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2 inch maximum.
- 4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.
- 5. For lines and surfaces do not vary from straight by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2 inch maximum.
- 6. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet, or 1/2 inch maximum.
- C. Joints:
 - 1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch, with a maximum thickness limited to 1/2 inch.
 - 2. For exposed bed joints, do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch.
 - 3. For head and collar joints, do not vary from thickness indicated by more than plus 3/8 inch or minus 1/4 inch.
 - 4. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch.

3.4 LAYING MASONRY WALLS

- A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.
- B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in running bond; do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.
- C. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than 2 inches. Bond and interlock each course of each wythe at corners. Do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.
- D. Stopping and Resuming Work: Stop work by racking back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar before laying fresh masonry.
- E. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.
- F. Fill space between steel frames and masonry solidly with mortar unless otherwise indicated.
- G. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath, wire mesh, or plastic mesh in the joint below and rod mortar or grout into core.

- H. Fill cores in hollow CMUs with grout 24 inches under bearing plates, beams, lintels, posts, and similar items unless otherwise indicated.
- I. Build non-load-bearing interior partitions full height of story to underside of solid floor or roof structure above unless otherwise indicated.
 - 1. Install compressible filler in joint between top of partition and underside of structure above.
 - 2. Fasten partition top anchors to structure above and build into top of partition. Grout cells of CMUs solidly around plastic tubes of anchors and push tubes down into grout to provide 1/2-inch clearance between end of anchor rod and end of tube. Space anchors 48 inches o.c. unless otherwise indicated.
 - 3. Wedge non-load-bearing partitions against structure above with small pieces of tile, slate, or metal. Fill joint with mortar after dead-load deflection of structure above approaches final position.
 - 4. At fire-rated partitions, treat joint between top of partition and underside of structure above to comply with Division 07 Section "Fire-Resistive Joint Systems."

3.5 MORTAR BEDDING AND JOINTING

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

3.6 MASONRY-CELL INSULATION

- A. Pour granular insulation into cavities to fill void spaces. Maintain inspection ports to show presence of insulation at extremities of each pour area. Close the ports after filling has been confirmed. Limit the fall of insulation to one story high, but not more than 20 feet.
- B. Install molded-polystyrene insulation units into masonry unit cells before laying units.

3.7 MASONRY JOINT REINFORCEMENT

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

3.8 ANCHORING MASONRY TO STRUCTURAL STEEL AND CONCRETE

- A. Anchor masonry to structural steel and concrete where masonry abuts or faces structural steel or concrete to comply with the following:
 - 1. Provide an open space not less than [1/2 inch] [1 inch] [2 inches] wide between masonry and structural steel or concrete unless otherwise indicated. Keep open space free of mortar and other rigid materials.
 - 2. Anchor masonry with anchors embedded in masonry joints and attached to structure.
 - 3. Space anchors as indicated, but not more than 24 inches o.c. vertically and 36 inches o.c. horizontally.

3.9 CONTROL AND EXPANSION JOINTS

- A. General: Install control and expansion joint materials in unit masonry as masonry progresses. Do not allow materials to span control and expansion joints without provision to allow for inplane wall or partition movement.
- B. Form control joints in concrete masonry using one of the following methods:

- 1. Fit bond-breaker strips into hollow contour in ends of CMUs on one side of control joint. Fill resultant core with grout and rake out joints in exposed faces for application of sealant.
- 2. Install preformed control-joint gaskets designed to fit standard sash block.
- 3. Install interlocking units designed for control joints. Install bond-breaker strips at joint. Keep head joints free and clear of mortar or rake out joint for application of sealant.
- 4. Install temporary foam-plastic filler in head joints and remove filler when unit masonry is complete for application of sealant.

3.10 LINTELS

- A. Provide concrete or masonry lintels where shown and where openings of more than 12 inches for brick-size units and 24 inches for block-size units are shown without structural steel or other supporting lintels.
- B. Provide minimum bearing of 8 inches at each jamb unless otherwise indicated.

3.11 FLASHING

- A. General: Install embedded flashing in masonry at lintels, ledges, other obstructions to downward flow of water in wall, and where indicated.
- B. Install flashing as follows unless otherwise indicated:
 - 1. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer.
 - 2. At lintels, extend flashing a minimum of 6 inches into masonry at each end. At heads and sills, extend flashing 6 inches at ends and turn up not less than 2 inches to form end dams.
 - 3. Interlock end joints of ribbed sheet metal flashing by overlapping ribs not less than 1-1/2 inches or as recommended by flashing manufacturer, and seal lap with elastomeric sealant complying with requirements in Division 07 Section "Joint Sealants" for application indicated.
 - 4. Install metal [**drip edges**] [**and**] [**sealant stops**] with ribbed sheet metal flashing by interlocking hemmed edges to form hooked seam. Seal seam with elastomeric sealant complying with requirements in Division 07 Section "Joint Sealants" for application indicated.
 - 5. Install metal drip edges beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch back from outside face of wall and adhere flexible flashing to top of metal drip edge.
 - 6. Install metal flashing termination beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch back from outside face of wall and adhere flexible flashing to top of metal flashing termination.
 - 7. Cut flexible flashing off flush with face of wall after masonry wall construction is completed.

- C. Install single-wythe CMU flashing system in bed joints of CMU walls where indicated to comply with manufacturer's written instructions. Install CMU cell pans with upturned edges located below face shells and webs of CMUs above and with weep spouts aligned with face of wall. Install CMU web covers so that they cover upturned edges of CMU cell pans at CMU webs and extend from face shell to face shell.
- D. Install reglets and nailers for flashing and other related construction where they are shown to be built into masonry.

3.12 REINFORCED UNIT MASONRY INSTALLATION

- A. Temporary Formwork and Shores: Construct formwork and shores as needed to support reinforced masonry elements during construction.
 - 1. Construct formwork to provide shape, line, and dimensions of completed masonry as indicated. Make forms sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
 - 2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and other loads that may be placed on them during construction.
- B. Placing Reinforcement: Comply with requirements in ACI 530.1/ASCE 6/TMS 602.
- C. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.
 - 1. Comply with requirements in ACI 530.1/ASCE 6/TMS 602 for cleanouts and for grout placement, including minimum grout space and maximum pour height.
 - 2. Limit height of vertical grout pours to not more than 60 inches.

3.13 FIELD QUALITY CONTROL

- A. Testing and Inspecting: Owner will engage special inspectors to perform tests and inspections and prepare reports. Allow inspectors access to scaffolding and work areas, as needed to perform tests and inspections. Retesting of materials that fail to meet specified requirements shall be done at Contractor's expense.
- B. Testing Prior to Construction: One set of tests.
- C. Testing Frequency: One set of tests for each 5000 sq. ft. of wall area or portion thereof.
- D. Concrete Masonry Unit Test: For each type of unit provided, according to ASTM C 140 for compressive strength.
- E. Mortar Aggregate Ratio Test (Proportion Specification): For each mix provided, according to ASTM C 780.
- F. Mortar Test (Property Specification): For each mix provided, according to ASTM C 780. Test mortar for compressive strength.

G. Grout Test (Compressive Strength): For each mix provided, according to ASTM C 1019.

3.14 PARGING

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

3.15 REPAIRING, POINTING, AND CLEANING

- A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.
- B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.
- C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.
- D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
 - 1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
 - 2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
 - 3. Protect adjacent stone and nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
 - 4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
 - 5. Clean concrete masonry by cleaning method indicated in NCMA TEK 8-2A applicable to type of stain on exposed surfaces.

3.16 MASONRY WASTE DISPOSAL

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

- B. Waste Disposal as Fill Material: Dispose of clean masonry waste, including excess or soilcontaminated sand, waste mortar, and broken masonry units, by crushing and mixing with fill material as fill is placed.
 - 1. Crush masonry waste to less than 4 inches in each dimension.
 - 2. Mix masonry waste with at least two parts of specified fill material for each part of masonry waste. Fill material is specified in Division 31 Section "Earth Moving."
 - 3. Do not dispose of masonry waste as fill within 18 inches of finished grade.
- C. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION 042200

SECTION 051200 - STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Structural steel.
 - 2. Prefabricated building columns.
 - 3. Field-installed shear connectors.
 - 4. Grout.
- B. Related Requirements:
 - 1. Section 051213 "Architecturally Exposed Structural Steel Framing" for additional requirements for architecturally exposed structural steel.
 - 2. Section 053100 "Steel Decking" for field installation of shear connectors through deck.
 - 3. Section 055000 "Metal Fabrications" for steel lintels and shelf angles not attached to structural-steel frame miscellaneous steel fabrications and other steel items not defined as structural steel.
 - 4. Section 099113 "Exterior Painting" and Section 099123 "Interior Painting" and Section 099600 "High-Performance Coatings" for surface-preparation and priming requirements.
 - 5. Section 133419 "Metal Building Systems" for structural steel.

1.3 DEFINITIONS

- A. Structural Steel: Elements of the structural frame indicated on Drawings and as described in AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."
- B. Seismic-Load-Resisting System: Elements of structural-steel frame designated as "SLRS" or along grid lines designated as "SLRS" on Drawings, including columns, beams, and braces and their connections.
- C. Heavy Sections: Rolled and built-up sections as follows:
 - 1. Shapes included in ASTM A 6/A 6M with flanges thicker than 1-1/2 inches.
 - 2. Welded built-up members with plates thicker than 2 inches.
 - 3. Column base plates thicker than 2 inches.

- D. Protected Zone: Structural members or portions of structural members indicated as "Protected Zone" on Drawings. Connections of structural and nonstructural elements to protected zones are limited.
- E. Demand Critical Welds: Those welds, the failure of which would result in significant degradation of the strength and stiffness of the Seismic-Load-Resisting System and which are indicated as "Demand Critical" or "Seismic Critical" on Drawings.

1.4 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation.

1.5 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.6 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: Show fabrication of structural-steel components.
 - 1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
 - 2. Include embedment Drawings.
 - 3. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld. Show backing bars that are to be removed and supplemental fillet welds where backing bars are to remain.
 - 4. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical, high-strength bolted connections.
 - 5. Identify members and connections of the Seismic-Load-Resisting System.
 - 6. Indicate locations and dimensions of protected zones.
 - 7. Identify demand critical welds.
- C. Welding Procedure Specifications (WPSs) and Procedure Qualification Records (PQRs): Provide according to AWS D1.1/D1.1M, "Structural Welding Code - Steel," for each welded joint whether prequalified or qualified by testing, including the following:
 - 1. Power source (constant current or constant voltage).
 - 2. Electrode manufacturer and trade name, for demand critical welds.

1.7 INFORMATIONAL SUBMITTALS

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

1.8 QUALITY ASSURANCE

- A. Fabricator Qualifications: A qualified fabricator that participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category STD, or is accredited by the IAS Fabricator Inspection Program for Structural Steel (AC 172).
- B. Installer Qualifications: A qualified installer who participates in the AISC Quality Certification Program and is designated an AISC-Certified Erector, Category ACSE.
- C. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code Steel."
 - 1. Welders and welding operators performing work on bottom-flange, demand-critical welds shall pass the supplemental welder qualification testing, as required by AWS D1.8/D1.8M. FCAW-S and FCAW-G shall be considered separate processes for welding personnel qualification.
- D. Comply with applicable provisions of the following specifications and documents:
 - 1. AISC 303.
 - 2. AISC 341 and AISC 341s1.
 - 3. AISC 360.
 - 4. RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

1.9 DELIVERY, STORAGE, AND HANDLING

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

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Connections: Provide details of simple shear connections required by the Contract Documents to be selected or completed by structural-steel fabricator.

2.2 STRUCTURAL-STEEL MATERIALS

- A. W-Shapes: ASTM A 992/A 992M ASTM A 572/A 572M, Grade 50 ASTM A 529/A 529M, or Grade 50 ASTM A 913/A 913M, Grade 50.
- B. Channels, Angles-Shapes: ASTM A 36/A 36M ASTM A 572/A 572M, Grade 50 ASTM A 529/A 529M, or Grade 50 ASTM A 913/A 913M, Grade 50.
- C. Plate and Bar: ASTM A 36/A 36M ASTM A 572/A 572M, Grade 50 or ASTM A 529/A 529M, Grade 50.
- D. Cold-Formed Hollow Structural Sections: ASTM A 500/A 500M, Grade B, structural tubing.
- E. Welding Electrodes: Comply with AWS requirements.

2.3 BOLTS, CONNECTORS, AND ANCHORS

- A. High-Strength Bolts, Nuts, and Washers: ASTM A 325, Type 1, heavy-hex steel structural bolts; ASTM A 563, Grade C, heavy-hex carbon-steel nuts; and ASTM F 436, Type 1, hardened carbon-steel washers; all with plain finish.
 - 1. Direct-Tension Indicators: ASTM F 959, Type 325, compressible-washer type with plain finish.

- B. High-Strength Bolts, Nuts, and Washers: ASTM A 490, Type 1, heavy-hex steel structural bolts or tension-control, bolt-nut-washer assemblies with splined ends; ASTM A 563, Grade DH, heavy-hex carbon-steel nuts; and ASTM F 436, Type 1, hardened carbon-steel washers with plain finish.
 - 1. Direct-Tension Indicators: ASTM F 959, Type 490, compressible-washer type with plain finish.
- C. Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F 1852, Type 1, heavyhex head assemblies consisting of steel structural bolts with splined ends, heavy-hex carbonsteel nuts, and hardened carbon-steel washers.
 - 1. Finish: Plain.
- D. Shear Connectors: ASTM A 108, Grades 1015 through 1020, headed-stud type, cold-finished carbon steel; AWS D1.1/D1.1M, Type B.
- E. Unheaded Anchor Rods: ASTM F 1554, Grade 36.
 - 1. Configuration: Straight.
 - 2. Nuts: ASTM A 563 heavy-hex carbon steel.
 - 3. Plate Washers: ASTM A 36/A 36M carbon steel.
 - 4. Washers: ASTM F 436, Type 1, hardened carbon steel.
 - 5. Finish: Plain.
- F. Headed Anchor Rods: ASTM F 1554, Grade 36, straight.
 - 1. Nuts: ASTM A 563 heavy-hex carbon steel.
 - 2. Plate Washers: ASTM A 36/A 36M carbon steel.
 - 3. Washers: ASTM F 436, Type 1, hardened carbon steel.
 - 4. Finish: Plain.
- G. Threaded Rods: ASTM A 36/A 36M.
 - 1. Nuts: ASTM A 563 heavy-hex carbon steel.
 - 2. Washers: ASTM F 436, Type 1, hardened carbon steel.
 - 3. Finish: Plain.

2.4 PRIMER

- A. Primer: Comply with Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."
- B. Primer: SSPC-Paint 25, Type I, zinc oxide, alkyd, linseed oil primer.
- C. Primer: SSPC-Paint 25 BCS, Type I, zinc oxide, alkyd, linseed oil primer.
- D. Primer: SSPC-Paint 23, latex primer.
- E. Primer: Fabricator's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer complying with MPI#79 and compatible with topcoat.

2.5 GROUT

- A. Metallic, Shrinkage-Resistant Grout: ASTM C 1107/C 1107M, factory-packaged, metallic aggregate grout, mixed with water to consistency suitable for application and a 30-minute working time.
- B. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107/C 1107M, factory-packaged, nonmetallic aggregate grout, noncorrosive and nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

2.6 FABRICATION

- A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC 303, "Code of Standard Practice for Steel Buildings and Bridges," and to AISC 360.
 - 1. Camber structural-steel members where indicated.
 - 2. Fabricate beams with rolling camber up.
 - 3. Identify high-strength structural steel according to ASTM A 6/A 6M and maintain markings until structural steel has been erected.
 - 4. Mark and match-mark materials for field assembly.
 - 5. Complete structural-steel assemblies, including welding of units, before starting shoppriming operations.
- B. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.
 - 1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1/D1.1M.
- C. Bolt Holes: Cut, drill, or punch standard bolt holes perpendicular to metal surfaces.
- D. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.
- E. Cleaning: Clean and prepare steel surfaces that are to remain unpainted according to SSPC-SP 1, "Solvent Cleaning."
- F. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1/D1.1M and manufacturer's written instructions.
- G. Steel Wall-Opening Framing: Select true and straight members for fabricating steel wallopening framing to be attached to structural-steel frame. Straighten as required to provide uniform, square, and true members in completed wall framing. Build up welded framing, weld exposed joints continuously, and grind smooth.
- H. Welded Door Frames: Build up welded door frames attached to structural-steel frame. Weld exposed joints continuously and grind smooth. Plug-weld fixed steel bar stops to frames. Secure removable stops to frames with countersunk machine screws, uniformly spaced not more than 10 inches o.c. unless otherwise indicated.
- I. Holes: Provide holes required for securing other work to structural steel and for other work to pass through steel members.
 - 1. Cut, drill, or punch holes perpendicular to steel surfaces. Do not thermally cut bolt holes or enlarge holes by burning.
 - 2. Baseplate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.
 - 3. Weld threaded nuts to framing and other specialty items indicated to receive other work.

2.7 SHOP CONNECTIONS

- A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
 - 1. Joint Type: Snug tightened.
- B. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
 - 1. Assemble and weld built-up sections by methods that maintain true alignment of axes without exceeding tolerances in AISC 303 for mill material.

2.8 SHOP PRIMING

- A. Shop prime steel surfaces except the following:
 - 1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches.
 - 2. Surfaces to be field welded.
 - 3. Surfaces of high-strength bolted, slip-critical connections.
 - 4. Surfaces to receive sprayed fire-resistive materials (applied fireproofing).
 - 5. Galvanized surfaces.
 - 6. Surfaces enclosed in interior construction.
- B. Surface Preparation: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:
 - 1. SSPC-SP 2, "Hand Tool Cleaning."
 - 2. SSPC-SP 3, "Power Tool Cleaning."
 - 3. SSPC-SP 7/NACE No. 4, "Brush-off Blast Cleaning."
 - 4. SSPC-SP 11, "Power Tool Cleaning to Bare Metal."
 - 5. SSPC-SP 14/NACE No. 8, "Industrial Blast Cleaning."
 - 6. SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 - 7. SSPC-SP 10/NACE No. 2, "Near-White Blast Cleaning."
 - 8. SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning."
 - 9. SSPC-SP 8, "Pickling."

- C. Priming: Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a minimum dry film thickness of 1.5 mils. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.
 - 1. Stripe paint corners, crevices, bolts, welds, and sharp edges.
 - 2. Apply two coats of shop paint to surfaces that are inaccessible after assembly or erection. Change color of second coat to distinguish it from first.
- D. Painting: Prepare steel and apply a one-coat, nonasphaltic primer complying with SSPC-PS Guide 7.00, "Painting System Guide 7.00: Guide for Selecting One-Coat Shop Painting Systems," to provide a dry film thickness of not less than 1.5 mils.

2.9 GALVANIZING

- A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel according to ASTM A 123/A 123M.
 - 1. Fill vent and drain holes that are exposed in the finished Work unless they function as weep holes, by plugging with zinc solder and filing off smooth.
 - 2. Galvanize lintels shelf angles and welded door frames attached to structural-steel frame and located in exterior walls.

2.10 SOURCE QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform shop tests and inspections.
 - 1. Provide testing agency with access to places where structural-steel work is being fabricated or produced to perform tests and inspections.
- B. Bolted Connections: Inspect and test shop-bolted connections according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
- C. Welded Connections: Visually inspect shop-welded connections according to AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:
 - 1. Liquid Penetrant Inspection: ASTM E 165.
 - 2. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration are not accepted.
 - 3. Ultrasonic Inspection: ASTM E 164.
 - 4. Radiographic Inspection: ASTM E 94.
- D. In addition to visual inspection, test and inspect shop-welded shear connectors according to requirements in AWS D1.1/D1.1M for stud welding and as follows:
 - 1. Perform bend tests if visual inspections reveal either a less-than-continuous 360-degree flash or welding repairs to any shear connector.

- 2. Conduct tests according to requirements in AWS D1.1/D1.1M on additional shear connectors if weld fracture occurs on shear connectors already tested.
- E. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify, with certified steel erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.
 - 1. Prepare a certified survey of existing conditions. Include bearing surfaces, anchor rods, bearing plates, and other embedments showing dimensions, locations, angles, and elevations.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place unless otherwise indicated.
 - 1. Do not remove temporary shoring supporting composite deck construction until cast-inplace concrete has attained its design compressive strength.

3.3 ERECTION

- A. Set structural steel accurately in locations and to elevations indicated and according to AISC 303 and AISC 360.
- B. Baseplates Bearing Plates and Leveling Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.
 - 1. Set plates for structural members on wedges, shims, or setting nuts as required.
 - 2. Weld plate washers to top of baseplate.
 - 3. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
 - 4. Promptly pack grout solidly between bearing surfaces and plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.

- C. Maintain erection tolerances of structural steel within AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."
- D. Align and adjust various members that form part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that are in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
 - 1. Level and plumb individual members of structure.
 - 2. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.
- E. Splice members only where indicated.
- F. Do not use thermal cutting during erection unless approved by Architect. Finish thermally cut sections within smoothness limits in AWS D1.1/D1.1M.
- G. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.
- H. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1/D1.1M and manufacturer's written instructions.

3.4 FIELD CONNECTIONS

- A. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
 - 1. Joint Type: Snug tightened.
- B. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
 - 1. Comply with AISC 303 and AISC 360 for bearing, alignment, adequacy of temporary connections, and removal of paint on surfaces adjacent to field welds.
 - 2. Remove backing bars or runoff tabs, back gouge, and grind steel smooth.
 - 3. Assemble and weld built-up sections by methods that maintain true alignment of axes without exceeding tolerances in AISC 303, "Code of Standard Practice for Steel Buildings and Bridges," for mill material.

3.5 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:
 - 1. Verify structural-steel materials and inspect steel frame joint details.
 - 2. Verify weld materials and inspect welds.
 - 3. Verify connection materials and inspect high-strength bolted connections.

- B. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- C. Bolted Connections: Inspect and test bolted connections according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
- D. Welded Connections: Visually inspect field welds according to AWS D1.1/D1.1M.
 - 1. In addition to visual inspection, test and inspect field welds according to AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:
 - a. Liquid Penetrant Inspection: ASTM E 165.
 - b. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration are not accepted.
 - c. Ultrasonic Inspection: ASTM E 164.
 - d. Radiographic Inspection: ASTM E 94.
- E. In addition to visual inspection, test and inspect field-welded shear connectors according to requirements in AWS D1.1/D1.1M for stud welding and as follows:
 - 1. Perform bend tests if visual inspections reveal either a less-than-continuous 360-degree flash or welding repairs to any shear connector.
 - 2. Conduct tests according to requirements in AWS D1.1/D1.1M on additional shear connectors if weld fracture occurs on shear connectors already tested.

3.6 REPAIRS AND PROTECTION

- A. Galvanized Surfaces: Clean areas where galvanizing is damaged or missing and repair galvanizing to comply with ASTM A 780/A 780M.
- B. Touchup Painting: Immediately after erection, clean exposed areas where primer is damaged or missing and paint with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
 - 1. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.
- C. Touchup Painting: Cleaning and touchup painting are specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."
- D. Touchup Priming: Cleaning and touchup priming are specified in Section 099600 "High-Performance Coatings."

END OF SECTION 051200

SECTION 052100 - STEEL JOIST FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. K-series steel joists.
 - 2. Joist accessories.

B. Related Requirements:

- 1. Division 03 Section "Cast-in-Place Concrete" for installing bearing plates in concrete.
- 2. Division 04 Section "Unit Masonry" for installing bearing plates in unit masonry.
- 3. Division 05 Section "Structural Steel Framing" for field-welded shear connectors.

1.3 DEFINITIONS

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

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of joist, accessory, and product.
- B. Shop Drawings:
 - 1. Include layout, designation, number, type, location, and spacing of joists.
 - 2. Include joining and anchorage details, bracing, bridging, and joist accessories; splice and connection locations and details; and attachments to other construction.
 - 3. Indicate locations and details of bearing plates to be embedded in other construction.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer.

STEEL JOIST FRAMING

- B. Welding certificates.
- C. Manufacturer certificates.
- D. Mill Certificates: For each type of bolt.
- E. Comprehensive engineering analysis of special joists signed and sealed by the qualified professional engineer responsible for its preparation.

1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A manufacturer certified by SJI to manufacture joists complying with applicable standard specifications and load tables in SJI's "Specifications."" and "Standard Specifications for Composite Steel Joists, CJ-Series" in "Standard Specifications for Composite Steel Joists, Weight Tables and Bridging Tables, Code of Standard Practice."
 - 1. Manufacturer's responsibilities include providing professional engineering services for designing special joists to comply with performance requirements.
- B. Welding Qualifications: Qualify field-welding procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code Steel."

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle joists as recommended in SJI's "Specifications."" and "Standard Specifications for Composite Steel Joists, CJ-Series" in "Standard Specifications for Composite Steel Joists, Weight Tables and Bridging Tables, Code of Standard Practice."
- B. Protect joists from corrosion, deformation, and other damage during delivery, storage, and handling.

1.8 SEQUENCING

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

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

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

2.2 K-SERIES STEEL JOISTS

- A. Manufacture steel joists of type indicated according to "Standard Specifications for Open Web Steel Joists, K-Series" in SJI's "Specifications," with steel-angle top- and bottom-chord members, underslung ends, and parallel top chord.
 - 1. Joist Type: K-series steel joists.
- B. Steel Joist Substitutes: Manufacture according to "Standard Specifications for Open Web Steel Joists, K-Series" in SJI's "Specifications," with steel-angle or -channel members.
- C. Provide holes in chord members for connecting and securing other construction to joists.
- D. Top-Chord Extensions: Extend top chords of joists with SJI's Type S top-chord extensions where indicated, complying with SJI's "Specifications."
- E. Extended Ends: Extend bearing ends of joists with SJI's Type R extended ends where indicated, complying with SJI's "Specifications."
- F. Do not camber joists.
- G. Camber joists according to SJI's "Specifications.".
- H. Equip bearing ends of joists with manufacturer's standard beveled ends or sloped shoes if joist slope exceeds 1/4 inch per 12 inches.

2.3 LONG-SPAN STEEL JOISTS

- A. Manufacture steel joists according to "Standard Specifications for Longspan Steel Joists, LH-Series and Deep Longspan Steel Joists, DLH-Series" in SJI's "Specifications," with steel-angle top- and bottom-chord members; of joist type and end and top-chord arrangements as follows:
 - 1. End Arrangement: Underslung.
 - 2. Top-Chord Arrangement: Parallel.
- B. Provide holes in chord members for connecting and securing other construction to joists.
- C. Camber long-span steel joists according to SJI's "Specifications" and as indicated.
- D. Equip bearing ends of joists with manufacturer's standard beveled ends or sloped shoes if joist slope exceeds 1/4 inch per 12 inches.

2.4 COMPOSITE STEEL JOISTS

- A. Manufacture steel joists according to "Standard Specifications for Composite Steel Joists, CJ-Series" in SJI's "Standard Specifications for Composite Steel Joists, Weight Tables and Bridging Tables, Code of Standard Practice," with steel-angle top- and bottom-chord members and parallel top chord, and with underslung ends.
- B. Camber composite steel joists as indicated.

2.5 PRIMERS

- A. Low-Emitting Materials: Paints and coatings shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- B. Primer: SSPC-Paint 15, or manufacturer's standard shop primer complying with performance requirements in SSPC-Paint 15.
- C. Primer: Provide shop primer that complies with Division 09 painting Sections.

2.6 JOIST ACCESSORIES

- A. Bridging: Provide bridging anchors and number of rows of horizontal or diagonal bridging of material, size, and type required by SJI's "Specifications" and "Standard Specifications for Composite Steel Joists, CJ-Series" in "Standard Specifications for Composite Steel Joists, Weight Tables and Bridging Tables, Code of Standard Practice" for type of joist, chord size, spacing, and span. Furnish additional erection bridging if required for stability.
- B. Fabricate steel bearing plates from ASTM A 36/A 36M steel with integral anchorages of sizes and thicknesses indicated. Shop prime paint.
- C. Steel bearing plates with integral anchorages are specified in Division 05 Section "Metal Fabrications."
- D. Furnish ceiling extensions, either extended bottom-chord elements or a separate extension unit of enough strength to support ceiling construction. Extend ends to within 1/2 inch of finished wall surface unless otherwise indicated.
- E. Carbon-Steel Bolts and Threaded Fasteners: ASTM A 307, Grade A, carbon-steel, hex-head bolts and threaded fasteners; carbon-steel nuts; and flat, unhardened steel washers.
 - 1. Finish: Plain, uncoated.
- F. High-Strength Bolts, Nuts, and Washers: ASTM A 325, Type 1, heavy hex steel structural bolts; ASTM A 563 heavy hex carbon-steel nuts; and ASTM F 436 hardened carbon-steel washers.
 - 1. Finish: Plain.
- G. Welding Electrodes: Comply with AWS standards.
- H. Furnish miscellaneous accessories including splice plates and bolts required by joist manufacturer to complete joist assembly.

2.7 CLEANING AND SHOP PAINTING

A. Clean and remove loose scale, heavy rust, and other foreign materials from fabricated joists and accessories by hand-tool cleaning, SSPC-SP 2 or power-tool cleaning, SSPC-SP 3.

- B. Do not prime paint joists and accessories to receive sprayed fire-resistive materials.
- C. Apply one coat of shop primer to joists and joist accessories to be primed to provide a continuous, dry paint film not less than 1 mil thick.
- D. Shop priming of joists and joist accessories is specified in Division 09 painting Sections.

PART 3 - EXECUTION

3.1 EXAMINATION

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

3.2 INSTALLATION

- A. Do not install joists until supporting construction is in place and secured.
- B. Install joists and accessories plumb, square, and true to line; securely fasten to supporting construction according to SJI's "Specifications,"" and "Standard Specifications for Composite Steel Joists, CJ-Series" in "Standard Specifications for Composite Steel Joists, Weight Tables and Bridging Tables, Code of Standard Practice," joist manufacturer's written recommendations, and requirements in this Section.
 - 1. Before installation, splice joists delivered to Project site in more than one piece.
 - 2. Space, adjust, and align joists accurately in location before permanently fastening.
 - 3. Install temporary bracing and erection bridging, connections, and anchors to ensure that joists are stabilized during construction.
 - 4. Delay rigidly connecting bottom-chord extensions to columns or supports until dead loads are applied.
- C. Field weld joists to supporting steel bearing plates and framework. Coordinate welding sequence and procedure with placement of joists. Comply with AWS requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
- D. Bolt joists to supporting steel framework using carbon-steel bolts.
- E. Bolt joists to supporting steel framework using high-strength structural bolts. Comply with Research Council on Structural Connection's "Specification for Structural Joints Using ASTM A 325 or ASTM A 490 Bolts" for high-strength structural bolt installation and tightening requirements.
- F. Install and connect bridging concurrently with joist erection, before construction loads are applied. Anchor ends of bridging lines at top and bottom chords if terminating at walls or beams.

3.3 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to inspect field welds and bolted connections and to perform field tests and inspections and prepare test and inspection reports.
- B. Visually inspect field welds according to AWS D1.1/D1.1M.
 - 1. In addition to visual inspection, test field welds according to AWS D1.1/D1.1M and the following procedures, as applicable:
 - a. Liquid Penetrant Inspection: ASTM E 165.
 - b. Magnetic Particle Inspection: ASTM E 709.
 - c. Ultrasonic Testing: ASTM E 164.
 - d. Radiographic Testing: ASTM E 94.
- C. Visually inspect bolted connections.
- D. Correct deficiencies in Work that test and inspection reports have indicated are not in compliance with specified requirements.
- E. Perform additional testing to determine compliance of corrected Work with specified requirements.

3.4 **PROTECTION**

- A. Touchup Painting: After installation, promptly clean, prepare, and prime or reprime field connections, rust spots, and abraded surfaces of prime-painted joists, bearing plates, abutting structural steel, and accessories.
 - 1. Clean and prepare surfaces by hand-tool cleaning according to SSPC-SP 2, or power-tool cleaning according to SSPC-SP 3.
 - 2. Apply a compatible primer of same type as primer used on adjacent surfaces.
- B. Touchup Painting: Cleaning and touchup painting are specified in Division 09 painting Sections.
- C. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that joists and accessories are without damage or deterioration at time of Substantial Completion.

END OF SECTION 052100

SECTION 053100 - STEEL DECKING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Roof deck.
- B. Related Requirements:
 - 1. Division 03 Section "Cast-in-Place Concrete" for normal-weight and lightweight structural concrete fill over steel deck.
 - 2. Division 03 Section "Lightweight Insulating Concrete" for lightweight insulating concrete fill over steel deck.
 - 3. Division 05 Section "Structural Steel Framing" for shop- and field-welded shear connectors.
 - 4. Division 05 Section "Metal Fabrications" for framing deck openings with miscellaneous steel shapes.
 - 5. Division 09 painting Sections for repair painting of primed deck and finish painting of deck.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of deck, accessory, and product indicated.
- B. Shop Drawings:
 - 1. Include layout and types of deck panels, anchorage details, reinforcing channels, pans, cut deck openings, special jointing, accessories, and attachments to other construction.

1.4 INFORMATIONAL SUBMITTALS

- A. Welding certificates.
- B. Product Certificates: For each type of steel deck.
- C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating that each of the following complies with requirements:

- 1. Power-actuated mechanical fasteners.
- 2. Acoustical roof deck.
- D. Evaluation Reports: For steel deck.
- E. Field quality-control reports.

1.5 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.
- B. Welding Qualifications: Qualify procedures and personnel according to AWS D1.3, "Structural Welding Code Sheet Steel."
- C. Electrical Raceway Units: Provide UL-labeled cellular floor-deck units complying with UL 209 and listed in UL's "Electrical Construction Equipment Directory" for use with standard header ducts and outlets for electrical distribution systems.
- D. FM Global Listing: Provide steel roof deck evaluated by FM Global and listed in its "Approval Guide, Building Materials" for Class 1 fire rating and Class 1-90 windstorm ratings.

1.6 DELIVERY, STORAGE, AND HANDLING

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

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

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

2.2 ROOF DECK

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. ASC Profiles, Inc.; a Blue Scope Steel company.
 - 2. Canam United States; Canam Group Inc.
 - 3. CMC Joist & Deck.
 - 4. Consolidated Systems, Inc.; Metal Dek Group.
 - 5. Cordeck.
 - 6. DACS, Inc.
 - 7. Epic Metals Corporation.
 - 8. Marlyn Steel Decks, Inc.
 - 9. New Millennium Building Systems, LLC.
 - 10. Nucor Corp.; Vulcraft Group.
 - 11. Roof Deck, Inc.
 - 12. Valley Joist; Subsidiary of EBSCO Industries, Inc.
 - 13. Verco Manufacturing Co.
 - 14. Wheeling Corrugating Company; Div. of Wheeling-Pittsburgh Steel Corporation.
- B. Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with "SDI Specifications and Commentary for Steel Roof Deck," in SDI Publication No. 31, and with the following:
 - 1. Galvanized-Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS),, G60 zinc coating.
 - 2. Deck Profile: As indicated.
 - 3. Profile Depth: 1-1/2 inches.
 - 4. Design Uncoated-Steel Thickness: As indicated.
 - 5. Span Condition: Double span.
 - 6. Side Laps: Overlapped or interlocking seam at Contractor's option.

2.3 ACCESSORIES

- A. General: Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.
- B. Mechanical Fasteners: Corrosion-resistant, low-velocity, power-actuated or pneumatically driven carbon-steel fasteners; or self-drilling, self-threading screws.
- C. Side-Lap Fasteners: Corrosion-resistant, hexagonal washer head; self-drilling, carbon-steel screws, No. 10 minimum diameter.
- D. Flexible Closure Strips: Vulcanized, closed-cell, synthetic rubber.
- E. Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of 33,000 psi, not less than 0.0359-inch design uncoated thickness, of same material and finish as deck; of profile indicated or required for application.

- F. Pour Stops and Girder Fillers: Steel sheet, minimum yield strength of 33,000 psi, of same material and finish as deck, and of thickness and profile recommended by SDI Publication No. 31 for overhang and slab depth.
- G. Column Closures, End Closures, Z-Closures, and Cover Plates: Steel sheet, of same material, finish, and thickness as deck unless otherwise indicated.
- H. Piercing Hanger Tabs: Piercing steel sheet hanger attachment devices for use with floor deck.
- I. Flat Sump Plates: Single-piece steel sheet, 0.0747 inch thick, of same material and finish as deck. For drains, cut holes in the field.
- J. Recessed Sump Pans: Single-piece steel sheet, 0.0747 inch thick, of same material and finish as deck, with 3-inch- wide flanges and sloped recessed pans of 1-1/2-inch minimum depth. For drains, cut holes in the field.
- K. Repair Paint: Manufacturer's standard rust-inhibitive primer of same color as primer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine supporting frame and field conditions for compliance with requirements for installation tolerances and other conditions affecting performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. Install deck panels and accessories according to applicable specifications and commentary in SDI Publication No. 31, manufacturer's written instructions, and requirements in this Section.
- B. Install temporary shoring before placing deck panels if required to meet deflection limitations.
- C. Locate deck bundles to prevent overloading of supporting members.
- D. Place deck panels on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting frame before being permanently fastened. Do not stretch or contract side-lap interlocks.
 - 1. Align cellular deck panels over full length of cell runs and align cells at ends of abutting panels.
- E. Place deck panels flat and square and fasten to supporting frame without warp or deflection.
- F. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to deck.

- G. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of deck, and support of other work.
- H. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.
- I. Mechanical fasteners may be used in lieu of welding to fasten deck. Locate mechanical fasteners and install according to deck manufacturer's written instructions.

3.3 ROOF-DECK INSTALLATION

- A. Fasten roof-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated or arc seam welds with an equal perimeter that is not less than 1-1/2 inches long, and as follows:
 - 1. Weld Diameter: 5/8 inch.
 - 2. Weld Spacing: Weld edge and interior ribs of deck units with a minimum of two welds per deck unit at each support. Space welds as indicated.
 - 3. Weld Washers: Install weld washers at each weld location.
- B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals not exceeding the lesser of 1/2 of the span or 18 inches, and as follows:
 - 1. Mechanically fasten with self-drilling, No. 10 diameter or larger, carbon-steel screws.
 - 2. Mechanically clinch or button punch.
 - 3. Fasten with a minimum of 1-1/2-inch-long welds.
- C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches, with end joints as follows:
 - 1. End Joints: Lapped 2 inches minimum.
- D. Roof Sump Pans and Sump Plates: Install over openings provided in roof deck and weld or mechanically fasten flanges to top of deck. Space welds or mechanical fasteners not more than 12 inches apart with at least one weld or fastener at each corner.
 - 1. Install reinforcing channels or zees in ribs to span between supports and weld or mechanically fasten.
- E. Miscellaneous Roof-Deck Accessories: Install ridge and valley plates, finish strips, end closures, and reinforcing channels according to deck manufacturer's written instructions. Weld or mechanically fasten to substrate to provide a complete deck installation.
 - 1. Weld cover plates at changes in direction of roof-deck panels unless otherwise indicated.
- F. Flexible Closure Strips: Install flexible closure strips over partitions, walls, and where indicated. Install with adhesive according to manufacturer's written instructions to ensure complete closure.

3.4 FIELD QUALITY CONTROL

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

3.5 **PROTECTION**

- A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.
- B. Repair Painting: Wire brush and clean rust spots, welds, and abraded areas on both surfaces of prime-painted deck immediately after installation, and apply repair paint.
 - 1. Apply repair paint, of same color as adjacent shop-primed deck, to bottom surfaces of deck exposed to view.
 - 2. Wire brushing, cleaning, and repair painting of bottom deck surfaces are included in Division 09 Section."
- C. Repair Painting: Wire brushing, cleaning, and repair painting of rust spots, welds, and abraded areas of both deck surfaces are included in Division 09 Section "."
- D. Provide final protection and maintain conditions to ensure that steel deck is without damage or deterioration at time of Substantial Completion.

END OF SECTION 053100

SECTION 06 10 53 - ROUGH CARPENTRY

PART 1 - GENERAL

<u>Rough carpentry</u>: Includes carpentry work not specified as part of other sections and which is generally not exposed, except as otherwise indicated.

SUBMITTALS:

In accordance with Section 01 33 00, Submittals, provide product data on chemical and pressure treated wood to the Architect for review.

PART 2 - PRODUCTS

LUMBER DESCRIPTION:

<u>Sizes</u>: Lumber shall be dressed to conform to PS 20 and unless otherwise specified, all lumber shall be surfaced four sides (S4S).

Size references, unless otherwise noted, are nominal sizes; actual sizes shall be within manufacturing tolerances allowed by the standard under which it is produced.

Lumber Types: All shall be Southern Pine or Douglas Fir.

CONCEALED BLOCKING:

Lumber shall be #2 Southern Pine or #2 Douglas Fir having a maximum moisture content of 19 percent, stamped "Dry".

PRESERVATIVE TREATED BLOCKING/GROUNDS:

<u>Moisture Treatment</u>: In accordance with the latest publications of The American Wood Preservers Institute.

Lumber in contact with masonry or concrete shall be pressure preservative treated #2 Southern Pine or #2 Douglas Fir.

Water-borne salt preservatives for painted, stained or exposed natural wood.

AWPB LP-2 for above ground use, AWPB LB-22 for ground contact application.

Lumber shall be redried to maximum moisture content of 19 percent, stamped "DRY".

Edge Treatment: Brush-coat surfaces of lumber sawed or cut after treatment with same preservative used originally.

PART 3 - EXECUTION

All rough carpentry work shall conform to the requirements of the Florida Building Code, latest edition or that noted herein or on the drawings, whichever is more stringent.

GENERAL APPLICATION:

The contractor shall coordinate the location and application of rough carpentry work with all other trades to assure that the installation of finish work may be properly executed to fulfill the design requirements.

Check all shop and contract drawings before initiating work to verify locations of supports and joints in connection with other work.

Apply all rough carpentry work in conjunction with the rough hardware, fastening devices and miscellaneous materials noted in Section 06 11 00.

WOOD GROUNDS:

Location: Install permanent and temporary wood grounds as indicated for proper execution of work of all trades. Remove temporary grounds when they are no longer required.

<u>Back Prime</u>: Prime all preservative treated wood with bituminous dampproofing compound as specified in Section 07 11 13, where it will be in contact with any ferrous metals.

<u>Fastening</u>: Except as otherwise required for special locations, form ground of kiln-dried, softwood, 1 1/2" wide, and of thickness to properly align related items of work. Securely fasten grounds into position by means of power-actuated fasteners, annealed wire, nails, brads, bolts, or other methods that will provide maximum results and corrosion resistance, particularly with preservative treated wood.

<u>Ground Anchorage</u>: Hardened corrosion resistant hot dip galvanized steel or stainless steel; nails, expansion bolts, thru bolts, metal plugs, or metal inserts, as most appropriate for each type of masonry or concrete construction shall be used.

WOOD BLOCKING:

<u>Location</u>: Install all wood blocking as required to provide anchorage for other materials. Form to shapes and sizes as indicated or as may be required to accomplish a particular installation. Form blocking of minimum 2" thick material.

<u>Roofing</u>: Form blocking in conjunction with flashings, gutters and gravel stops to shapes as detailed. Stagger built-up boards a minimum of 18" between ends. Anchor with thru bolts, embed bolts, countersunk bolts, including washers and nuts at 16" c.c. in staggered fashion with 2 fasteners at end of boards. Fastener pullout resistance to be not less than 400 lb./fastener. Wood shall be pressure treated, creosote not allowed. Wood shall be No. 2 or better Southern yellow pine, kiln dried, salt pressure-treated in compliance with Fed. Specification TT-550, TT-W-517 and LP-2 of AMPI standards at a minimum.

<u>Anchorage</u>: Wedge, anchor and align blocking to provide a rigid and secure installation of both blocking and other work related thereto.

END OF SECTION 06 10 53

SECTION 06 11 00 - ROUGH HARDWARE

PART 1 - GENERAL

Rough hardware, fastening devices and accessory products shall generally be as manufactured by HECKMAN BUILDING PRODUCTS, INC., Chicago, Illinois or by CLEVELAND STEEL SPECIALTY, Cleveland, Ohio, and shall conform to the Federal Specifications listed herein. Products of this section for all carpentry and woodwork shall be of the type and size best suited for its intended use and as recommended by the Architectural Woodwork Institute (AWI) of America.

PART 2 - PRODUCTS

Rough hardware and fastening devices shall include, but not be limited to the following:

Bolts: Machine, lag, toggle and anchor types, FS FF-B-575C and FS FF-B-584D Lag Screws and Bolts: FS FF-S-325 Expansion Shields: FS FF-B-561C Nuts and Washers: FS FF-N-836C Wood Screws: FS FF-S-111C Toggle Bolts: FS FF-B-588C

In general, all steel hardware shall be ASTM A 1 or A 36 and all rough hardware and fastening devices to be used at exterior locations or in conjunction with preservative treated wood shall be hot dip galvanized or stainless steel.

Related products for miscellaneous uses include:

Mastic and Adhesives Building Paper: Kraft or rosin types Building Felt: Asphalt saturated, ASTM 0226, #15 Back Prime: Use bituminous dampproofing compound per specifications section 07 11 13 Films and Moisture Barriers: Polyethylene sheet

Other products as specified under other sections, as recommended by the manufacturer, may also be used provide all comply with the Florida Building Code, latest edition and are suitably corrosion resistant for long life in keeping with the location used.

PART 3 - EXECUTION

Install and use all fastening devises in accordance with the manufacturers recommendations.

END OF SECTION 06 11 00

SECTION 06 40 23 - ARCHITECTURAL LAMINATE CASEWORK

PART 1 - GENERAL

DESCRIPTION OF WORK:

Extent of each type of casework is shown on drawings and specified herein and further shown by typical details.

Types of laminate clad casework include: Base Cabinets, to receive solid surface countertops. Solid surface materials and Science Laboratory (and storage room) casework are specified elsewhere in the specifications.

Coordinate work of this section with manufactured countertops by others within another section, where applicable.

QUALITY ASSURANCE:

AWI Quality Standard: Comply with applicable requirements of "Architectural Woodwork Quality Standards" published by the Architectural Woodwork Institute (AWI) for Section 400 and its Division 400B and as may otherwise be specified herein or noted on the drawings.

Installer Qualifications: Arrange for installation of architectural woodwork items by same firm which fabricated them.

SUBMITTALS:

In accordance with the requirements of Section 01 33 00, Submittals, provide the following items for review by the Architect.

Product Data: Manufacturer's product data for hardware, plastic laminate and other premanufactured items.

Quality Certification: Submit fabricator's certification, stating that woodwork complies with quality grades and requirements indicated herein.

Shop Drawings: Submit shop drawings showing location of each item, dimensioned plans and elevations, large scale details, attachment devices and other components.

Samples: Submit the following samples:

- Plastic laminate; color and pattern chips for all colors and patterns to review and make selection.
- Cabinet hardware, one unit of each type and finish.
- Edge trim; color and pattern of all available colors for selection.

Job Dimensions: Verify dimensions of all cabinet locations in the building prior to fabrication as much as possible.

PART 2 - PRODUCTS

MANUFACTURERS:

Casework by recognized manufacturers will be considered for bid with prior approval by the architect. They shall demonstrate that they comply with these specifications and can provide

proof that they have a minimum of 5 years experience in casework manufacture on similar projects.

MATERIALS:

Vertical Surface High Pressure Laminate: High pressure laminate for vertical surfaces shall be of a textured or gloss finish and meet NEMA standards LD3-1980 GP28 for vertical grade. <u>Colors, patterns and finishes to be selected by the Architect.</u>

High Pressure Laminate Cabinet Liner: High pressure laminate cabinet liner, light beige or other color as selected by Architect, shall meet NEMA standards LD3-1980 CL20 for cabinet liner.

Low Pressure Laminate Cabinet Liner: Low pressure laminate cabinet liner for interior surfaces shall be a double top coated resin impregnated laminate (4 mil bonded to substrate). Color to be light beige or as selected by Architect.

Plywood: Plywood shall be Douglas Fir, exterior grade as described in commercial standard CS 45-60.

Prefinished Hardboard: Wood fiber hardboard shall be 1/4" thick with one side prefinished to match interior of cabinet.

Plastic Edging: Door and drawer face edges shall be edged with high pressure laminate or 3 mm PVC edge banding as selected by Architect. PVC edge color shall match or compliment face front color, as selected by the architect.

Hardware:

Hinges shall be five knuckle, 2 3/4" overlay type, hospital tip, .095" thick steel with either dull chrome or color finish as selected by architect. Hinges shall have a minimum of eight (8) edge and leaf fastenings. Doors 48" to 72" shall have three (3) hinges per door.

Door and Drawer Pulls: Door and drawers shall be aluminum 'wire' pull 3" long x 1/4" diameter minimum in finish to match hinges.

Drawer Suspensions: Drawer Suspensions for regular drawers shall be equipped with one pair of ball bearing nylon roller suspensions which shall be self-closing from a four (4) inch extension. Each guide shall have a minimum load capacity of one hundred (100) lbs. and be of zinc coated cold rolled steel. In lieu of the above, the contractor may provide the GRASS #6036-V1, 100 lb. load capacity system for regular drawers. File drawer suspensions shall be the full extension type with a 150 lb. load capacity and have nylon ballbearing rollers, self closing from a four inch (4") extension.

Drawer Stops: Drawer stops for all regular drawers shall be equipped with two drawer stops attached to the cabinet ends. The cabinet drawer stops shall be metal with attached rubber bumper and be installed to prevent the drawer face from touching the cabinet end's edges when the drawer is in a closed position.

Door Catches: Door catches shall be magnetic type with a minimum ten (10) pound pull, attached with screws and slotted for adjustment.

Shelf Supports: Adjustable shelf supports shall be heavy-duty, self-locking nylon, designed for installation in pre-drilled holes in cabinet ends and vertical partitions. The shelf supports shall have two (2) pins, .020" in diameter, designed to prevent the shelf support from rotating.

PART 3 - EXECUTION

CONSTRUCTION:

Cabinet Joinery: Tops and bottoms shall be joined to cabinet ends using a minimum of six (6) dowels for twenty four (24) inch deep cabinets and a minimum of four (4) dowels for twelve (12) inch deep cabinets. All dowels are to be hardwood, laterally fluted, with chamfered ends and a minimum diameter of ten (10) millimeters, internal cabinet components such as fixed horizontals, rails and verticals are to be doweled in place. Dowels and cabinet edges are to be securely glued and cabinets clamped under pressure during assembly until dry to assure secure joints and cabinet squareness.

Cabinet Base: Base shall be 2 x 6 pressure treated milled lumber cut to 4" height. Where cabinet backs or sides extend to the floor and the bottom edge will contact the floor, laminate clad exterior plywood shall be used.

Cabinet Top and Bottom: Tops and bottoms shall be 3/4" thick exterior plywood, laminated on the interior with low pressure laminate cabinet liner with a backer sheet, of a neutral color on the unexposed surface. The interior surface of sink cabinet bottoms shall be laminated with high pressure laminate cabinet liner. The bottom surface of all upper cabinets shall be high pressure laminate. Front edges to be with high pressure laminate edging.

Counter Tops and Splashes: Counter tops and splashes shall be post formed and of plywood. Select locations of wet areas shall be a solid surface material as specified under Section 09 40 00, Solid Surface Countertops.

Cabinet Ends: Cabinet ends shall be 3/4" thick exterior plywood, laminated on the interior with low pressure laminate cabinet liner and a backer sheet of a neutral color on the exterior unexposed surface. Exposed cabinet ends shall be laminated with vertical surface high pressure laminate on the exterior and high pressure laminate cabinet liner, light beige color, on the interior. Holes shall be drilled for adjustable shelf clips 32MM (1 1/4") on center.

Fixed Intermediates and Adjustable Shelves: Unexposed shelving shall be 3/4" thick lumber or plywood laminated on both sides with low pressure laminate cabinet liner. Color shall be light beige on both surfaces. Front edges to be banded with PVC edging. Adjustable shelves up to and including 30" wide shall be 3/4" thick. Shelves over 30" shall be 1" thick.

Cabinet Back: Standard recessed cabinet back to be 1/4" thick prefinished hardboard. Color to match cabinet interior. All sink cabinets to have split back, removable from inside. Exposed exterior back on fixed or movable cabinets to be plywood, 3/4" thick, laminated with high pressure laminate on the exterior surface and light beige colored high pressure laminate cabinet liner on the interior surface.

Cabinet Doors and Drawer Fronts: Doors and drawer fronts shall be, 3/4" thick exterior plywood, laminated with vertical surface high pressure laminate on the exposed surface and light beige colored high pressure laminate cabinet liner on the interior surface. All corners shall be radiused and all edges edged with high pressure laminate or PVC edge banding. Double doors shall be used on all cabinets in excess of 24" in width unless specifically shown otherwise.

Drawers: Sides, back and sub-front and bottom shall be plywood, 1/2" thick, laminated with light colored low pressure laminate liner. The back and sub-front are doweled and glued into the sides. Dowels shall be spaced 32mm (1 1/4"). Dowels are to be hardwood, laterally fluted, with chamfered ends and a minimum diameter of eight (8) millimeters. Top edge is banded with PVC edging. Drawer bottom is light beige color, 1/2" thick, prefinished hardboard or plywood let into sub-front, sides and back. In lieu of the sides as noted, the contractor may use the GRASS 6036 System.

Open Shelving Units: All open (exposed) shelving units shall have exposed surfaces of high pressure plastic laminate. Tops and bottoms of shelves shall be balanced and sides and back edges will also receive edge banding. Shelves up to and including 30" wide shall be 3/4" particle board. Shelves over 30" to 42" shall be 1" particle board. All exposed shelving within a room shall be of the same thickness based on largest size required.

INSTALLATION:

Casework to be accurately set in place, scribed and permanently secured to walls and/or floors with stainless steel or non-ferrous tap cons at masonry/concrete and flat head screws elsewhere.

Caulk with clear silicone or color as selected by the architect at tops, joints and splashes. Use marine grade caulk at all sink areas.

Do not install casework until building is dry, secure and painting and ceiling grid have been completed.

END OF SECTION 06 40 23

SECTION 06 65 00 - RECYCLED PLASTIC LUMBER

PART 1 - GENERAL

SCOPE OF WORK:

Furnish and install recycled plastic lumber where shown on detailed drawings and specified herein.

For this project, plastic lumber is primarily shown in use under the track of metal stud walls.

SUBMITTALS:

In accordance with Section 01 33 00, Submittals, provide product data, test data, and copy of warranty for review by the Architect.

PART 2 – PRODUCTS

MANUFACTURER:

This specification is based on products manufactured by the TREX Company LLC, Winchester, VA ,1-800-289-8739.

Similar products by U.S. Plastics Lumber Ltd. (<u>www.eepl.com</u>) and other manufacturers will be considered.

MATERIAL:

Wood dust and polyethylene matrix.

SIZE:

Decking, nominal 2×4 , or 2×6 . Longest lengths available.

FASTENERS:

Hot dip galvanized or stainless steel for power actuated installation.

COLOR:

Contractor's option for all concealed locations.

ACCESSORIES:

Furnish and install fasteners, adhesives, sealants and flashing in accordance with details for a completed installation.

PART 3 - EXECUTION

INSTALLATION:

Install under track for select metal stud walls and set onto double strip of sealant.

END OF SECTION 06 65 00

SECTION 07 11 13 BITUMINOUS DAMPPROOFING

PART 1 - GENERAL

SCOPE OF THE WORK:

The work consists of, but is not necessarily limited to, providing all necessary labor, equipment, materials, supplies, tools and transportation necessary to complete the dampproofing work noted on the drawings and or specified herein.

Include coating from foundation top to underside of roof deck on masonry walls. Coat the face behind the rigid insulation (i.e.: brick cavity or room side where walls are to receive drywall).

QUALITY ASSURANCE:

Single Source Responsibility: Obtain dampproofing products from a single manufacturer.

Materials shall be installed by skilled workmen certified or approved by the material's manufacturer to install their product. Written approval or certification shall be submitted.

SUBMITTALS:

In accordance with Section 01 33 00, Submittals, provide product data, sample guarantee, certifications, drawings of layout and details standard or newly designed for installation of any accessories.

PART 2 - PRODUCTS

Cold-Applied Asphalt Cut-Back Dampproofing:

Asphalt Compound: Manufacturer's standard asphalt and solvent compound, recommended for dry below-grade exterior and for above-grade interior applications, compounded to penetrate substrate and build to moisture-resistant, vapor-resistant, firm, elastic coating.

Provide semi-fibrated type semi-mastic non-asbestos compound, complying with FS SS-A-694, except containing non-asbestos, inorganic fibrous reinforcement and filler materials.

Miscellaneous Materials:

General: Provide materials acceptable to manufacturer(s) of primary dampproofing materials (bitumens).

PART 3 - INSTALLATION

Job Conditions:

Weather: Proceed with dampproofing work only when existing and forecasted weather conditions will permit work to be performed in accordance with manufacturer's recommendations.

General:

Comply with manufacturer's instructions, except where more stringent requirements are shown or specified, and except where project conditions require extra precautions or provisions to ensure satisfactory performance of work.

Apply dampproofing compound to achieve a continuous vapor barrier with no holidays, skips, voids and etc. Comply with manufacturer's recommended rate of application and minimum number of coats to achieve intended results.

Fill voids, seal joints, and apply bond breakers (if any) as recommended by prime materials manufacturer, with particular attention at construction joints.

Install separate flashings and corner protection stripping as recommended by prime materials manufacturer, where indicated to precede application of dampproofing. Comply with manufacturer's recommendations. Give particular attention to requirements at building expansion joints, if any.

Mask or otherwise protect adjoining work to prevent spillage or migration of dampproofing materials onto other surfaces of work. Do not allow dampproofing materials to enter drains or conductors.

END OF SECTION 07 11 13

SECTION 07 20 60 - CONCRETE MASONRY UNIT - CELL FOAM INSULATION

PART 1 - GENERAL

DESCRIPTION OF WORK:

The material specified herein shall be installed in the masonry cells of the exterior block walls which are not otherwise furred and insulated with materials specified elsewhere.

SUBMITTALS

In accordance with Section 01 33 00, Submittals, provide product data on the material to be used.

Provide certification that installer is licensed by the manufacturer and properly trained in the installation of the insulation and use of required equipment.

PART 2 - PRODUCTS

MANUFACTURER:

This specification is based on products manufactured by Tailored Chemical Products, Hickory, North Carolina. Similar products of other manufacturers meeting or exceeding these specifications, and the characteristics implied but not written by reference to particular manufacturer, may be considered.

FOAM INSULATION:

Core-Fill 500 Foam Insulation shall be installed in all masonry exterior walls after the tie beam is installed.

PART 3 - EXECUTION

GENERAL PREPARATION:

Inspect the areas to receive foam insulation and notify architect that material can be installed as specified. Execution of the contract to perform this work is confirmation that this material may be installed as herein specified.

INSTALLATION:

Install the product in accordance with the manufacturer's recommendations.

Do not block or fill the work of other trades if they are not completed.

Protect and do not fill electrical "J" boxes, light fixtures or other such appliances.

CLEAN UP AND PROTECTION:

All building surfaces shall be protected from damage by the Contractor while this material is installed.

The Contractor shall clean up any debris due to this application and remove it from the project site.

END OF SECTION 07 20 60

SECTION 07 21 00 - THERMAL BATT INSULATION

PART 1 - GENERAL

DESCRIPTION OF WORK:

Batt insulation shall be furnished and installed in wall locations as shown on the drawings. Sizes shown on drawings.

SUBMITTALS:

In accordance with Section 01 33 00, Submittals, provide product data for review by the Architect.

PART 2 - PRODUCTS

<u>Unfaced and Faced Mineral Fiber Blanket/Batt Insulation</u>: Thermal insulation produced by combining mineral fibers of type described below with thermosetting resins respectively; and as follows:

Mineral Fiber Type: Fibers manufactured from glass.

Combustion Characteristics: Unfaced blanket/batt passes ASTM E 136 test. Faced blankets shall comply with ASTM C 665 for Type III, Class A blankets with reflective foil-scrim-kraft vapor-retarder membrane on one face with flame spread of 25 or less).

Surface Burning Characteristics: Maximum flame spread and smoke developed values of 25 and 50, respectively.

PART 3 - EXECUTION

All insulation shall be installed in a snug, continuous and secure manner between wall frame or furring members. The entire wall spaces shall be filled with the insulation material specified.

The insulation shall be installed after all electric wiring, plumbing, and other concealed work is in place; areas around electrical outlets, pipes, and all other protruding objects shall be snugly fitted.

END OF SECTION 07 21 00

SECTION 07 21 13 - RIGID WALL INSULATION

PART 1 - GENERAL

DESCRIPTION OF WORK:

Provide rigid insulation at all exterior masonry walls of conditioned spaces where noted or where not otherwise insulated (foam fill).

SUBMITTALS:

In accordance with Section 01 33 00, Submittals, provide product data for review.

PART 2 - PRODUCTS

EXTRUDED POLYSTYRENE BOARD:

Subject to compliance with the requirements, provide products by the following manufacturer(s). Equal products by other manufacturers will be considered prior to and after the bid period.

DOW CHEMICAL COMPANY

Composition: Rigid closed-cell, extruded polystryene foam insulation board, FS HH-1-524C Type IV, and ASTM C578, Type IV.

Size: 48" W x 96" L of thickness as required (typically 1 1/2"), w/ scores @ 16" and 24" o.c.

Thermal Resistance: R = 5.0 minimum, aged, per inch thickness (ASTM C518)

Mastic: As approved by manufacturer compatible with rigid insulation board.

ACCESSORIES:

Fasteners, adhesives, asphalt binders, flashings and tape, shall be installed by the Contractor to provide a complete and fully sealed surface.

PART 3 - EXECUTION

Installation of insulation board must be in accordance with applicable codes.

For interior of building, rigid insulation must be encapsulated with noncombustible material, i.e., gypsum wallboard. This includes areas above ceiling or attic spaces.

Inspect substrate and provide smooth level surface for application of insulation material.

Install sheets of insulation tight and continuously over substrate in manner as recommended by manufacturer and as approved by the architect. Provide fully sealed and taped joints or cover with 8 mil visqueen with sealed joints.

END OF SECTION 07 21 13

SECTION 07 23 13 - FOIL FACED SEMI-RIGID WALL INSULATION

PART 1 - GENERAL

DESCRIPTION OF WORK:

Provide rigid insulation at exterior masonry walls above ceiling areas where walls below are insulated and covered with drywall. This will allow upper areas to be uncovered with drywall.

SUBMITTALS:

In accordance with Section 01 33 00, Submittals, provide product data for review.

PART 2 - PRODUCTS

FACED GLASS FIBERBOARD:

Subject to compliance with the requirements, provide products by Owens-Corning. Equal products by other manufacturers will be considered in accordance with Section 01600 Products and Substitutions.

Composition: #703, FRK faced glass fiber thermal insulation complying with ASTM C612, Type 1A and 1B.

Size: 48" W x 96" L, 1-1/2" thickness, of 3.0 pcf density.

Thermal Resistance: R = 5.0 minimum, aged, per inch thickness (ASTM C518)

Combustion Characteristics: Maximum flame spread and smoke developed valves shall be 25 and 50, respectively.

Mastic and Seam Tape: As approved by manufacturer compatible with insulation.

ACCESSORIES:

Fasteners, adhesives, tape, etc., shall be installed by the Contractor to provide a complete and fully sealed surface.

PART 3 - EXECUTION

Installation of insulation board must be in accordance with applicable codes.

Inspect substrate and provide smooth level surface for application of insulation material.

Install sheets of insulation tight and continuously over substrate in manner as recommended by manufacturer and as approved by the architect. Fasten to substrate with adhesive or approved mechanical fasteners.

END OF SECTION 07 23 13

SECTION 07 24 00 SUBSTRATE SHEATHING

PART 1 - GENERAL

SCOPE OF WORK:

Provide substrate siding at the wall areas to receive new stucco exterior finish.

SUBMITTALS:

In accordance with Section 01 33 00 - Submittals, provide product data and manufacturer's installation instructions.

Include data to confirm product complies with the Florida Building Code relative to a Florida Product Approval for wind loading.

PART 2 - PRODUCTS

Substrate sheathing shall be that as manufactured by USG United States Gypsum Co., (800) 950-3839, <u>www.usg.com</u> or equal approved by the architect per Section 01 60 00, Substitutions

Substrate Sheathing shall be Aqua Tough of 5/8" thickness.

Fasteners shall be of size as recommended by siding manufacturer and shall be hot dip galvanized or similar non-corrosive type as approved by the architect.

PART 3 - EXECUTION

Install substrate sheathing in strict accordance with manufacturer's written instructions, the Florida Product Approval, and as approved by the architect.

END OF SECTION 07 24 00

SECTION 07 41 13 - PREFORMED METAL SOFFITS & TRIM

PART 1 - GENERAL

SCOPE OF WORK:

The scope of work for this section includes performed metal soffits for this project, including miscellaneous flashing and trim associated to the installation and tie in.

SUBMITTALS:

In accordance with Section 01 33 00, Submittals, submit color chips, product data, shop drawings, and certifications. Shop Drawings shall be prepared by the panels' manufacturer or representative designated and approved by them and will be signed and sealed by an engineer registered in Florida certifying that the attachment complies with applicable code. Shop drawings will be reviewed and approved by a qualified representative of the panel manufacturer's technical staff certifying that all details are in accordance with their recommendations. Submit other data and samples as may be required.

A Florida Product Approval Number and certification data shall be submitted for the roof panels/system. The approval shall be consistent with the requirements for the project site including certification for windborne debris, cyclical loading and weathertightness. If such product approval is not available, a submittal of the Miami-Dade Product Approval which confirms that testing procedures TAS 201, 202 and 203 of the code have been satisfactorily performed.

Provide details, signed and sealed by a Florida Registered Engineer for the anchorage clips confirming compliance with the required wind resistance.

QUALITY ASSURANCE:

Preinstallation Conference: A preinstallation conference shall be held in accordance with Section 01 41 00 - Project Coordination.

As a condition for payment, the manufacturer shall visit the site during the final stages of installation of this specified material. The manufacturer shall furnish a certificate stating that the materials are installed in accordance with the manufacturer's recommendations.

Metal soffit installer shall be certified by the panel manufacturer and shall be certified by the panel manufacturer and shall have 5 years experience at installing panel products on projects similar to this type.

Provide performed soffit panels and trim systems which have been pretested and certified by the manufacturer to meet the following. Tests, all data, shall be provided in printed form issued by a recognized independent testing laboratory.

<u>Coating Systems Integrity Test:</u> A sample shall withstand a salt-fog test for a minimum of 1000 hours in accordance with ASTM B117, including scribe requirement in test. Immediately upon removal of specimen from test, the coating shall receive a rating of 10. No blistering, as determined by ASTM D714; and a rating of 10, no edge creep as ASTM D1654 rating schedule No. 1.

<u>Pollution-Resistance Test:</u> A flat specimen with no protected edges shall be subject to 30 cycles of Kesternich testing, ASTM G87, without blistering, or loss of adhesion and only slight edge creepage. Kesternich test consists of 8 hours of exposure at 104 F. with 100% relative humidity (condensing) in a controlled sulfur dioxide (SO2), carbon dioxide (CO2) atmosphere. Atmospheric concentration of pollutant gases shall be in accordance with Kesternich test

standards (2.0 liters of SO2 and 2.0 liters of CO2). This shall be followed by 16 hours of dry time which concludes one cycle of testing.

<u>Humidity-Resistance Test:</u> A sample shall be tested for 1000 hours at 100 degrees F. in accordance with ASTM D2247 with no blistering, peeling or loss of adhesion.

<u>Abrasion-resistance Test for Coating System:</u> A flat specimen shall be subjected to the abrasionresistance test. Test shall be conducted in accordance with ASTM D968 (Falling Sand). Coating system shall resist abrasion to extent indicated by use of not less than 75 liters of sand to product the exposure of 3.9 mm diameter area of bare metal

<u>Field Measurements:</u> Prior to fabrication of prefabricated panels, take field measurements of structure or substrates to receive panel system. Notify Contractor of discrepancies from contact drawings. Do not proceed with installation until discrepancies are resolved.

STRUCTURAL PERFORMANCE REQUIREMENTS

The installation shall meet the requirements of the Florida Building Code, latest edition, for minimum windspeed, exposure category and importance factor as noted on the structural drawings. The contractor and installer are to refer to the wind load diagram on the structural drawings and supply metal roofing materials, panel clips and fasteners to meet the loads identified in the diagram.

FINISH AND WEATHERTIGHTNESS WARRANTY:

The Owner reserves the right that the specified "<u>FINISH WARRANTY</u>" and "WEATHERTIGHTNESS WARRANTY AND GUARANTEE OF PERFORMANCE FOR <u>PREFORMED METAL ROOF</u>", be the actual warranty.

FINISH WARRANTY:

Manufacturer hereby issues the following warranty in support of the specification and use of (coating) for their building components in the project listed below.

Within twenty (20) years after date of substantial completion, the finish color coating will not crack or check, peel, blister, flake, chip, or otherwise lose adhesion, and will not chalk in excess of eight (8), or face in excess of five (5) NBS units.

Color change determination shall be made in accordance with ASTM D-2244-78, Paragraph 4.2.2.4, by comparing exposed panels and unexposed (retained) panels from a given batch. Any chalk or dirt on panels shall be removed by carefully washing with Ivory Soap solution and wiping dry with a soft cloth before making color change determination.

This warranty covers the product exposed to normal atmospheric conditions (which herein excludes highly corrosive or aggressive atmosphere such as those contaminated with chemical fumes in the Continental United States unless Owner agrees otherwise in writing. This warranty shall not apply where product failure is the result of fire, other accident or casualty, vandalism atomic radiation, harmful fumes or foreign substances in the atmosphere, mishandling, acts of God, or other such similar or dissimilar occurrences beyond manufacturer's control.

The atmosphere at the site on the date of bidding is hereby acknowledged as within the definition of normal atmospheric conditions.

Manufacturer's liability under the terms of this warranty will be limited to the direct cost of refinishing the failed exposed metal. Refinishing of the failed exposed metal shall be performed by using standard finishing practices and materials to match the specified product.

All repaired areas shall continue to be covered under the original terms of this warranty, with expiration of such coverage expiring on the date of expiration of this warranty.

Claims under the warranty must be made to manufacturer in writing within sixty (60) days after customer becomes aware of any alleged defect, and manufacturer must be given a reasonable opportunity to inspect the system claimed to be defective, prior to initiation of any repair of failed exposed metal.

Except as set forth herein, the manufacturer does not make other warranties, expressed or implied, including any implied warranty of merchantability or fitness for a particular purpose with respect to product finish. In no way shall manufacturer be responsible for any general, special, compensatory, or consequential damages resulting from the failure of this coating unless unduly negligent in producing an expeditious response.

This guarantee is between the manufacturer and Owner of the facility. This warranty is non-transferable, in whole or in part, to any other party. Customer is to be the Owner.

PART 2 - PRODUCTS

MATERIALS

ACCEPTABLE MANUFACTURERS:

Subject to compliance with the performance outlined in these specifications, "SNAP CLAD" & "PAC 850" for the roof and soffits panels as manufactured by Petersen Aluminum Co. are the basis of the design. Equivalent products by other manufacturers will be considered prior to bids in accordance with Section 01 60 00 Products and Substitutions.

ROOF AND SOFFIT MATERIALS:

Aluminum: Sheets are of .032, 3105-H4 aluminum for roof and soffit panels. Use .040, 3105-H4 aluminum for gutters, collector boxes, trim and edge flashings.

ROOF PANEL FABRICATION:

Roof panels are formed to include a 1 3/4" leg height and a continuous interlock held to the substrate via a concealed clip system.

SOFFIT PANEL FABRICATION:

Soffit panels are formed to include a hook and grab interlock at panel edges parallel to the 'vee' groove profiles which are 6" o.c. Vented panels shall be included but limited in locations.

METAL FINISH & COLOR:

Flourocarbon coating: Premium coating produced with full strength Kynar 500 resin in minimum 1.5 mil thick with 0.5 mil clear coat, having a 20 year minimum warranty against cracking, peeling and fade.

Color: To be selected by the Architect from all standard colors available from the manufacturer.

MISCELLANEOUS MATERIALS:

Fasteners: Manufacturer's standard noncorrosive types galvanized in accordance with ASTM A153 or stainless steel. All fasteners shall be concealed unless same cannot be achieved.

Where not concealed, fasteners shall be smooth and visually unobtrusive and stainless steel with color finish to match panel.

Accessories: Except as indicated as work of another specification section, provide components required for a complete roofing system, including trim, copings, fascias, gravel stops, accent extrusions, mullions, sills, corner units, ridge closures, clips, seam covers, battens, flashings, gutters, sealants, and gaskets, fillers, closure strips and similar items. Match finishes of preformed panels but provide in 20 gage material thickness.

Trim, wall copings and other decorative metal details independent of the metal roof shall match the metal roof in material, color, and finish as directed by the architect.

Bituminous Coatings: Cold-applied asphalt mastic, SSPC paint 12, compounded for 15 mil dry thickness per coat.

PART 3 - INSTALLATION:

Installer shall inspect the substrate and note, in writing to the Contractor and Architect, any deficiencies; otherwise, the substrate shall be deemed acceptable with regards to factors which affect panel installation and appearance of panel after installed.

Panel shall be installed on underlayment in strict accordance with the panel manufacturer's latest product manual and shall include all the necessary accessories for anchorage, joint sealers, flashing and trim for the proper and permanent installation of panels, with provisions for thermal expansion, erected in panel pattern indicated.

END OF SECTION 07 41 13
SECTION 07 52 16 - STYRENE-BUTADIENE-STYRENE (SBS) MODIFIED BITUMINOUS MEMBRANE ROOFING

PART 1 – GENERAL

SUMMARY OF THE WORK:

The work includes SBS-modified bituminous membrane roofing on flat (1/4" per foot slope) roof areas with rigid insulation on steel deck substrate.

RELATED WORK SPECIFIED ELSEWHERE:

Division 05 Section "Steel Decking"

Division 06 Section "Miscellaneous Rough Carpentry" for wood nailers, cants, curbs, and blocking

Division 07 Section "Sheet Metal Flashing and Trim" for metal roof penetration flashings, flashings, and counterflashings

Division 22 Section "Storm Drainage Piping Specialties" for roof drains

REFERENCES:

Roofing Terminology: Refer to the following publications for definitions of roofing work related terms in this Section:

- ASTM D 1079 "Terminology Relating to Roofing and Waterproofing"
- Glossary of NRCA's "The NRCA Roofing and Waterproofing Manual"
- Roof Consultants Institute "Glossary of Roofing Terms" for definition of terms related to roofing work in this Section.

Sheet Metal Terminology and Techniques: SMACNA Architectural Sheet Metal Manual

DESIGN CRITERIA:

General: Installed roofing membrane system shall remain watertight; and resist specified wind uplift pressures, thermally induced movement, and exposure to weather without failure.

Material Compatibility: Roofing materials shall be compatible with one another under conditions of service and application required, as demonstrated by roofing system manufacturer based on testing and field experience.

Wind Uplift Performance: Roofing system shall be identical to systems that have been successfully tested by a qualified testing and inspecting agency to resist wind uplift pressure calculated in accordance with ASCE-7 -10 to meet the Florida Building Code Approvals. The following wind uplift pressures where provided by TLC Engineering. The following roof assembly meets the Florida Building Code with the Exterior Research and Design, LLC Trinity Evaluation Report J8230.03.08-R4 for FL2948-R6, System No. S-7.

- Field-of-Roof Uplift Pressure: -55.0 lbf/sq. ft. (kN/sq. m)
- Perimeter Uplift Pressure: -92.2 lbf/sq. ft. (kN/sq. m)
- Corner Uplift Pressure: -138.8 lbf/sq. ft. (kN/sq. m)

SUBMITTALS:

Product Data: Manufacturer's data sheets for each product to be provided.

Detail Drawings: Provide roofing system plans, elevations, sections, details, and details attachment to other Work, including:

- Base flashings, cants, and membrane terminations.
- Tapered insulation, including slopes.
- Crickets, saddles, and tapered edge strips, including slopes.
- Insulation fastening patterns.

Verification Samples: Provide for each product specified.

Maintenance Data: Refer to Johns Manville's latest published documents on www.specJM.com.

Guarantees: Special guarantees specified in this Section.

QUALITY ASSURANCE:

Installer Qualifications: A qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive the specified manufacturer's guarantee.

Manufacturer Qualifications: A qualified manufacturer that has Florida Building Code for roofing system identical to that used for this Project.

Testing Agency Qualifications: An independent testing agency with the experience and capability to conduct the testing indicated, as documented according to ASTM E 548.

Test Reports:

- Roof drain and leader test or submit plumber's verification.
- Core cut (if requested).
- Roof deck fastener pullout test.

Moisture Survey: Submit prior to installation, results of a non-destructive moisture test of roof system completed by approved third party. Utilize one of the approved methods:

- Infrared Thermography
- Nuclear Backscatter

Source Limitations: Obtain all components from the single source roofing system manufacturer guaranteeing the roofing system. All products used in the system shall be labeled by the single source roofing manufacturer issuing the guarantee.

Provide evidence of CERTA training for any installer of torch-applied modified bitumen membrane. Copies of certifications are required prior to award and must be maintained on the jobsite for inspection at any time.

Fire-Test-Response Characteristics: Provide roofing materials with the fire-test-response characteristics indicated as determined by testing identical products per test method below by UL, or another testing and inspecting agency acceptable to authorities having jurisdiction. Materials shall be identified with appropriate markings of applicable testing and inspecting agency.

- Exterior Fire-Test Exposure: Class <u>A</u>; ASTM E 108, for application and roof slopes indicated.
- Fire-Resistance Ratings: ASTM E 119, for fire-resistance-rated roof assemblies of which roofing system is a part.

DELIVERY, STORAGE, AND HANDLING:

Deliver roofing materials in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, and directions for storage.

Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer.

Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.

Handle and store roofing materials and place equipment in a manner to avoid permanent deflection of deck.

PROJECT CONDITIONS:

Weather Limitations: Proceed with installation only when current and forecasted weather conditions permit roofing system to be installed in accordance with manufacturer's written instructions and guarantee requirements.

GUARANTEE:

Provide manufacturer's system guarantee equal to Johns Manville's Peak Advantage No Dollar Limit Roofing System Guarantee.

- Single-Source special guarantee includes roofing plies, base flashings, liquid applied flashing, roofing membrane accessories, granule surfaced roofing membrane roof insulation, fasteners, cover board, substrate board, walkway products, [manufacturer's expansion joints, manufacturer's edge metal products, and other single-source components of roofing system marketed by the manufacturer.
- Guarantee Period: 20 years from date of Substantial Completion.

Installer's Guarantee: Submit roofing Installer's guarantee, signed by Installer, covering Work of this Section, including all components of roofing system, for the following guarantee period:

• Guarantee Period: Five Years from date of Substantial Completion.

PART 2 – PRODUCTS:

SBS-MODIFIED ASPHALT-SHEET MATERIALS:

Roofing Membrane Sheet: [ASTM D 6164, Grade S, Type I, polyester-reinforced], SBS-modified asphalt sheet; smooth surfaced; suitable for application method specified. Basis of Design: [DynaWeld 180 S]

Roofing Membrane Cap Sheet: [ASTM D 6164, Grade G, Type [I] or [II], polyester-reinforced], SBSmodified asphalt sheet; granular surfaced; suitable for application method specified. Basis of Design: [DynaWeld Cap 180 FR]

BASE FLASHING SHEET MATERIALS – SBS:

Backer Sheet: [ASTM D 6164, Grade S, Type I, polyester-reinforced], SBS-modified asphalt sheet; smooth surfaced; suitable for application method specified. Basis of Design: [DynaLastic 180 S]

Flashing Sheet: [ASTM D 6164, Grade G, Type II, polyester-reinforced], SBS-modified asphalt sheet; granular surfaced; suitable for application method specified. Basis of Design:] [DynaWeld Cap 180 FR]

Liquid Applied Flashing: A liquid and fabric reinforced flashing system created with a stitchbonded polyester scrim and a two-component, moisture cured, elastomeric, liquid applied flashing material, consisting of an asphalt extended urethane base material and an activator. Basis of Design: <u>PermaFlash</u> <u>System</u>

AUXILIARY ROOFING MEMBRANE - BITUMINOUS:

General: Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with built-up roofing.

Asphalt Primer: ASTM D 41. Basis of Design: Asphalt Primer

Cold-Applied Flashing Adhesive: Roofing system manufacturer's asphalt-based, two-component, asbestos-free, trowel-grade, cold-applied adhesive specially formulated for compatibility and use with flashing applications. Basis of Design: <u>MBR Flashing Cement</u>

Mastic Sealant: As required by Johns Manville.

Fasteners: Factory-coated steel fasteners and metal or plastic plates meeting corrosion-resistance provisions in FMG 4470, designed for fastening roofing membrane components to substrate, tested by manufacturer for required pullout strength, and provided by the roofing system manufacturer. Basis of Design: <u>UltraFast Fasteners and Plates</u>

Roofing Granules: Ceramic-coated roofing granules matching specified cap sheet, provided by roofing system manufacturer.

Coating: Acrylic elastomeric coating with unique bleed-blocking properties particularly well suited for coating over asphalt surfaces. Basis of Design: <u>JM CR Seam Coating</u>

Miscellaneous Accessories: Provide miscellaneous accessories recommended by roofing system manufacturer.

AUXILIARY ROOFING SYSTEM COMPONENTS:

Fascia System: Manufacturer's factory fabricated fascia consisting of a base piece and a snap-on cover. Provide product manufactured and marketed by single-source membrane supplier that is included in the No Dollar Limit guarantee. Basis of Design: <u>Presto-Tite Fascia</u>

Metal Flashing Sheet: Metal flashing sheet is specified in Division 07 Section "Sheet Metal Flashing and Trim."

WALKWAYS:

Walkway Pads: Mineral-granule-surfaced, reinforced modified asphalt composition, slip-resisting pads, manufactured as a traffic pad for foot traffic provided by roofing system manufacturer, with a pad size of 32 inch x 32 inch. Basis of Design: <u>Johns Manville DynaTred</u>

COVER BOARD:

Gypsum Board: ASTM C1278, non-faced, gypsum and cellulose fiber substrate, 1/2 inch (13 mm) thick. Basis of Design: JM <u>Securock</u> Gypsum-Fiber Roof Board

ROOF INSULATION:

General: Preformed roof insulation boards that comply with requirements and referenced standards, selected from manufacturer's standard sizes and of thicknesses indicated.

Polyisocyanurate Board Insulation: ASTM C 1289, Type II, Basis of Design: ENRGY 3

- Provide insulation package with R Value greater than R-38
- Install no boards thicker than 2.0" and multiple layers.

TAPERED INSULATION:

Tapered Insulation: ASTM C 1289, provide factory-tapered insulation boards fabricated to slope of 1/4 inch per 12 inches (1:48), unless otherwise indicated. Basis of Design: <u>Tapered ENRGY 3</u>

INSULATION ACCESSORIES:

General: Roof insulation accessories recommended by insulation manufacturer for intended use and compatible with membrane roofing.

Provide factory preformed saddles, crickets, tapered edge strips, and other insulation shapes where indicated for sloping to drain. Fabricate to slopes indicated. Basis of Design: <u>Tapered Pre-Cut Cricket</u>

Wood Nailer Strips: Comply with requirements in Division 06 Section "Miscellaneous Rough Carpentry."

PART 3 – EXECUTION

EXAMINATION:

Examine substrates, areas, and conditions for compliance with requirements affecting performance of roofing system:

Proceed with installation only after unsatisfactory conditions have been corrected.

PREPARATION:

Clean and remove from substrate sharp projections, dust, debris, moisture, and other substances detrimental to roofing installation in accordance with roofing system manufacturer's written instructions.

Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction.

Prime surface of concrete deck with asphalt primer at a rate recommended by roofing manufacturer and allow primer to dry.

Proceed with installation only after unsatisfactory conditions have been corrected.

INSULATION INSTALLATION:

Coordinate installation of roof system components so insulation and cover board is not exposed to precipitation or left exposed at the end of the workday.

Comply with roofing system manufacturer's written instructions for installation of roof insulation and cover board.

Insulation Cant Strips: Install and secure preformed 45-degree insulation cant strips at junctures of roofing membrane system with vertical surfaces or angle changes greater than 45 degrees per manufacturer's instruction.

Install tapered insulation under area of roofing to conform to slopes indicated.

Install insulation boards with long joints in a continuous straight line with end joints staggered between rows, abutting edges and ends between boards. Fill gaps exceeding 1/4 inch (6 mm) with like material.

Install one or more layers of insulation under area of roofing to achieve required thickness. Where overall thickness is 2.0 inches or greater, install 2 or more layers with joints of each succeeding layer staggered from joints of previous layer a minimum of 6 inches (150 mm) in each direction.

Trim surface of insulation boards where necessary at roof drains so completed surface is flush and does not restrict flow of water.

Install tapered edge strips at perimeter edges of roof that do not terminate at vertical surfaces.

Mechanically Fastened to Steel Deck with Subsequent Layers Adhered Insulation: Secure first layer of insulation to deck using mechanical fasteners specifically designed and sized for fastening specified board-type to steel deck type.

- Fasten first layer according to requirements in Florida Building Code Approval for specified Windstorm Resistance Classification.
- Fasten first layer of insulation with 16 fasteners in the field, 28 fasteners at the perimeter, and 39 fasteners in the corners to resist uplift pressure.
- Install subsequent layers in a two-part urethane adhesive according to roofing system manufacturer's instruction.

Proceed with installation only after unsatisfactory conditions have been corrected.

COVER BOARD INSTALLATION:

Coordinate installing membrane roofing system components so cover board is not exposed to precipitation or left exposed at the end of the workday.

Comply with membrane roofing system manufacturer's written instructions for installing roof cover board.

Install cover board with long joints of cover board in a continuous straight line with end joints staggered between rows, abutting edges and ends between boards. Fill gaps exceeding 1/4 inch (6 mm) with cover board.

• Cut and fit cover board within 1/4 inch (6 mm) of nailers, projections, and penetrations.

Trim surface of cover board where necessary at roof drains so completed surface is flush and does not restrict flow of water.

• Install tapered edge strips at perimeter edges of roof that do not terminate at vertical surfaces.

Adhered Cover Board: Adhere cover board to substrate as follows:

• Install in a two-part urethane adhesive according to roofing system manufacturer's instruction.

Proceed with installation only after unsatisfactory conditions have been corrected.

ROOFING MEMBRANE INSTALLATION, GENERAL:

Install roofing membrane in accordance with roofing system manufacturer's written instructions, applicable recommendations of the roofing manufacturer and requirements in this Section.

Start installation of roofing membrane in presence of roofing system manufacturer's technical personnel.

Where roof slope exceeds 1/2 inch per 12 inches (1:24, contact the membrane manufacturer for installation instructions regarding installation direction and backnailing

Cooperate with testing and inspecting agencies engaged or required to perform services for installing roofing system.

Coordinate installing roofing system so insulation and other components of the roofing membrane system not permanently exposed are not subjected to precipitation or left uncovered at the end of the workday or when rain is imminent.

- Provide tie-offs at end of each day's work to cover exposed roofing membrane sheets and insulation with a course of coated felt set in roofing cement or hot roofing asphalt with joints and edges sealed.
- Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system.
- Remove and discard temporary seals before beginning work on adjoining roofing.

Substrate-Joint Penetrations: Prevent roofing asphalt from penetrating substrate joints, entering building, or damaging roofing system components or adjacent building construction.

Proceed with installation only after unsatisfactory conditions have been corrected.

SBS-MODIFIED BITUMINOUS MEMBRANE INSTALLATION:

Install one modified bituminous roofing membrane sheet and a cap sheet according to roofing manufacturer's written instructions, starting at low point of roofing system. Extend roofing membrane sheets over and terminate beyond cants, installing as follows:

- Torch apply to substrate according to roofing system manufacturer's instruction.
- Unroll roofing membrane sheets and allow them to relax for minimum time period required by manufacturer.

Laps: Accurately align roofing membrane sheets, without stretching, and maintain uniform side and end laps. Stagger end laps. Completely bond and seal laps, leaving no voids.

- Repair tears and voids in laps and lapped seams not completely sealed.
- Apply roofing granules to cover exuded bead at laps while bead is hot.

Install roofing membrane sheets so side and end laps shed water.

Proceed with installation only after unsatisfactory conditions have been corrected.

FLASHING AND STRIPPING INSTALLATION:

Install base flashing over cant strips and other sloping and vertical surfaces, at roof edges, and at penetrations through roof, and secure to substrates according to roofing system manufacturer's written instructions and as follows:

- Prime substrates with asphalt primer if required by roofing system manufacturer.
- Backer Sheet Application: Install backer sheet and torch apply substrate as required by roofing system manufacturer.
- Flashing Sheet Application: Torch apply flashing sheet to substrate as required by roofing system manufacturer.

Extend base flashing up walls or parapets a minimum of 8 inches (200 mm) above roofing membrane and 4 inches (100 mm) onto field of roofing membrane.

Mechanically fasten top of base flashing securely at terminations and perimeter of roofing.

• Seal top termination of base flashing with a strip of glass-fiber fabric set in MBR Flashing cement.

Roof Drains: Flash drain using PermaFlash system. Clamp roofing membrane, flashing, and stripping into roof-drain clamping ring.

• Install stripping according to roofing system manufacturer's written instructions.

Proceed with installation only after unsatisfactory conditions have been corrected.

WALKWAY INSTALLATION:

Walkway Pads: Install walkway pads using units of size indicated or, if not indicated, of manufacturer's standard size according to walkway pad manufacturer's written instructions.

Walkway Cap Sheet Strips: Install roofing membrane walkway cap sheet strips over roofing by torch application. – SBS

Proceed with installation only after unsatisfactory conditions have been corrected.

FIELD QUALITY CONTROL:

Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform roof tests and inspections and to prepare test reports.

Roof Inspection: Arrange for roofing system manufacturer's Registered Roof Observer (RRO) to inspect roofing installation at start up and upon completion and submit report to Architect.

Repair or remove and replace components of roofing system where test results or inspections indicate that they do not comply with specified requirements.

Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

PROTECTION AND CLEANING:

Protect roofing system from damage and wear during remainder of construction period.

Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction. END OF SECTION 07 52 16

SECTION 07 62 00 - PREFABRICATED PARAPET TOP & COLLECTOR BOXES

PART 1 - GENERAL

SCOPE OF WORK:

The work includes the furnishing of material, equipment and labor to install the edge flashing along the top of parapet walls, edge and wall flashing and miscellaneous flashings in conjunction with membrane (not metal) roofing. It also includes the scuppers, conductor heads (boxes) and downspouts.

CONTRACTOR'S REPRESENTATION:

The installation of the flashings SHALL NOT VOID the roofing warranty and the roofing manufacturers shall accept the use of the products specified herein. It is intended that this work be inclusive of all materials and labor to complete a weather tight, non-metal roof installation.

SUBMITTALS:

In accordance with section 01 33 00, the Contractor shall provide product data, samples and shop drawings to describe the proposed material/system and the typical installation(s). Submit color chips for selection of painted finishes.

Additionally, provide a Florida Product Approval Number and certification data which demonstrates compliance with the test requirements required by the Florida Building Code, latest active edition. Product shall satisfy all requirements including that for windbourne debris resistance.

PART 2 - MATERIALS

Manufacturer: Products specified herein are those manufactured by Metal-Era, <u>www.metalera.com</u>. Equivalent products will be considered prior to bid.

Parapet Wall Top Cap: Parapet cap shall match the existing cap and be field painted to match.

Collector Boxes: Provide fully welded collector boxes of .050" aluminum minimum. Provide attachment at back for thru wall pvc pipe connection.

Sealant/Adhesives: Provide sealant or adhesive as recommended by roofing manufacturer to seal or adhere the bar to substrate.

PART 3 - EXECUTION

<u>Preparation:</u> Before setting parapet wall termination bar, top of wall must be clean, dry and free from dirt, dust, moisture, loose mortar or any other foreign substances. The roof membrane base ply shall run up and onto the precast parapet top.

An acceptable method of mechanically fastening the cleats with non-corrosive fasteners will need to be approved by the architect.

<u>Edge Flashing Installation</u>: Starting at the corners, install retainer bar at corners then between. Thereafter install the fascia mitered corners and flashing between.

Precautions: Allow for expansion at each joint. Locate the center line of a coping chair under each joint so the chair can act as a rain gutter and also support both coping sections. Before

installing coping covers, check cleats and chairs to be sure that they have adhered well to the wall.

Other Flashings: Install per SMACNA, Soprema or product manufacturer's written installation instructions. Properly lap and seal for watertightness.

END OF SECTION 07 62 00

SECTION 07 84 10 - FIRE RATED PENETRATIONS & JOINTS

PART 1 – GENERAL

DESCRIPTION OF WORK:

The contractor shall enlist the services of a subcontractor or subcontractors skilled in the installation and sealing of penetration thru fire rated floors, walls and any other rated construction joints/penetrations to complete the installation of all rated penetrations in this project. This section shall apply to all other sections, where consistent with the intent herein.

All subcontractors (i.e.: mechanical, electrical, door installer and etc.) shall follow the procedures required herein and shall provide submittals if they intend to self-perform the installation of any rated penetration.

SUBMITTALS:

In accordance with section 01 33 00, provide product data, installation instructions and samples of all products to be used. Include U.L. (or other code approved agency) details or data for each type of penetration and bind into booklet.

CERTIFICATION:

Submit written certification(s) that the contractor or subcontractor has inspected each and every installation of all penetrations thru fire (or smoke) rated partitions/construction.

PART 2 – PRODUCTS

MATERIALS:

Foamed-In-Place Fire-Stopping Sealant: Two-part, foamed-in-place, silicone sealant formulated for use as part of a through-penetration fire-stop system for filling openings around cables, conduit, pipes and similar penetrations through walls and floors, with fire-resistance rating indicated per ASTM E 814, listed by U.L. or other testing and inspecting agency acceptable to authorities having jurisdiction.

One-Part Fire-Stopping Sealant: One part elastomeric sealant formulated for use as part of a through-penetration fire-stop system for sealing openings around cables, conduit, pipes and similar penetrations through walls and floors, listed by U.L. or other testing and inspecting agency acceptable to authorities having jurisdiction.

Accessory Materials: Forming, joint fillers, packing, sleeves and other accessory materials as required for installation of fire/smoke stopping sealants.

PART 3 – EXECUTION

Install sealant, etc. and accessories per the U.L. (or other) design written instructions.

END OF SECTION 07 84 10

SECTION 07 90 00 - JOINT SEALERS

PART 1 - GENERAL

Provide joint sealers at interior and exterior locations throughout the project to insure a fully sealed water and air tight structure. Additionally, to provide for the sealing of fire/smoke rated assemblies. Carefully review other sections of the project specifications for required sealant joints not specifically shown on the drawings or noted herein.

QUALITY ASSURANCE:

Preconstruction Field Tests: Prior to installation of joint sealers, field-test their adhesion to joint substrates as recommended in ASTM C 962.

Warranty: Provide only products which are warranteed by manufacturer for a period of 20 years.

It is anticipated that a firm who specializes in the sealing (installation and product types) of buildings will be secured by the general contractor/CM to complete the work of this section.

SUBMITTALS:

In addition to product and warranty data submit the following:

Samples of each type and color of joint sealer for this work.

<u>Schedule of sealants</u> to be used clearly identifying where each type is to be installed. Refer to example Joint Sealant Schedule at end of this section. The contractor or sealant's subcontractor shall prepare a schedule, even if products will be provided by others, and submit it for review. He shall coordinate the work of other trades and assure all products are compatible.

PART 2 - PRODUCTS

<u>Compatibility:</u> Provide joint sealers, joint fillers and other related materials that are compatible with one another and with joint substrates under service and application conditions, as demonstrated by testing and field experience.

Color: Provide color of exposed joint sealers as selected by Architect.

<u>Elastomeric Sealant Standard:</u> Provide manufacturer's standard chemically curing, elastomeric sealant of base polymer indicated, complying with ASTM C 920 requirements.

<u>One-Part Mildew-Resistant Silicone Sealant:</u> Type S; Grade NS; Class 25; Uses NT, G, A, and O; intended for sealing interior joints with nonporous substrates exposed to moisture.

One-Part Nonsag Urethane Sealant: Type S; Grade NS; Class 25; Uses NT, M, A and O.

<u>Acrylic Sealant:</u> Manufacturer's standard one-part nonsag, solvent-release- curing, acrylic terpolymer sealant complying with ASTM C 920 for Type S; Grade NS; Uses NT, M, G, A and O; except for selected test properties which are revised as follows:

Heat-aged hardness:	40 - 50
Weight loss:	15%
Max. cyclic movement capability (Class):	+/- 7 1/2%

<u>Butyl Sealant:</u> Manufacturer's standard one-part, nonsag, solvent-release-curing, polymerized butyl sealant complying with FS TT-S-001657 for Type I and formulated with minimum of 75% solids to be nonstaining, paintable, and have a tack-free time of 24 hours or less.

<u>Acrylic-Emulsion Sealant:</u> Manufacturer's standard, one-part, nonsag, acrylic, mildew-resistant, acrylic-emulsion sealant complying with ASTM C 834.

<u>Acoustical Sealant for Concealed Joints:</u> Manufacturer's standard, nondrying, nonhardening, nonskinning, nonstaining, gunnable, synthetic rubber sealant recommended for sealing interior concealed joints to reduce transmission of airborne sound.

<u>Butyl-Polyisobutylene Sealant:</u> Manufacturer's standard, solvent-release- curing, butyl-polyisobutylene sealant complying with AAMA 809.1, recommended for concealed joints.

<u>Butyl-Polyisobutylene Tape Sealant:</u> Manufacturer's standard, solvent-free, butyl-polyisobutylene tape sealant with a solids content of 100%; complying with AAMA 804.1; formulated to be nonstaining, paintable, and non-migrating in contact with nonporous surfaces; packaged on rolls with a release paper on one side; with or without reinforcement thread to prevent stretch.

Self-Expanding Cork Joint Filler: Preformed strips complying with ASTM D 1752 for Type III.

Cork Joint Filler: Preformed strips complying with ASTM D 1752 for Type II.

<u>Sponge Rubber Joint Filler:</u> Preformed strips of composition below, complying with ASTM D 1751:

Asphalt saturated fiberboard.

<u>Sealant Backings, General:</u> Non-staining; compatible with joint substrates, sealants, primers and other joint fillers; approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

<u>Plastic Foam Joint-Fillers:</u> Preformed, compressible, resilient, non-waxing, non-extruding strips of plastic foam of closed-cell polyethylene foam, non-gassing, and of size, shape and density to control sealant depth and otherwise contribute to producing optimum sealant performance.

<u>Elastomeric Tubing Joint-Fillers:</u> Neoprene, butyl or EPDM tubing complying with ASTM D 1056, non-absorbent to water and gas, capable or remaining resilient at temperatures down to -26 degrees F. (-32 degrees C). Provide products with low compression set and size and shape to provide a secondary seal, to control sealant depth and otherwise contribute to optimum sealant performance.

<u>Bond-Breaker Tape:</u> Polyethylene tape or other plastic tape as recommended by sealant manufacturer for preventing bond between sealant and joint filler or other materials at back (3rd) surface of joint.

<u>Primer:</u> Type as recommended by joint sealer manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint sealer-substrate and field tests.

<u>Accessory Materials for Fire-Stopping Sealants:</u> Forming, joint-fillers, packing and other accessory materials as required for installation of fire-stopping sealants.

PART 3 - EXECUTION

INSTALLATION OF JOINT SEALERS:

General: Comply with joint sealer manufacturer's printed installation instructions applicable to products and applications indicated, except where more stringent requirements apply.

Sealant shall be installed at all necessary locations to insure a water and air tight structure, and where required as part of rated separations. The following schedule is a guide and shall not be a means of limiting the sealant locations.

JOINT SEALER SCHEDULE (GENERAL):

DESCRIPTION OF JOINT CONSTRUCTION AND LOCATION WHERE SEALANT IS TYPICALLY APPLIED

JOINT SEALERS (GENERAL)	(SEE NOTE BELOW)
One-Part Non-Sag Urethane Sealant	Exterior and interior joints in vertical surfaces of concrete and masonry; between concrete masonry or stone; between metal and concrete, mortar or stone; perimeters of metal frames in exterior walls; overhead or ceiling joints; and on interior of glazed curtain wall.
One-Part Mildew-Resistant Silicone Sealant	Interior joints in vertical surfaces of ceramic tile in toilet rooms, showers, and kitchens.
Acrylic-Emulsion or Latex Sealant	Interior joints in field-painted vertical and over-head surfaces at perimeter of elevator door frames, hollow metal door frames, gypsum drywall, plaster and concrete or concrete masonry; and all other interior locations not indicated otherwise.

Note: Install sealant indicated in joints fitting descriptions and locations listed.

<u>Elastomeric Sealant Installation Standard</u>: Comply with recommendations of ASTM C 962 for use of joint sealants as applicable to materials, applications and conditions indicated.

Latex Sealant Installation Standard: Comply with requirements of ASTM C 790 for use of latex sealants.

<u>Acoustical Sealant Application Standard</u>: Comply with recommendations of ASTM C 919 for use of joint sealants in acoustical applications as applicable to materials, applications and conditions indicated.

<u>Installations of Sealant Backings</u>: Install sealant backings to comply with the following requirements:

<u>Install joint-fillers</u> to provide support of sealants during application and at position required to produce the cross-sectional shapes and depths of installed sealants relative to joint widths which allow optimum sealant movement capability.

Do not leave gaps between ends of joint-fillers.

Do not stretch, twist, puncture or tear joint-fillers.

Remove absorbent joint-fillers which have become wet prior to sealant application and replace with dry material.

<u>Install bond breaker tape</u> between sealants and joint-fillers, compression seals or back of joints where required to prevent third-side adhesion of sealant to back of joint.

Install compressible seals serving as sealant backings to comply with requirements indicated above for joint fillers.

<u>Installation of Sealants</u>: Install sealants by proven techniques that result in sealants directly contacting and fully wetting joint substrates, completely filling recesses provided for each joint substrates, completely filling recesses provided for each joint configuration and providing uniform, cross-sectional shapes and depths relative to joint widths which allow optimum sealant movement capability.

<u>Tooling of Nonsag Sealants</u>: Immediately after sealant application and prior to time skinning or curing begins, tool sealants to form smooth, uniform beads of a <u>concave joint configuration</u> per Figure 6A in ASTM C 962, to eliminate air pockets and to ensure contact and adhesion of sealant with sides of joint. Remove excess sealants from surfaces adjacent to joint. Do not use tooling agents which discolor sealants or adjacent surfaces or are not approved by sealant manufacturer.

PROTECTION AND CLEANING:

<u>Protect joint sealers</u> during and after curing period from contact with contaminating substances or from damage resulting from construction operations or other causes so that they 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 sealers immediately and reseal joints with new materials to produce joint sealer installations with repaired areas indistinguishable from original work.

<u>Clean off excess sealants</u> or sealant smears adjacent to joints as work progresses by methods and with cleaning materials approved by manufacturers of joint sealers and of products in which joints occur.

END OF SECTION 07 90 00

SECTION 08 10 00 - HOLLOW METAL FRAMES

PART 1 - GENERAL

DESCRIPTION OF WORK:

All door and window frames scheduled, or otherwise detailed as hollow metal shall be standard steel frames as furnished by an established manufacturer who regularly engages in the fabrication of such metal components. All metal frames shall be of the types and sizes shown on the drawings and in the door schedule and shall include all standard accessory items. The work includes label frames, see schedule.

SUBMITTALS:

In accordance with Section 01 33 00, Submittals, provide shop drawings, product data, warranty, certifications and tests. Exterior frames shall be certified along with the doors confirming compliance with the Florida Building Code Product Approval. Submit copy of product approval.

PART 2 - PRODUCTS

MATERIALS:

Frames shall be made of commercial grade cold-rolled steel conforming to ASTM designation A-366.

Frame Gauge: Oversize frames shall be formed from 12 gauge steel sheet, all other frames shall be formed from No. 14 gauge steel sheet.

All frames not scheduled to receive weatherstripping shall be equipped with rubber bumpers or silencers on the strike jamb of single doors (minimum 3/jamb) and on the head member of double doors (one/door leaf).

CONSTRUCTION:

<u>Size</u>: All metal door and window frames shall be accurately fabricated to the sizes and shapes shown on the drawings. Frames shall be custom-made units to match the new doors or to fit existing openings where noted.

<u>Shape</u>: Frames shall typically have double rabbeted and cased opening profiles, depth as shown on the drawings, with 2" faces and 1/2" returns typical.

Minimum depths of stops shall be 5/8" or as required for U.L. labeled doors and standard width for all stops shall be in accordance with detail drawings.

<u>Joints</u>: All frames shall be welded unit type with head and jamb members mitered, continuously welded and ground smooth. Door frames shall be provided with steel bottom spreader.

All finished work shall be strong and rigid, neat in appearance, square, true, and free of defects, warp, or buckle. Members shall be clean cut, straight, and of uniform profile throughout their lengths.

HARDWARE PROVISIONS:

Frames shall be prepared at the factory for the installation of hardware. Frames shall be mortised, reinforced, drilled and tapped to templates for all mortised hardware.

Frames shall be mortised for template type hinges conforming to CS 9-65, see hardware schedule.

Minimum thickness of hardware reinforcement plates shall be as follows:

Hinge and pivot reinforcements: No. 7 gauge Strike, flush bolt, closer and other surface mounted hardware: No. 12 gauge Dust covers, at all hardware cutouts: No. 24 gauge

ANCHORS:

<u>Wall Anchors</u>: Metal anchors of shapes and sizes required for the adjoining type of wall construction shall be provided as required.

Fabricate jamb anchors of steel, not lighter than the gauge used for frame.

Locate anchors on jambs near the top and bottom of each frame and at intermediate points not over 24" apart.

Provide for securing anchors to wood studs with 1/4" round head machine or wood screws.

<u>Floor Anchors</u>: Floor anchors shall be welded inside each jamb, with holes provided for floor anchorage. Minimum thickness shall be No. 14 gauge.

STOPS AND BEADS:

Metal glazing beads shall be furnished with the hollow metal frames at window openings and other locations where beads are indicated in hollow metal frames.

Drill and tap frames to receive the type of glazing beads, stops and gaskets required.

FINISHES:

After fabrication, before priming, all tool marks and surface imperfections shall be removed, and exposed faces of all welded joints shall be dressed smooth.

All frames shall be galvanized, A60 rating, and shall then be chemically treated to insure maximum paint adhesion and shall be coated on all accessible surfaces with a rust-inhibitive primer. Insides of all frames to be grouted shall also be factory coated with a bituminous water resistant paint.

All frames shall be cleaned, bonderized and shop primed to receive finish painting (Section 09 91 00).

PART 3 - EXECUTION

Frames shall be securely installed according to publication #105 by Steel Door Institute.

Frames shall be carefully plumbed and aligned. Brace frames until permanent anchors are set. Anchor base of frames to floor with non-corrosive expansion bolts or with power fasteners. Grout solid all frames in masonry or concrete walls.

END OF SECTION 08 10 00

SECTION 08 11 00 - HOLLOW METAL DOORS

PART 1 - GENERAL

DESCRIPTION OF WORK:

All doors scheduled, or otherwise designated, as hollow metal steel shall be of standard full flush construction as manufactured by an established firm regularly engaged in the fabrication of such door types. Hollow metal doors shall be furnished complete with all accessory components and related specialty items as specified or noted in the drawings.

Door types, frames and details are scheduled in the drawings.

SUBMITTALS:

In accordance with Section 01 33 00, Submittals, provide shop drawings, product data, warranty and certifications; and, test data indicating compliance with the Building Code impact resistance requirements for the exterior doors.

TESTING AND PERFORMANCE REQUIREMENTS FOR EXTERIOR INSTALLATION:

Test Units: All tests, unless otherwise noted, shall conform to the impact, static, cyclic, air and water tests as set forth by the Florida Building Code, and SBCCI SSTD 12-97; latest editions.

PART 2 - PRODUCTS

MANUFACTURERS:

For exterior door installations, the H.M. door manufacturer shall be one selected and tested using the hardware specified in the Door - Window Schedule Legend.

MATERIALS:

Doors shall be made of commercial quality, level, rolled steel conforming to ASTM Designation A-366 and free of scale, pitting, or other surface defects.

Face Sheets: Face sheets for all doors shall be minimum of No. 16 gauge rolled steel sheet.

All structural components shall be manufactured of steel, utilizing maximum-strength welding design and techniques throughout.

DOOR CONSTRUCTION:

<u>Door Faces</u>: Shall be rigid, and neat in appearance, free from warpage, or buckle. Corner bends shall be true and straight and of minimum radius for the gauge of metal used.

Face sheets, as well as lock and hinge edges, shall have a smooth, seamless and unbroken surface.

Face panels shall be laminated to core materials and welded to perimeter channel edge at 5" o.c. to assure maximum strength and rigidity.

<u>Edges</u>: Lock and hinge edges shall be formed by full overlap of each face sheet around the perimeter vertical channels of a unitized grid structure, meeting at the centerline of each edge and continuously welded, filled and ground smooth. Top and bottom edges shall be closed flush to the door face sheets.

The resulting seam shall be closed by a continuous bead arc weld, and ground smooth.

Top, bottom, and lock channels: 16 g. steel, minimum.

<u>Core Materials</u>: All hollow metal doors shall be completely filled with a rigid urethane core foamed in place and chemically bonded to all internal door surfaces.

Door face sheets shall be uniformly supported by the rigid core material thereby providing increased sound retardation and thermal barrier properties.

Sizes: Door types and sizes shall be as defined in the drawings and/or scheduled.

Unless noted otherwise, all doors shall be 1 3/4" thick.

HARDWARE PROVISIONS:

Doors shall be mortised, reinforced, drilled and tapped at the factory for field applied, fully templated hardware only, in accordance with the approved hardware schedule and templates provided by the hardware contractor.

Where surface mounted hardware is to be applied, doors shall have reinforcing plates only; all drilling and tapping shall be done in the field.

Mortising: Doors shall be mortised for 4 1/2" x 4 1/2" template type hinges, unless specified otherwise in the hardware schedule, conforming to CS9-65.

Active doors shall be prepared for mortise and cylindrical locksets with 2 3/4" backsets and ANSI A115.2 lock front.

Hardware Reinforcement:

Hinge Reinforcement: 8 gauge minimum, tapped and drilled by manufacturer. Closer Reinforcement: 12 gauge minimum. Lock Reinforcement: 14 gauge minimum.

FINISHES:

Pre-clean and shop prime each door for finish painting which will be performed at the job site under Section 09 91 00 of these specifications.

After fabrication, all tool marks and surface imperfections shall be dressed as required to make all faces and vertical edges smooth, level, and free of all irregularities.

All exterior and specially designated doors shall be galvanized with a zinc coating G90 per ASTM A525 and shall then be chemically treated to insure maximum paint adhesion and shall be coated, on all exposed surfaces, with a primer which is fully-cured before shipment.

All doors shall be bonderized and finished as standard with one prime coat of baked-on rust inhibitive paint capable of passing humidity resistance of 500 hours minimum, according to ASTM D714 and a salt spray resistance of 250 hours minimum according to ASTM B117.

FEATURES:

<u>Glazing</u>: Where specified or scheduled, doors shall be provided with moldings in accordance with glass opening sizes shown or scheduled on the drawings.

Doors with glass lights shall have manufacturer's standard glass molding, not less than 20 gauge with no exposed screws.

Louvers:

Type: Suitable for interior and exterior applications as required. Exterior shall be G90 galvanized.

Size: Dimensions according to door schedule and drawings.

Screen: Galvanized steel insect screens 16 x 14 fibers/in. mesh with frames for all exterior louvers.

Construction: 18 gauge steel frame and blades of inverted "Y" design.

Finish: Standard prime gray finish.

Frame: Self-clamping and not screwed to door skin.

Free area: Louvers shall have 30% free air space.

<u>Labeled Doors</u>: Where required, doors with fire-rating classification shall be provided with a label attached thereto.

All doors and frames for labeled openings shall be of the construction and design as furnished by the door manufacturer having specific UL approval according to current procedures for the specified fire rating.

PART 3 - EXECUTION

Install all metal doors throughout the building in strict accordance with all pertinent codes, regulations, recommendations of Steel Door Institute (SDI), the approved shop drawings, and the manufacturer's recommendations, anchoring all components firmly in position for long life under hard use.

END OF SECTION 08 11 00

SECTION 08 20 00 - WOOD DOORS

PART 1 -GENERAL

SECTION INCLUDES:

Wood doors and transom panels; flush and flush glazed configuration; fire-rated and non-rated as applicable

REFERENCES:

ASTM E152 — Methods of Fire Tests of Door Assemblies.

AWI — Architectural Woodwork Institute Quality Standards.

NFPA 80 — National Fire Protection Association Pamphlet 80 Fire Doors and Windows.

NFPA 252 — National Fire Protection Association Standard Method of Fire Tests for Door Assemblies.

UL 10B — Underwriters Laboratories Fire Tests of Door Assemblies.

DOOR AND PANEL DESCRIPTION:

Flush Interior Doors (Non-rated)

Flush Interior Doors (Fire-Rated)

SUBMITTALS:

Submit under provisions of Section 01 33 00.

Shop Drawings: Illustrate door opening criteria, elevations, sizes, types, swings, undercuts required, special beveling, special blocking for hardware, identify cutouts for glazing, louvers, etc.

Product Data: Indicate door core materials and construction; veneer species, type and characteristics; factory machining criteria and factory finishing criteria.

Samples: Submit samples of door veneer, 6 X 6 inch in size illustrating wood grain, stain color and sheen.

REGULATORY REQUIREMENTS:

Fire-Rated Door and Panel Construction: Shall conform to required codes, including ASTM E152, NFPA 252, UL 10B, WHI as applicable.

Installed Door and Panel Assembly: Shall conform to NFPA 80 for fire-rated class as scheduled.

DELIVERY, STORAGE AND HANDLING:

Accept doors at job site in manufacturer's standard packaging. Inspect for damage.

Do not store in damp or wet areas. Cover stored doors with opaque covering material where sunlight might bleach veneer. Seal top and bottom edges if stored more than one week.

Break seal at job site to permit ventilation.

WARRANTY:

Provide manufacturer's warranty including replacement, refinishing and rehanging for the "Life of Original Installation" (unlimited lifetime).

Include coverage for delamination of veneer, warping beyond specified installation tolerances, defective materials, and telegraphing core construction.

PART 2 - PRODUCTS

AWI QUALITY STANDARDS:

AWI Quality Standards, Section 1300; core and facing qualities as specified below.

Supply all doors from same manufacturer.

DOOR CORE CONSTRUCTION:

<u>Core (Solid, Non-Rated)</u>: AWI Section 1300: Glued Block SLC-7; staved wood, kiln dried softwood, one species per core.

<u>Core (Solid, Fire-Rated)</u>: AWI Section 1300: Doors rated 45 minutes or higher shall be 5 ply with mineral core and treated rails for 60 minute or greater rating.

Stiles and Rails: Hardwood treated for rated doors.

DOOR FACING

<u>Veneer (Flush Interior Doors):</u> AWI Type, Premium quality, 1/32 to 1/41 inch (0.8 to 0.62 mm) thick mechanically spliced Birch species wood, rotary cut with pair matched grain, and end matched transoms, as applicable for transparent finish.

Exposed Vertical Edges: Hardwood for transparent finish.

ADHESIVES:

Facing Adhesive: Type I — waterproof

ACCESSORIES:

Vision Frames in Rated Doors: Wood veneer wrapped metal, of same species as facing.

<u>Vision Frames in Non-Rated Doors:</u> Wood of same species as door facing; shape; mitered corners; prepared for countersink style tamper proof screws.

FABRICATION:

Fabricate fire-rated and non-rated doors in accordance with specified manufacturers' and UL requirements.

Meeting Edges for Fire-Rated Double Doors: Steel, T shaped astragal, wood veneer wrapped of same species as facing, overlapping and recessed at face edge, specifically for double doors.

Provide non-rated flush doors with stiles of wood species to match face veneer.

Bond stiles and rails to cores. Sand for uniform thickness.

Factory sand assembled door leaf.

Factory machine doors for finish hardware in accordance with hardware requirements and dimensions. Do not machine for surface hardware.

Factory cut lite and louver openings.

Factory fit doors for frame opening dimensions identified on shop drawings.

Cut and configure exterior door edge to receive recessed weather stripping devices as applicable, see Hardware Schedule.

Provide inner blocks at lock edge and top of door for closer for hardware reinforcement as recommended by door manufacturer.

FINISH:

Factory finish doors in accordance with AWI Quality Standards Section 1500, catalyzed conversion varnish; stain color and sheen as selected by the Architect. Wrap and protect door during shipment and on site storage prior to installation.

PART 3 - EXECUTION

EXAMINATION:

Verify that opening sizes and tolerances are acceptable. Do not install doors in frame openings that are not plumb or are out of tolerance for size or alignment.

INSTALLATION:

Install fire-rated and non-rated doors in accordance with AWI Quality Standard, NFPA 80 and to UL requirements. Trim non-rated door width by cutting equally on both jamb edges.

Trim door height by cutting bottom edges to a maximum of 3/4 inch (19 mm). Trim fire-rated door height at bottom edge only, in accordance with fire-rating requirements.

Pilot drill screw and bolt holes using templates provided. Machine cut for hinges and closers. Core for handsets and cylinders.

Coordinate installation of doors with installation of frames and hardware identified in the Door -Window Schedule, Section 08999. Coordinate installation of glass and glazing specified in Section 08 80 00 and Schedule, Section 08 99 99.

ADJUSTING:

Adjust door for smooth and balanced door movement.

END OF SECTION 08 20 00

SECTION 08 21 00 - HARDBOARD FACED DOORS

PART 1 - GENERAL

DESCRIPTION OF WORK:

Provide hardboard doors for interior locations and as designated for openings in the door schedule.

SUBMITTALS:

In accordance with Section 01 33 00, Submittals, provide product data, schedule, guarantee and sample of each door type specified.

PART 2 - PRODUCTS

TYPE:

Hollow and solid core doors with paint grade hardboard faces on both sides.

ACCEPTABLE MANUFACTURERS:

Mohawk Flush Doors, Inc. (717) 473-3557 is the basis of design. Equal products by other manufacturers will be considered prior to bidding per section 01 60 00.

MATERIALS:

Size: Per door schedule

Face: Type 1, 1/8" hardboard

Solid Core Door Core: 28 to 30 lb. density, particle board conforming to ANSI A208.1, grade 1 or mineral core for '45 minute' or greater labeled fire doors.

Solid Core Door Edges: 1 3/8" rails and stiles bonded to particle board core. Larger for '45 minute' or greater labeled doors.

Adhesive: Type 11, water resistant

Guarantee: 5 year

Hardware: See Specification Section 08 71 00.

PART 3 - EXECUTION

<u>Fitting</u>: All wood doors shall be installed in accordance with requirements of the NWMA "Standard Door Guarantee," in locations in accordance with the drawings.

Doors shall be carefully plumbed and aligned within the frame.

The utility, structural strength, or appearance of the door must not be impaired in the fitting of the door, the application of the hardware, or the cutting and altering the door for lights, louvers, panels or other special details.

<u>Hanging</u>: Doors shall be fitted, hung plumb and true to within the allowable warpage tolerances of NWMA.

<u>Clearances</u>: Provide clearances of 1/8" at sides and top; lock edges shall have required bevel to clear frame. Provide the minimum adequate clearance between the bottom of the door and the finish floor covering and/or thresholds.

Trim: Trim equal amounts of wood off each stile and rail when fitting doors.

Sanding: Slightly round all door edges with fine sandpaper to eliminate sharp corners.

Finish: Primed, field painted per section 09 91 00, in color as selected by Architect

END OF SECTION 08 21 00

SECTION 08 31 00 - ACCESS DOORS

<u>PART 1 - GENERAL</u>

DESCRIPTION OF WORK:

Provide access doors as generally required in wall and hard ceiling surfaces to gain access to HVAC, plumbing and electrical valves, shutoffs, or other devices. Generally, except where specifically noted, the need for an access panel is referenced by inference by a related trade. The Contractor shall coordinate the work between trades to be able to provide the quantity of access panels of a size and in a location as needed by the work at no additional costs to the Owner. All access panel types, sizes and locations shall be submitted by the Contractor prior to installation and approved by the Architect.

SUBMITTALS:

In accordance with Specification Section 01 33 00, Submittals, provide product data on materials to be used and shop drawings which indicate size, type and location of each access door.

Where access doors are to be provided into rated walls or ceilings, provide certification of the required rating.

PART 2 - PRODUCTS

ACCEPTABLE MANUFACTURERS:

Products of the following manufacturers meeting these specifications will be considered.

- J. L. Industries, Bloomington, MN
- Milcov Inc., Lima, Ohio
- Nystrom Inc., Minneapolis, MN
- Williams Bros. Corp., Sandberg Co., Inc., E. Moline, III.

MASONRY & WALLBOARD INSTALLATION:

Materials: Interior installation Door: 14 ga. steel Frame: 16 ga. steel w/min. 1" flange Finish: Primed for paint Hinge: Concealed, opens to 150-180 degrees Lock: Flush screwdriver operated steel cam. Size: As required and approved

PART 3 - EXECUTION

PREPARATION:

Prepare opening for size of unit required. Cut square to adjacent surfaces. Provide adequate concealed bracing to install unit.

INSTALLATION:

Install unit in accordance with manufacturer's recommendations.

Paint when specified to match adjacent surfaces in accordance with Section 09 91 00, Painting. END OF SECTION 08 31 00

SECTION 08 40 91 - ALUMINUM ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

DESCRIPTION OF WORK:

Extent of aluminum entrances and storefronts is indicated on drawings and schedules.

Types of aluminum entrances and storefronts required include the following:

Exterior entrance doors Frames for exterior entrances Storefront type framing system for exterior windows

SYSTEM PERFORMANCES:

Thermal Movement: Allow for expansion and contraction resulting from ambient temperature range of 120 deg. F. (49 deg. C.).

Wind Loading: Provide capacity to withstand loading, meeting the latest edition of the Florida Building Code. Refer to structural drawings for psf valves.

Transmission Characteristics of Fixed Framing: Comply with requirements indicated below for transmission characteristics and test methods.

- Air and Water Leakages: Air infiltration of not more than 0.06 CFM per sq. ft. of fixed area per ASTM E 283 and no uncontrolled water penetration per ASTM E 331 at pressure differential of 6.24 psf (excluding operable door edges).

Transmission Characteristics of Entrances: Provide entrance doors with jamb and head frames which comply with requirements indicated below for transmission characteristics and test methods.

- Air Leakage: Air filtration per linear foot of perimeter crack of not more than 0.50 CFM for single doors and 1.0 CFM for pairs of doors per ASTM E 283 at pressure differential of 1.567 psf.

QUALITY ASSURANCE:

Drawings: Plans, elevations and details show spacings of members as well as profile and similar dimensional requirements of aluminum entrances and storefront work. Minor deviations will be accepted in order to utilize manufacturer's standard products when, in Architect's sole judgments, such deviations do not materially detract from design concept of intended performances.

TESTING AND PERFORMANCE REQUIREMENTS:

<u>Test Units:</u> All tests, unless otherwise noted, shall conform to the impact, static, cyclic, air and water tests as set forth by the Florida Building Code and, SBCCI SSTD 12-97, latest edition.

SUBMITTALS:

Provide submittals in accordance with Section 01 33 00 and include shop drawings, product data, samples, Florida Product Approval and test data indicating compliance with the Florida Building Code requirements for exterior entrances and storefront system.

SPECIAL PROJECT WARRANTY:

Provide written warranty signed by Manufacturer, Installer, and Contractor, agreeing to service or replace aluminum entrances and storefront which fail in materials or workmanship within time period as indicated below. Failure of materials or workmanship includes excessive leakage or air infiltration, excessive deflections, faulty operation of entrances, deterioration of finish or construction in excess of normal weathering, and defects in hardware, weatherstripping, and other components of the work. Service visits are included in this scope and are not to be considered billable to owner within warranty period.

- Time Period: 3 years from date of substantial completion.

PART 2 - PRODUCTS

ACCEPTABLE MANUFACTURERS:

Manufacturer: Subject to compliance with requirements, provide products of one of the following:

Kawneer Company, Inc.* Vistawall Architectural Products YKK Architectural Products

*Drawings are based on Kawneer's "IR 500" stile aluminum entrance and storefront system. Another equivalent standard system will be considered when differences do not materially detract from design concept or intended performances, as judged solely by the Architect.

MATERIALS AND ACCESSORIES:

Aluminum Members: Alloy and temper recommended by manufacturer for strength, corrosion resistance, and application of required finish; ASTM B 221 for extrusions, ASTM B 209 for sheet/plate.

Fasteners: Aluminum, non-magnetic stainless steel, or other materials warranted by manufacturer to be noncorrosive and compatible with aluminum components.

- Do not use exposed fasteners except where unavoidable for application of hardware. Match finish of adjoining metal and provide Phillips flat-head machine screws for any unavoidable exposed fasteners.

Concealed Flashing: Dead-soft stainless steel, 26 gage minimum, or extruded aluminum, 0.062" minimum, of an alloy and type selected by manufacturer for compatibility with ASTM A 386.

Concrete/Masonry Inserts: Cast-iron, malleable iron, or hot-dip galvanized steel complying with ASTM A 386.

Bituminous Coatings: Cold-applied asphalt mastic complying with SSPC-PS 12, compounded for 30-mil thickness per coat.

Compression Weatherstripping: Manufacturer's standard replaceable stripping of either molded neoprene gaskets complying with ASTM D 2000 or molded PVC gaskets complying with ASTM D 2287.

Sliding Weatherstripping: Manufacturer's standard replaceable stripping of wool, polypropylene, or nylon woven pile, with nylon fabric or aluminum strip backing, complying with AAMA 701.2.

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DOOR HARDWARE:

General: Refer to hardware section of Division 8 for requirements for hardware items other than those indicated herein to be provided by manufacturer of aluminum entrances.

Provide door manufacturer's standard heavy-duty hardware units as indicated, scheduled or required for operation of each door, including the following items of sizes, number, and type as recommended by door manufacturer for service required, finished to match door, unless otherwise indicated. Coordinate hardware types where auto open hardware specified for use.

- Hinges: Assemblies complying with ANSI A156.4, Grade 1 requirements; compatible with aluminum frame. Size and quantity as required for door size and weight. NRP.

- Overhead Closers: Units complying with ANSI A 156.4, of the following type, grade, functions and features. Surface mounted, parallel arm, separate different materials. Selective hold open equal to LCN super smooth.

- Panic Hardware: Provide concealed-rod type panic unit exit devices actuated by full-width crash bar; comply with UL 305 equal to Jackson 2086.

- Break Away Feature: Contractor responsible to verify doors provide required break away feature and break away egress width required for each installation.

- Automatic Door Operator: Equal to NABCO Entrances Inc. (877) 622-2694, for single or double door entrances. GT System 710 for automatic and manual operation. Locate H.C. accessible push buttons on interior and exterior where shown. If locations are not show, ask for clarifications before bid. All exterior public entrance doors shall include auto open feature. Coordinate operation with exit device concealed up and bottom latch bolts; and, other hardware as necessary. Provide motion detector and hold open feature coordinated to provide ample time for safe entry.

- Thresholds: Extruded aluminum in mill finish, complete with anchors and clips, coordinated with pivots and floor-concealed closers, of size indicated or manufacturer's standard, if not indicated.

- Latch (Lockset): Adams Rite 4510, dead latch, lever #4560, on exterior in combination with panic devices, one for each door leaf.

- Keyed Cylinder: Provide housing to receive lock cylinder specified elsewhere. For door pairs provide cylinder in right-hand-reverse leaf.

- Weatherstripping: Provide for all aluminum door installations. With door pairs, provide weatherstripping closure at meeting stiles.

GLASS:

Provide SAF-GLAS 9/16" impact resistant glass by Security Impact Glass or equal.

FABRICATION:

Prefabrication: To greatest extent possible, complete fabrication, assembly, finishing, hardware application, and other work before shipment to project site.

Welding: Comply with AWS recommendations to avoid discoloration; grind exposed welds smooth and restore mechanical finish.

Reinforcing: Install reinforcing as necessary for performance requirements; separate dissimilar metals with bituminous paint or other separator which will prevent corrosion.

Fasteners: Conceal fasteners wherever possible.

Weatherstripping: For exterior doors, provide compression weatherstripping against fixed stops; at other edges, provide sliding weatherstripping retained in adjustable strip mortised into door edge. Provide EPDM/vinyl blade gasket weatherstripping in bottom door rail, adjustable for contact with threshold.

Provide finger guards of collapsible neoprene or PVC gasketing securely anchored into frame at hinge-jamb of center-pivoted doors.

STOREFRONT FRAMING SYSTEM:

General: Provide inside-outside matched resilient flush-glazed system with provisions for glass replacement. Shop-fabricate and preassemble frame components where possible. System is detailed around Kawneer IR-500, 2 1/2" x 5" framing typically.

STILE-AND-RAIL TYPE ALUMINUM DOORS:

Frame: Provide tubular frame members, fabricated with mechanical joints using heavy inserted reinforcing plates and concealed tie-rods or j-bolts, or fabricate with structurally welded joints, at manufacturer's option.

Design: Provide doors 1-3/4" thick (5" nominal stile width).

Glazing: Fabricate doors to facilitate replacement of glass or panels, without disassembly of door stiles and rails. Provide snap-on extruded aluminum glazing stops, with exterior stops anchored for non-removal.

ALUMINUM DOOR FRAMES:

Fabricate tubular and channel frame assemblies, as indicated, with either welded or mechanical joints in accordance with manufacturer's standards, reinforced as necessary to support required loads.

FINISHES:

Anodized Aluminum Finishes:

Class I Anodized Finish: AA-M12C22A41 (#14 clear)

Non-specular as fabricated mechanical finish; chemical etch, medium matte; 0.7 mil min. thick integrally or electrolytically deposited anodic coating.

PART 3 - EXECUTION

PREPARATION:

Take field measurements prior to preparation of shop drawings and fabrication, to ensure proper fitting of work.

INSTALLATION:

Comply with manufacturer's instructions and recommendations for installation of aluminum entrances and storefronts.

Set units plumb, level, and true to line, without warp or rack of framing members, doors, or panels. Anchor securely in place, separating aluminum and other corrodible metal surfaces from sources of corrosion of electrolytic action at points of contact with other materials.

Set sill members and other members in bed of sealant as indicated, or with joint fillers or gaskets as indicated to provide weathertight construction. Aluminum sills to be continuously soldered and sealed. Comply with requirements of Division 7 for sealants, fillers, and gaskets.

ADJUST AND CLEAN:

Adjust operating hardware to function properly, without binding, and to prevent tight fit at contact points and weatherstripping.

Clean complete system, inside and out, promptly after erection and installation of glass and sealants. Remove excess glazing and joint sealants, dirt, and other substances from aluminum surfaces.

END OF SECTION 08 40 91

SECTION 08 52 10 - ALUMINUM WINDOWS

PART 1 - GENERAL

DESCRIPTION OF WORK:

Standards: Comply with applicable requirements for aluminum windows, terminology and standards of performance, and fabrication workmanship specified in applicable sections of ANSI/AAMA GS-001.

SUBMITTALS:

In accordance with Section 01 33 00, Submittals, provide certified test reports, shop drawings, product data including half-size details of each typical section, showing glazing details. Submit specific information on operating parts, hardware, weatherstripping, finishes for aluminum and preglazed construction. Test data to verify requirements for wind loading consistent with the Florida Building Code 2010. A Florida Product Approval Number and supporting data which confirms compliance with Test Standards shall be provided. All windows shall bear a current label to confirm compliance.

QUALITY CONTROL:

All operable window sections shall comply with the performance requirements of AAMA/ANSI and shall bear the AAMA certification label.

WARRANTY:

Submit written warranty signed by Manufacturer, Installer and Contractor, agreeing to repair or replace aluminum window units which fail in materials or workmanship within 3 years of date of acceptance. Failure of materials or workmanship shall include (but not be limited to) excessive leakage or air infiltration, excessive deflections, faulty operation of sash, deterioration of finish or metal in excess of normal weathering (local climate), and defects in hardware, weatherstripping, and other components of work beyond normal wear and tear. Methods to determine extensive failure of all or portions of units shall be via visual inspections by experienced personnel or testing by a recognized testing agency.

MANUFACTURERS:

Subject to compliance with the requirements, products by the following manufacturer (<u>www.cgiwindows.com</u>) are those which the drawings and design are based upon. Equivalent products by other manufacturers will be considered prior to bid and per Section 01 60 00.

CGI Windows – Series 238 Project Out Windows (AAMA HC-110 rating)

DESIGN REQUIREMENTS:

Design Requirements: Comply with air infiltration, water penetration and structural performance requirements indicated in AAMA for the type, grade and performance class of window units required.

The "Performance Class Number" included as a part of the window designation system is the actual design pressure in pounds per sq. ft. used to determine the structural test pressure and the water test pressure.

Where the required design pressure exceeds the minimum for the specified window grade, comply with requirements of AAMA, "Optional Performance Classes" for higher than minimum performance class.

Design wind velocity at the project site shall be as identified on structural.

Sizes and Profiles: Required sizes for window units and profile requirements are indicated on the drawings.

PART 2 - MATERIALS:

Windows shall be constructed using, 6063-T6 extruded aluminum frame and vent members, 6063-T5 extruded aluminum glazing beads. Minimum wall thickness to be as follows: .080" at frame /.090" at vent / .045" at glazing bead. Vent depth shall be 1 ³/₄" minimum.

All frame and vent member fasteners shall be stainless steel and #10 or larger.

Provide (8) .062" thick stainless steel corner keys per window. Provide (4) .062" thick aluminum corner keys per window.

Glass thickness shall meet FBC requirements for wind loads and energy efficiency. Values for thermal resistance (U) shall be <.45 and solar heat gain coefficient (SHGC) shall be <.24.

Provide 100% silicone sealants for frame construction.

HARDWARE:

- (2) Anderbert S/S four bar concealed hinge (no exposed hinges).
- Truth Roto Type Metal Operator (finish to match window) and S/S track. Projection shall be 8 ½".
- Truth Metal Cam Locks (finish to match windows) and S/S keepers.
- Custodial type locks.

ACCESSORIES:

Aluminum extruded frame screen (held in place without visible retaining clips) and charcoal fiberglass mesh.

Sealant for exterior shall be Sonaborn NP-1 or approved equal.

Caulking for interiors shall be a latex base low odor product.

ALUMINUM FINISH:

Kynar 500 paint in color: Selected by Architect from manufacturer's standard range, including clear aluminum.

INSTALLATION:

Windows shall be installed individually or as a combination in the same rough opening. Include vertical aluminum meeting mullion per opening, anchored as specified per manufacturer, for combination units.

Windows shall be installed square, plumb, level and secured in a professional manner to assume neat, strong, weathertight construction in accordance with ANSI/ASTM specification E-737 and in compliance with manufacturer's recommendations when more stringent.

Also comply with approved installation per Product Approval procedure/requirements . However, any variations must be approved by the Architect.

Anchor window units securely in place, with permanent separations to prevent electrolytic corrosion. Properly seal the entire perimeter of each unit.

Installation shall follow shop drawings relative to engineer certified fastener type, spacing and etc. to insure compliance with test certifications/approvals by the FBC Product Approval.

Check window opening for correct size.

Assure wood bucks are of the correct size and type set on a smooth flat surface, properly bed in sealant and securely attached to structure. Wood bucks should not be separated at corners. Verify that wood bucks are plumb, level and square.

Label which vent belongs to which frame (they are not interchangeable). Also, mark the bottom edge of the vent to prevent from installing upside down.

Clean window flange and apply a generous amount of sealant to flange at full perimeter. Assure sealant is compatible and will adhere to aluminum and wood.

Slightly open operable window and install window frame from outside onto wood bucks. It may be necessary to disengage the operator arm or limit opening device to access all the screws on the frame.

Temporarily secure window frame using installation screws as selected from the Product Approvals for your specific application. Shim every installation screw snugly (shim space should not exceed ¼"). Make sure operable windows operate correctly. Make sure that when closing an operable vent, window is not racked and closing unevenly. Make sure window is plumb, level and square. Tighten down all installation screws and verify that window still opens and closes correctly.

Caution: Any window frame, which is forced into an opening and racked or twisted, can cause glass breakage once the glazed vent is forced to adjust to the racked frame.

Assure mullion tubes are properly attached to structure at each end with the supplied clips.

Check window for leakage at corner frame joints. It may be necessary to reseal frame corners after installing. The factory applied sealant may get damaged during transport of the window due to racking.

Properly seal exterior perimeter of window and caulk interior perimeter of window to the adjacent opening face.

Check window for proper operation. Adjust keepers as required for proper locking. Lubricate moving hardware using silicone based lubricant.

Clean aluminum surfaces promptly after installation; do not damage protective coating. Repair minor damage to the finish. Clean glass promptly after installation.

END OF SECTION 08 52 10

SECTION 08 71 00 - FINISH HARDWARE

<u> PART 1 - GENERAL</u>

DESCRIPTION OF WORK:

Types of finish hardware required is indicated by manufacturer, in schedules under on the construction drawings.

Types of finish hardware required include the following:

Hinges; Pivots; Lock cylinders and keys; Lock and latch sets; Bolts; Exit devices; Push/pull units; Closers; Miscellaneous door control devices; Door trim units; Protection plates; Weatherstripping for exterior doors; Sound stripping for interior doors; and Thresholds.

Additionally, various electronic hardware shall be provided at select doors where noted on the schedule.

Hardware for aluminum, special entrance or other doors are specified elsewhere in Division 8.

QUALITY ASSURANCE:

<u>Manufacturer:</u> Obtain each type of hardware (latch and lock sets, hinges, closers, etc.) from a single manufacturer, although several may be indicated as offering products complying with requirements.

<u>Wind Rating for Exterior Doors:</u> In accordance with current Florida Building Codes, exterior door, frame and hardware are to be tested for wind resistance. Only those materials meeting the requirements of the test and codes shall be provided for exterior openings for this work. Proof shall be provided in the form of test results signed by a Licensed Florida Engineer.

Specific hardware types are typically noted in the Door-Window Schedule shown on the drawings or the Specifications. <u>Alternative hardware types or manufacturers providing products equal to or exceeding the specified quality will be considered only during the bid period and information sent for review to Architect ten (10) days prior to the bid date.</u>

<u>Fire-Rated Openings:</u> Provide hardware for fire-rated openings in compliance with <u>NFPA</u> <u>Standard No. 80</u> and governing building code requirements. Provide only hardware which has been tested and listed by UL or FM for types and sizes of doors required and complies with requirements of door and door frame labels.

Where emergency exit devices are required on fire-rated doors (with supplementary marking on doors, UL or FM labels indicating "Fire Door to be Equipped with Fire Exit Hardware") provide UL or FM label on exit devices indicating "Fire Exit Hardware".

Typically where fire-rated assemblies are noted, the contractor shall provide all necessary additional hardware and seals whether scheduled or not, to meet NFPA No. 80. In addition, it is the responsibility of the hardware supplier to furnish the proper hardware that is required for all openings, whether or not herein detailed. The hardware supplier shall supply all necessary accessories as drop plates, proper length strikes, and correct size protective plates to meet the requirements for proper operation and function of the hardware.

Where required, the contractor shall provide hardware meeting ANSI A117.1, Specifications for Making Buildings and Facilities Accessible to and Usable by Physically Handicapped People.

Products Requiring Electrical Connection: Listed and classified by Underwriter's Laboratories Inc. (UL) as suitable for the purpose specified and indicated.

SUBMITTALS:

In accordance with Section 01 33 00, Submittal, provide product data and hardware schedule. Include:

Type, style, function, size, and finish of each hardware item.

Name and manufacturer of each item.

Fastenings and other pertinent information.

Location of hardware set cross-referenced to indications on drawings both on floor plans and in door and frame schedule.

Explanation of all abbreviations, symbols, codes, etc. contained in schedule.

Mounting locations for hardware.

Door and frame sizes and materials.

Keying information.

<u>Keying Schedule:</u> Submit separate detailed schedule indicating clearly how the Owner's final instructions on keying of locks has been fulfilled.

<u>Samples:</u> Prior to submittal of the final hardware schedule and prior to final ordering of finish hardware, submit one sample of each type of exposed hardware unit, finished as required, and tagged with full description for coordination with schedule. Samples will be returned to the supplier.

<u>Templates:</u> Furnish hardware templates to each fabricator of doors, frames and other work to be factory-prepared for the installation of hardware. Check shop drawings of such other work, to confirm that adequate provisions are made for proper location and installation of hardware.

<u>Manufacturer's Installation Instructions:</u> Indicate special procedures, perimeter conditions requiring special attention, and all weather and sound control hardware.

<u>For Exterior Door Hardware:</u> Submit data indicating compliance with impact, static, and cyclic loads and air infiltration test as set forth by the Florida Building Code, latest edition. This data may take the form of test data and reports. All items shall be signed and sealed by an engineer registered in the State of Florida if required by code.

OPERATION AND MAINTENANCE DATA:

Submit under provisions of Section 01 77 00.

Operations and Maintenance Data: At the completion of the job, furnish to the architect the required copies of an Owner's Operation and Maintenance Manual. The manual shall consist of the following:

- Maintenance instructions for each item of hardware.
- Catalog pages for each product
- Data of operating and adjusting hardware
- Lubrication requirements
- Inspection procedures related to preventative maintenance
- Name and phone number of distributor of hardware
- Name and phone number of manufacturer of hardware
- Parts list for each product
- Copy of final as installed hardware schedule
- Copy of final keying and bitting schedule

QUALIFICATIONS:

Manufacturer: Products furnished in the work of this section shall be by a company specializing in manufacturing the products specified in this section with three years documented experience.

Hardware Supplier: The company furnishing the materials under this section shall be a recognized architectural door hardware supplier with a successful in-service performance for supplying door hardware in this geographic area for a period of no less than three years.

WARRANTY:

Warrant door closers against failure due to defective materials and workmanship for a period of ten (10) years. Closers judged defective during this period shall be replaced or repaired at no cost to the owner.

Warrant mechanical exit devices against failure due to defective materials and workmanship for a period of three (3) years. Exit devices judged defective during this period shall be replaced or repaired at no cost to the owner.

The hardware supplier shall provide in writing that all additional materials furnished under this section shall be free from defects in material and workmanship for a period of one year from date of substantial completion of work.

PART 2 - PRODUCTS

MANUFACTURERS:

Reference to specific proprietary products are used to establish the minimum standards of quality to be allowed. Unless otherwise approved by the architect, provide only the products specified in the schedule 'legend' with the Door Schedule on the construction drawings. A request made to furnish a substitute product must be submitted in writing to the architect a minimum of fourteen (14) days prior to the scheduled bid date. The submittal shall include technical data including cut sheets which fully explain the proposed product and how it is different from the product specified. Provide the manufacturer's standard warranty information with the submittal.

GENERAL:

All door hardware shall be new and free from defects affecting the service ability and appearance. All parts shall be properly fitted and work smoothly without unnecessary play.

All door hardware for metal doors and frames shall be installed to template locations, and furnished with the proper fasteners to give complete and satisfactory installation.

Furnish all hardware with the necessary screws, shields, bolts, and other fasteners of suitable size and type to anchor the hardware in position for long life under hard use. Provide concealed fasteners.

Use of self-tapping or sheet metal type screws is prohibited except for application of flush mounted protective plates (flat goods).

Fasteners exposed to the weather shall be of non-ferrous metal or of stainless steel.

MATERIALS AND FABRICATION:

Hand of door: Drawings show direction of slide, swing or hand of each door leaf. Furnish each item of hardware for proper installation and operation of door movement as shown.

Base Metal: Produce hardware units of basic metal and forming method indicated, using manufacturer's standard metal alloy, composition, temper and hardness, but in no case of lesser (commercially recognized) quality than specified for applicable hardware units by applicable ANSI A156 series standard for each type hardware item and with ANSI A156.18 for finish designations indicated.

Provide concealed fastener for hardware units which are exposed when door is closed. Do not use thru-bolts for installation, where bolt head or nut on opposite face is exposed in other work.

Tools and Maintenance Instructions for Maintenance: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of finish hardware. The hardware shall include all necessary screws, bolts, expansion shields and other devices necessary for the proper application of the hardware.

HINGES, BUTTS, AND PIVOTS:

Manufacturer: Hager

Construction: Ball bearing and standard weight as required.

Templates: Except for hinges and pivots to be installed entirely (both leaves) into wood doors and frames, provide only template-produced units.

Screws: See above, "General".

Hinge Pins: Except as otherwise indicated, provide hinge pins as follows:
Steel Hinges: Steel pins
Non-ferrous Hinges: Stainless steel pins
Exterior Doors: Non-removable pins
Out-swing Corridor Doors: Non-removable pins
Interior Doors: Non-rising pins
Tips: Flat button and matching plug, finished to match leaves, except where hospital tip (HT) indicated.
Number of hinges: Provide number of hinges indicated but not less than 3 hinges for door leaf for doors 90" or less in height and one additional hinge for each 30" of additional height.

Provide hinges with sufficient throw to clear the wall condition and trim when opening to 180 degrees.

LOCK CYLINDERS AND KEYING:

General: Supplier will meet with Owner's Facility representative, not Architect-Engineer, to finalize keying requirements and submit final instructions in writing thru the Architect.

Manufacturers: Refer to schedule on the drawings and provide "Schlage" per local district requirements.

Existing System: Provide new to match existing Great Grand or Grand Master system.

Equip locks with cylinders for interchangeable-core pin tumbler inserts. Furnish temporary inserts for the construction period only, and remove these when directed and install cores to match Owner approved keying schedule. <u>Do not</u> install finish cores for Contractor and subcontractors use.

Metals: Construct lock cylinder parts from brass/bronze, stainless steel or nickel silver.

All locksets shall meet or exceed ANSI 156.2, Grade I, Series 4000, and ANSI A117.1 Accessibility Code or better where required to satisfy wind loading or impact resistance.

All levers shall be knurled in areas of hazard in accordance with the State of Florida Accessibility Requirements.

Comply with Owner's instructions for master keying and, except as otherwise indicated, provide individual change key for each lock which is not designated to be keyed alike with a group of related locks.

Key Material: Provide keys of nickel silver only.

Key Quantity: Furnish 3 change keys for each lock; 5 master keys for each master system; and 5 grand master keys for each grandmaster system.

Provide a key control system including envelopes, labels, tags with self-locking key clips, receipt forms, 3-way visible card index, temporary markers, permanent markers, and standard metal cabinet, all as recommended by system manufacturer, with capacity for 150% of the number of locks required for the project. Provide hinged-panel type cabinet, for wall mounting.

LOCKS, LATCHES, AND BOLTS:

Manufacturers: Same as for previous paragraph, "Lock Cylinders".

Strikes: Provide manufacturer's standard wrought box strike for each latch or lock bolt, with curved lip extended to protect frame, finished to match hardware set.

Lock Throw: Provide 5/8" minimum throw of latch and deadbolt used on pairs of doors. Comply with UL requirements for throw of bolts and latch bolts on rated fire openings and for exterior doors in windborne debris locales.

Provide 1/2" minimum throw on other latch and deadlock bolts.

Flush Bolt: Minimum of 1/2" diameter rods of brass, bronze or stainless steel, with minimum 12" long rod for doors up to 7'0" in height. Provide longer rods as necessary for doors exceeding 7'0" in height. Provide "dust proof" strikes at floor strikes for all flush or other bolts. Furnish flush bolts in pairs (top and bottom of door). Flush bolts shall have a minimum 5/8 inch throw and a 7/8 inch vertical adjustment.

Exit Device Dogging: Except on fire-rated doors, wherever closers are provided on doors equipped with exit devices, equip the units with keyed dogging device to hold the push bar down and the latch bolt in the open position.

Rabbeted Doors: Where rabbeted door stiles are indicated, provide special rabbeted front on lock and latch units and bolts.

EXIT DEVICES:

Manufacturer: Refer to schedule on the drawings and provide product(s) by "Von Duprin".

Construction: Horizontal push bar of extruded aluminum with steel channel reinforcement. Chassis of heavy duty extruded aluminum. Plastic touch pads are not acceptable. Latch bolts shall have a self-lubricating coating to reduce wear. Plated or plastic coated latch bolts are not acceptable. All strikes shall be of stainless steel roller type construction.

Rating: All devices shall be U.L. rated.

Coordination: Where knob, lever or thumb lever set is specified for outside side of door leaf; the knob and/or lever shall activate the latch assembly.

All exit devices shall incorporate a fluid dampener which decelerates the touch pad on it's return stroke, and thus eliminates the noise associated with exit device operation.

A representative of the manufacturer shall inspect and adjust as necessary all exit devices at substantial completion of the work.

PUSH/PULL UNITS:

Manufacturer: Refer to schedule on the drawings and when not listed, Hager.

Exposed Fasteners: Provide manufacturer's standard exposed fasteners for installation; throughbolted for matched pairs, but not for single units. The door pull shall be installed using thru bolts. The head of the thru bolt shall be countersunk on the opposite side of the door from the pull when using a push plate. Do not drill the push plate for the thru bolt to extend thru.

All push plates, kick plates, and armor plates shall be constructed from .05 inch (US 18 ga.) stainless steel (US32D).

All flat goods shall be delivered to the job site with a protective vinyl covering over the entire finished surface. This protective covering shall be removed after the plate has been properly installed on the door.

CLOSERS AND DOOR CONTROL DEVICES:

Manufacturer: Refer to schedule on the drawings and provide "LCN" products.

<u>Size of Units:</u> Except as otherwise specifically indicated, comply with the manufacturer's recommendations for size of door control unit, depending upon size of door, exposure to weather and anticipated frequency of use.

Provide fully concealed closers when possible; where not, provide parallel arms for all overhead closers.

Closers shall be fully hydraulic, full rack and pinion action with a high strength cast iron cylinder.

Hydraulic fluid shall be type requiring no seasonal adjustment for temperatures 120 degrees F (40 degrees C) to 30 degrees F (-35 degrees C).

Hydraulic regulation shall be tamper-proof, non-critical screw valves, adjustable only with a hex wrench. Closers shall have separate adjustment for latch speed, general closing speed, and hydraulic back check.

All closers mounted with parallel arm mounting shall have forged main and forearm. All closers mounted with regular arm mounting shall have solid forged main arm and adjustable fore arm.

All door closers shall be tested to ANSI/BHMA A156.4 test requirements by a BHMA certified testing laboratory. Upon the request of the architect, a written certification showing successful completion of a minimum of 10,000,000 cycles must be provided.

Closers on exterior doors shall meet the 8.5 pound opening force requirement, and interior closers shall meet the 5 pound opening force requirement in accordance with the State of Florida Accessibility Code Manual. Note: Life Safety NFPA 101 and NFPA 80 supersede.

A representative of the manufacturer shall inspect and adjust as necessary all closers at substantial completion of the work.

DOOR TRIM UNITS:

Manufacturer: Refer to schedule on the drawings and when not listed, provide Hager.

Fasteners: Provide manufacturer's standard exposed fasteners for door trim units (kick plates, edge trim, viewers, knockers, mail drops, door stops and similar units); either machine screws of self-tapping screw.

Fabricate edge trim of stainless steel, not more than 1/2" nor less than 1/16" smaller in length than door dimension.

Fabricate protection plates (armor, kick, or mop) not more than 1 1/2" less than door width on stop side and not more than 1/2" less than door width on pull side, x the height of 8".

Metal plates: Stainless steel, 0.50" (U.S. 18 gauge).

Door stops: Shall be type that are wall mounted at knob/lever height unless no wall is present, then use floor mounted type. Wall type shall have grey neoprene rubber depressed in center for screw set. Floor type shall be solid rubber, half circle set in metal frame and attached to floor.

SILENCERS:

Provide silencers on all door frames where required.

Furnish three (3) silencers on all single openings, and two (2) silencers on all pair of door openings.

WEATHERSTRIPPING:

Manufacturer: Refer to schedule on the drawings and when not listed, provide Hager.

<u>General:</u> Except as otherwise indicated, provide continuous weatherstripping at each edge of every exterior door leaf. Provide smoke seals as required for all labeled doors. Provide type, sizes, and profiles shown or scheduled. Provide non-corrosive fasteners as recommended by manufacturer for application indicated.

<u>Replaceable Seal Strips:</u> Provide only those units where resilient or flexible seal strip is easily replaceable and readily available from stocks maintained by manufacturer.

<u>Weatherstripping at Jambs and Heads:</u> Provide bumper-type resilient insert and metal retainer strips, surface-applied unless shown as mortised or semi-mortised, of following metal, finish, and resilient bumper material:

Extruded aluminum in finish to match door/frames, 0.05" minimum thickness of main walls and flanges.

Flexible bulb or loop insert of vinyl, conforming to MIL R 6055, Class II, Grade 40.

THRESHOLDS:

Manufacturer: Refer to schedule on the drawings and when not listed, provide Hager.

General: Except as otherwise indicated provide standard metal threshold unit of type, size, and profile as shown or scheduled. Assure ADA compliance in all installations.

Exterior Hinged/Pivoted Doors: Provide units not less than 4" wide, formed to accommodate change in floor elevation where indicated, fabricated to accommodate door hardware and to fit door frames, and for out-swinging doors, provide rabbeted type units with replaceable weatherstrip insert in stop.

HARDWARE FINISHES:

For this work provide finish Exterior use: 630, US 32D - stainless steel metal, Interior use: 626, US 26D Other items are specified, submit to Architect for approval.

Provide matching finished for hardware units at each door or opening, to the greatest extent possible, and except as otherwise indicated. Reduce differences in color and textures as much as commercially possible where the base metal or metal forming process is different for individual units of hardware exposed at the same door or opening. In general, match items to the manufacturer's standard finish for the latch and lock set (or push-pull units if no latch-lock sets) for color and texture.

Provide finishes which match those established by BHMA or, if none established, match the Architect's sample.

Provide quality of finish, including thickness of plating or coating (if any), composition, hardness and other qualities complying with manufacturer's standards, but in no case less than specified for the applicable units of hardware by referenced standards.

Provide protective lacquer coating on all exposed hardware finishes of brass, bronze, and aluminum, except as otherwise indicated.

The designations used in schedules and elsewhere to indicate hardware finishes are those listed in ANSI A156.18 "Materials & Finishes Standard", including coordination with the traditional U.S. finishes shown by certain manufacturers for their products.

PART 3 - EXECUTION

INSTALLATION:

Mount hardware units at heights indicated in "Recommended Locations for Builders Hardware for Standard Steel Doors and Frames" by the Door and Hardware Institute; and, as required by the Florida BBCS Accessibility Requirements Manual and ANSI A117.1 latest edition, except as specifically indicated or required to comply with governing regulations, and except as may be otherwise directed by Architect.

Install each hardware item in compliance with the manufacturer's instructions and recommendations. Wherever cutting and fitting is required to install hardware onto or into surfaces which are later to be painted or finished in another way, coordinate removal, storage and

reinstallation or application of surface protections with finishing work specified in the Division-9 sections. Do not install surface-mounted items until finishes have been completed on the substrate.

Set units level, plumb and true to line and location. Adjust and reinforce the attachment substrate as necessary for proper installation and operation.

Drill and countersink units which are not factory-prepared for anchorage fasteners. Space fasteners and anchors in accordance with industry standards.

Set thresholds for exterior doors in full bed of butyl-rubber or polyisobutylene mastic sealant.

ADJUST AND CLEAN:

Adjust and check each operating item of hardware and each door, to ensure proper operation or function of every unit. Replace units which cannot be adjusted to operate freely and smoothly as intended for the application made. Clean adjacent surfaces soiled by hardware installation.

Final Adjustment: Wherever hardware installation is made more than one month prior to acceptance or occupancy of a space or area, return to the work during the week prior to acceptance or occupancy, and make final check and adjustment of all hardware items in such space or area. Clean operating items as necessary to restore proper function and finish of hardware and doors. Adjust door control devices to compensate for final operation of heating and ventilating equipment.

Instruct Owner's Personnel in proper adjustment and maintenance of hardware and hardware finishes, during the final adjustment of hardware.

Continued Maintenance Service: Approximately six months after the acceptance of hardware in each area, the Installer, accompanied by the representative of the latch and lock manufacturer, shall return to the project and re-adjust every item of hardware to restore proper function of doors and hardware. Consult with and instruct Owner's personnel in recommended additions to the maintenance procedures. Replace hardware items which have deteriorated or failed due to faulty design, materials, or installation of hardware units.

END OF SECTION 08 71 00

SECTION 08 80 00 - GLASS AND GLAZING

PART 1 - GENERAL

DESCRIPTION OF WORK:

Glass and glazing materials for interior windows and doors. For exterior doors and windows refer to other Division 8 specification sections.

SUBMITTALS:

In accordance with Section 01 33 00, Submittals, provide product data submit the following:

Samples of each glass indicated, except for clear single pane units; and of each type of sealant or gasket exposed to view.

Certificates of compliance from glass and glazing materials manufacturers.

Test reports for sealant-substrate adhesion and sealant compatibility.

QUALITY ASSURANCE:

Glazing Standard: Comply with FGMA "Glazing Manual" and "Sealant Manual".

Safety Glazing Standard: Comply with ANSI Z97.1 and testing requirements of 16 CFR Part 1201 for category II materials.

Fire Resistance Rated Clear Glass: Provide UL labeled and listed products, identical with those tested per ASTM E 163 (UL 9), ANSI Z97.1 for impact.

PART 2 - PRODUCTS

<u>Glass Manufacturers:</u> Subject to compliance with requirements, provide products by one of the following, other manufacturers may be considered:

Ford Glass Div. LOF Glass, Inc. PPG Industries Inc. Technical Glass Products

<u>Sizes:</u> Fabricate glass of thicknesses indicated or required to comply with expected loading and to sizes required for glazing openings indicated, with edge clearances and tolerances complying with recommendations of glass manufacturer.

Primary Glass Products: Comply with ASTM C 1036 for the following:

Clear Float Glass: Type I, Class 1, Quality q3.

Fire Rated Clear Glass: Firelite or Firelite Plus, 1/4" thick, as mfg. by Tech. Glass Products.

Uncoated Heat-Treated Glass Products: Comply with ASTM C 1048 and with manufacturing process indicated for the following:

- Clear Tempered Float Glass: Kind FT, Condition A, Type I, Class 1, Quality q3.

Glazing Sealant: Comply with sealant and glass manufacturers for selection of glass sealants which suit project application and installation conditions and which are compatible with surfaces contacted. Provide color of exposed sealants indicated or as selected by Architect.

Dense Elastomeric Compression Seal Gaskets: ASTM C 864, extruded or molded neoprene, EPDM, or thermoplastic polyolefin rubber.

Cellular Elastomeric Preformed Gaskets: ASTM C 509, Type II, black; extruded or molded neoprene.

Cleaners, Primers and Sealers: Type recommended by manufacturer of sealants/gaskets.

Blocks and Spacers: Neoprene, EPDM or silicone as required for compatibility with glazing sealants; of 80 to 90 Shore A hardness for setting blocks and, for spacers and edge blocks, of hardness recommended by glass and sealant manufacturer for application indicated.

Compressible Filler Rods: Closed-cell or waterproof-jacketed rod stock of synthetic rubber of plastic foam, 5-10 psi compression strength for 25% compression.

PART 3 - EXECUTION

<u>General:</u> Comply with referenced FGMA standards and instructions of manufacturers of glass, glazing sealants, and gaskets, to achieve airtight and watertight performance, and to minimize breakage.

Protect glass from edge damage during handling and installation. Inspect glass during installation and discard pieces with edge damage that could affect glass performance.

Set units of glass in each series with uniformity of pattern, draw, bow and similar characteristics.

<u>Protect glass</u> from contact with contaminating substances resulting from construction operations; remove any such substances by method approved by glass manufacturer.

<u>Wash glass on both faces</u> not more than 4 days prior to date scheduled for inspections intended to establish date of substantial completion. Wash glass by method recommended by glass manufacturer.

END OF SECTION 08 80 00

SECTION 09 12 00 - CEILING SUSPENSION SYSTEMS

PART 1 GENERAL

DESCRIPTION OF WORK:

Provide suspension systems for exposed grid suspension systems. Refer to drawings and finish schedule,

section 09 99 99.

Materials and equipment furnished and installed under other Divisions/ Sections, but related to this section:

- Luminaires, ballasts, lenses, lamps: Electrical/Lighting.

- Air diffusers, return air grilles: Mechanical.
- Acoustical Ceiling Panels: Section 09 51 13

SUBMITTALS:

In accordance with Section 01 33 00, Submittals, provide shop drawings, product data and samples for review by the Architect.

Give careful consideration to expansion contraction of large expanses of solid ceilings which would require control of expansion and contraction. Provide shop drawings to indicate proposed joint locations including the necessary joint types.

PART 2 - PRODUCTS

EXPOSED GRID SUSPENSION SYSTEMS (FOR ACOUSTICAL LAY-IN PANELS):

<u>Design:</u> Suspension systems shall be designed to comply with ASTM C635 and to support lay-in units with deflection of suspension members not to exceed 1/360 of span of member.

<u>Components:</u> Systems shall consist of main support tees, cross tees, splice clips, wall angles, hold-down clips, and all miscellaneous moldings.

- Main Tees: 15/16 exposed flange, integral reverse splice, cross tee holes 6" o.c.

- Cross Tees: 15/16 exposed flange, interlocking tee web, lower flange extended and offset to provide a flush, level appearance.

- Wall Molding: Channel or angle shape, hemmed edges, 1" exposed face or 9/16" narrow grid as the case may be, see Section 09512, Ceiling Panels.

Systems:

- Location: Use in conjunction with 2' x 2' lay-in acoustic panels.

- Type: Exposed tee grid (two-way).
- Construction: Double web tee design with bulb and hemmed edges.
- Material: Commercial quality cold rolled steel.
- Color/Finish: To be selected by Architect.
- Pattern: 2' x 2' layout as indicated on drawings/schedules.

<u>Clips for</u> securing hangers to steel structural members shall be of a type to develop fully the strength of the hanger, and shall be approved by the Architect.

Wire: Minimum No. 12 gauge galvanized steel wire.

OTHER MATERIALS:

Provide all other trim, including clips, wire ties, fasteners, expansion/control joints, brackets, support yokes, anchor straps, personnel and visual access panels, etc., not specifically mentioned herein, but required for a complete, and secure installation of work under this and related sections.

PART 3 - EXECUTION

COORDINATION:

Grid systems and tile lines are primarily modular ceiling systems to which other Divisions/Sections must work. Protrusions of other Divisions/Sections must be symmetrically and consistently placed with respect to grid systems and/or tile lines.

Erect suspension grillage and/or grid systems, suspended from structure above and provide any necessary sub-suspension systems to avoid work of other Divisions/Sections, and appropriate edge and other trim. Construct all required fascias and soffits. If main runners occur normal to joists, install hangers from joist to top chords.

Cooperate with other Divisions/Sections in construction of grid system so that work of others which penetrates grid system is centered in panels. Random placement of work of other Divisions/Sections will not be accepted.

GENERAL:

Lay out major grid lines at given elevations. Unless otherwise shown, center systems in space with grid parallel with walls.

Notify Architect of any discrepancies which prohibit installation to comply with reflected ceiling plans; secure an inspection and approval of Architect; make any necessary adjustments and proceed with installation after receipt of approval.

Erect grid systems so that joints occur at grid member intersections; systems must have all joists neatly cut, well trimmed, and closely fit.

Comply with all requirements of ASTM C636 and U.L. directory when specific rated ceiling systems are indicated. Comply with more stringent requirements noted herein or on the drawings.

TOLERANCES:

Flatness: Maximum deviation from true plane at required elevation; 1/4" in any space and 1/8" in any 12'0".

Parallelness: Maximum deviation from required grid; 1/4" in entire space.

Bow: Maximum; 1/360 span.

SUPPORT:

Where hangers fall at structural members, secure hanger wire around or to structural member.

Provide adequate support and backing for surface mounted fixtures/devices.

Place channel supports for ceiling supply air diffusers.

Erect trusses for luminaires support.

Wire hangers must be securely attached to structure. Grid members for finished ceiling are then to be installed as required following required codes, regulations and manufacturer's instructions.

Fire rated gypsum board ceiling must retain its integrity. Any penetrations must be taped, patched and/or sealed to retain rating.

END OF SECTION 09 12 00

SECTION 09 12 50 - INTERIOR NON-BEARING METAL FRAMING

PART 1 - GENERAL

DESCRIPTION OF WORK:

The work includes the items specified herein and/or shown in the drawings for interior nonbearing metal studs, framing and furring.

SUBMITTALS:

In accordance with Section 01 33 00, Submittals, provide product data for review by the architect.

QUALITY ASSURANCE:

Fire Resistance Rating: Where metal studs or furring are identified as a part of fire rated construction provide materials and installations which are identical to those assemblies tested per ASTM E119 and by fire testing laboratories acceptable to authorities having jurisdiction at the project location.

Provide rated fire resistance assemblies identical to those listed in the latest U.L. "Fire Resistance Directory."

Comply with "Gypsum Construction Handbook" published by United States Gypsum Co.

PART 2 - PRODUCTS/MATERIALS

STUDS, FRAMING AND FURRING:

Comply with ASTM C645 and provide minimum 22 gage thick base metal material, or greater where local codes or manufacturers written literature require it even though not specifically designated herein or detailed on the drawings.

Depth of Section: 3 5/8" minimum depth of section unless specifically detailed as less; greater where noted, or required for height or lateral stability, or as recommended by manufacturer's written literature.

Runners: Match studs with type as recommended in manufacturer's literature for floor, ceiling or vertical abutment conditions, including that for deflection.

Furring sections for this work shall be 'Z' zee shaped.

Depth of furring section shall be 1 1/2" minimum or of a size required to match insulation thickness.

All members shall be galvanized, A60 minimally.

FASTENERS:

Comply with type and size as recommended in manufacturer's literature for substrate and application indicated.

PART 3 - EXECUTION

INSTALLATION OF METAL SUPPORT SYSTEMS:

General:

Metal Support Installation Standard: Comply with ASTM C754.

Do not bridge building expansion joints with support system; frame both sides of joints with furring and other support as indicated.

Wall/Partition Support Systems:

Install supplementary framing, blocking and bracing at termination in the work and for support of fixtures, equipment, services, heavy trim, grab bars, toilet accessories, furnishings and similar work, to comply with applicable published recommendations of gypsum board manufacturer or if not available, of "Gypsum Construction Handbook" published by United States Gypsum Co.

Isolate stud system from transfer of structural loading to system, both horizontally and vertically. Provide slip or cushioned type joints to attain lateral support and avoid axial loading.

Install runner tracks at floors, ceiling and structural walls and columns where gypsum drywall stud system abuts other work, except as otherwise indicated. Set track on 2X pressure treated wood plate also coated with dampproofing at toilet or wet areas. Set track in two strips of sealant at all other locations.

Extend partition stud system through acoustical ceilings and elsewhere at minimum of 4'0" intervals to the structural support.

Space all members at 16" o.c., unless otherwise indicated.

Frame door openings to comply with details indicated or to comply with applicable published recommendations of gypsum board manufacturer, or if not available, of "Gypsum Construction Handbook" published by United States Gypsum Co. Attach vertical studs at jambs with screws either directly to frames or to jamb anchor clips on door frames; install runner track section (for jack studs) at head and secure to jamb studs.

- Extend vertical jamb studs through suspended ceilings and attach to underside of floor or roof structure above, unless otherwise indicated.

Frame openings other than door openings to comply with details indicated or if not indicated, in same manner as required for door openings; and install framing below sills of openings to match framing required above door heads.

Space wall furring members 16" o.c., unless otherwise indicated.

END OF SECTION 09 12 50

SECTION 09 24 00 - LATH AND STUCCO

PART 1 GENERAL

SCOPE OF WORK:

Provide metal furring, lathing and Portland cement stucco.

QUALITY ASSURANCE:

Single Source Responsibility: Obtain gypsum lath and stucco from a single manufacturer.

SUBMITTALS:

In accordance with Section 01 33 00, Submittals, provide product data for cementitious materials and all accessories. Provide 24" x 24" mock-up samples of textures for review and approval by Architect.

DELIVERY, STORAGE AND HANDLING:

Deliver materials in original packages, containers or bundles bearing brand name and identification of manufacturer.

Store materials inside, under cover and in manner to keep them dry, protected from weather, direct sunlight, surface contamination, aging, corrosion, and damage from construction traffic and other causes. Neatly stack gypsum lath flat to prevent deformation.

PROJECT CONDITIONS:

Environmental Requirements: Comply with requirements of referenced application standards and recommendations of materials manufacturer for environmental conditions before, during, and after application of stucco.

Cold Weather Protection: When ambient outdoor temperatures are below 55 degrees F (13 degrees C), maintain continuous uniform temperature of not less than 55 degrees F (13 degrees C), nor more than 70 degrees F (21 degrees C), for not less than 1 week prior to beginning stucco application, during its application, and until stucco is dry but for not less than one week after application is complete.

Protect contiguous work from soiling, spattering, moisture deterioration and other harmful effects which might result from plastering.

PART 2 - PRODUCTS

MANUFACTURERS:

Provide products by a recognized manufacturer whose products comply with the referenced materials and application standards as noted herein or intended for a complete guaranteed installation.

MATERIALS:

Expanded Metal Lath: ASTM C 647, fabricated from zinc-coated (galvanized) steel sheet of type and configuration indicated below:

Self-Furring Diamond Mesh Lath: 3.4 lbs. per sq. yd.

Paper Backing for Diamond Mesh Lath: FS UU-B-790, Type I, Grade D, Style 2; provide where indicated.

Lath Attachment Devices: Of materials and type required by standard and recommended by lath manufacturer for application indicated.

Base Coat Cements:

- Portland Cement, ASTM C150, Type I or III

Finish Coat:

- Portland Cement, ASTM C150, Type 1

- Finishing Hydrate Limes: ASTM C 206, Type S.

Aggregates for Base Coat:

- Sand aggregate, per ASTM C35 unless otherwise indicated.

Aggregates for Finish Coat Stucco with Floated Finish:

- Sand aggregate, per ASTM C35, graded per ASTM C842

Water for Mixing and Finishing Stucco: Drinkable, free of substances deleterious to plaster or lath.

Hanger Anchorage Devices: Screws, concrete inserts or other devices appropriate for anchorage to the form of structural framing indicated and whose suitability for use intended has been proven through standard construction practices or certified test data. Use only long life corrosion resistant devices.

Size devices to develop full strength of hanger but not less than 3 times calculated hanger loading, except size direct pullout concrete inserts for 5 x calculated hanger loading.

Bonding compound: ASTM C 631.

ACCESSORIES:

Provide type recommended by lath manufacturer and as shown on the drawings.

Provide zinc alloy units including corner beads, casing beads, base screeds, cornerite, stripite, control joints and scoring beads. Vinyl (PVC) accessories will be considered. **Zinc coated steel is not acceptable.**

Provide extruded aluminum reveals and trim of size and thickness noted or required by the installation called for on all drawings. Reveal shall be equal to the Fry Channel Screed as manufactured by The Fry Reglet Co. Extruded aluminum, concealed fastening, caulked joints, color of reveal per architect, factory applied. PVC reveals will be considered.

MIXES AND COMPOSITIONS:

General: Comply with ASTM C 926 for Portland cement plaster base and finish coat mixes as applicable to plaster bases, materials and other requirements and indicated.

Portland Cement Stucco Base Coat Mixes and Compositions: Proportion materials for respective base coats in parts by volume for cementitious materials and in parts by volume per sum of cementitious materials for aggregates to comply with the following requirements for each method of application and plaster base indicated. Adjust mix proportions below within limits specified to attain workability.

Three-Coat Work Over Metal Lath: Base coats as indicated below:

- Scratch Coat: 1 part Portland cement, 2 1/2 4 parts sand
- Brown Coat: 1 part Portland cement, 3 5 parts sand

Three-Coat Work over Concrete and Concrete Unit Masonry: Base coat as indicated below:

- Scratch Coat: 1 part Portland cement, 2 1/2 4 parts sand
- Brown Coat: 1 part Portland cement, 3 5 parts sand.

Finish Coats: Proportion materials for finish coats to comply with stucco manufacturer directions and ASTM C 842.

Finish textures shall be smooth sand finish.

PART 3 - EXECUTION

PREPARATION AND INSTALLATION:

Interior Lathing and Furring Installation Standard: Install lathing and furring materials indicated for gypsum plaster to comply with ASTM C 841.

Portland Cement Stucco Application Standard: Apply Portland cement concrete stucco materials, compositions, and mixes to comply with ASTM C 926.

Number of Coats: Apply Portland cement plaster, of composition indicated, to comply with the following requirements:

- Use three-coat work over lath bases (interior and exterior applications)

- Use three-coat work over concrete and unit masonry (exterior applications)

Apply bond coat to concrete (cast-in-place or precast) when surface complies with ASTM C 926 for stucco bonded direct to solid base.

Moist cure Portland cement stucco base and finish coats to comply with ASTM C 926, including recommendations for time between coats and curing in "Annex A2 Design Considerations".

CUTTING AND PATCHING:

Cut, patch, point-up and repair plaster as necessary to accommodate other work and to repair cracks, dents and imperfections. Repair or replace work to eliminate blisters, buckles, excessive crazing and check cracking, dry-outs, efflorescence, sweat-outs and similar defects, and where bond to the substrate has failed.

Sand smooth-troweled finishes lightly to remove trowel marks and arises.

CLEANING AND PROTECTION:

Remove temporary protection and enclosure of other work. Promptly remove stucco from door frames, windows, and other surfaces which are not to be stuccoed. Repair floors, walls and other

surfaces which have been stained, marred or otherwise damaged during the stucco work. When work is completed, remove unused materials, containers and equipment and clean floors of stucco debris.

Provide final protection and maintain conditions, in a manner suitable to Installer, which ensure work being without damage or deterioration at time of substantial completion.

END OF SECTION 09 24 00

SECTION 09 29 00 - GYPSUM DRYWALL

PART 1 GENERAL

DESCRIPTION OF WORK:

Provide gypsum board where noted herein, in the finish schedule and details. The work includes drywall finishing. Refer to section 09 29 10 Tile Backer Board for special wallboard to be used behind ceramic tile.

SUBMITTALS:

In accordance with Section 01 33 00, Submittals, provide product data and drawings.

When not shown, prepare shop drawings which will locate expansion control per USG recommendations.

PROJECT CONDITIONS:

Interior drywall shall not be stored on the site or installed until building roof and walls are in place.

PART 2 - PRODUCTS

MANUFACTURER:

Gypsum wallboard and general drywall system materials shall be products equivalent to those manufactured by UNITED STATES GYPSUM (USG), Chicago, Illinois, Gold Bond Products, Louisiana Pacific Corp. and the Ameray Corporation of Randolph, New Jersey. Gypsum wallboard products shall be of the types described herein and the drywall system shall further include all other accessory items required for a complete installation.

GYPSUM WALLBOARD:

All wallboard shall be furnished in 48" widths with tapered edges, in lengths as great as practicable to minimize number of joints. Wallboard shall be 5/8" thick minimum unless otherwise noted.

<u>Regular Gypsum Wallboar</u>d: Wallboard shall be in accordance with ASTM C36 and FS SS-L-30C, Type III, Grade R, Class 1.

Moisture Resistant Gypsum Wallboard: Wallboard shall conform to ASTM C630 and FS SS-L-30D, Type VII, Grade 'R' or 'X' where core and both faces are specially treated.

Location: Bathroom and toilet walls (adjacent to tile areas) and ceilings; between base and upper cabinets at sink areas; and, other similar locations.

<u>Type "X" Gypsum Panels for Fire-Resistant Rated Assemblies</u>: Wallboard shall conform to ASTM C36 and FS-SS-L-30C Type III, Grade X, where core is specially treated highly resistant to fire.

<u>High Impact Resistant Gypsum Wallboard Panels:</u> Impact resistant wallboard which conforms to ASTM C36 and C1396, FS-SS-L-30D, Type III Grade X (Gypsum Tough Rock).

OTHER MATERIALS:

<u>Drywall Accessories:</u> Provide miscellaneous shapes to finish drywall board installation; this includes but is not limited to corner beads, 'J' beads, reveals, control joints, drywall expansion joints, radius corners, etc. These items shall be incorporated into the finishing (tape and mud) process unless identified otherwise.

For metal framing: 1" USG brand screws, Type S bugle head or equal conforming to ASTM C646 or ASTM C1002.

For masonry and concrete application: Drywall adhesive shall be USG ready-to-use durabond adhesive of the appropriate type, complying with ASTM C557-73.

<u>Jointing</u>: Joint tape shall be perforated, reinforced tape conforming to ASTM C475-70 and FS SS-J-570A, Type II.

Joint compound shall be ready mixed conforming to ASTM C475-70 ready-mixed and FS SS-J-570A, Type I.

Metal corner beads, "J" beads casings, control joints (USG #093) shall be galvanized steel, sizes and shapes as required and conforming to ASTM A525.

Sealants: Water resistant sealant required, similar to USG sheetrock brand W/R sealant.

Acoustic sealant; highly elastic; permanently flexible, non-staining, water base caulking supplied by gypsum wallboard manufacturer.

Vinyl foam tape to be supplied as required in conjunction with the drywall adhesives.

<u>Finish:</u> Provide a semi-course orange peel or splatter texture substrate for painting system using a spray applied latex based coating on the drywall. Confirm texture with architect before starting.

PART 3 - EXECUTION

<u>GENERAL</u>:

All applications and workmanship shall be in accordance with ANSI A97.1 and the manufacturer's written instructions.

LOCATION:

Gypsum wallboard types shall be applied where noted herein, or in the finish schedule and wall details.

Use abuse resistant wallboard on corridor walls in the classrooms addition attached to the Theatre.

Gypsum wallboard shall be applied to suspended ceiling systems or joists as indicated in finish schedule or the drawings.

COORDINATION:

Coordinate application of drywall system with trades for metal or wood framing, suspended ceilings, and furring.

Coordinate installation of gypsum wallboard with work of other trades in regard to mechanical and electrical fixtures and provisions, acoustical and building insulation, backing or anchors for support of specialty items, etc.

INSTALLATION TECHNIQUES:

Install wallboards on walls in vertical fashion, <u>horizontal installation will not be accepted unless</u> <u>specifically accepted by the architect</u>. Use longest boards available from manufacturer.

Neatly fit ends and edges of wallboard without forcing.

Support ends and edges of wallboard panels on framing or furring members.

Cut and fit gypsum wallboard by scoring and breaking, or by sawing, working from face side.

Smooth cut edges and ends of gypsum wallboard to achieve neat joining.

Where core of wallboard is exposed by cut-out or trimming, seal with approved sealer.

Arrange joints on opposite sides of partitions to occur on different framing members.

<u>Trim/Beads</u>: Cover wallboard end joint at dissimilar surfaces with a metal trim strip against a continuous bead of caulking.

Install "J" bead, corner bead, expansion bead or other trim as detailed or appropriate.

Reinforce and finish internal corners with tape and compound.

Apply trim to exposed corners and edges.

<u>Attachment</u>: Attach single layer of wallboad to metal framing support with USG Type S drywall screws at corners, spaced 12" o.c. in field of board and 8" o.c. along vertical abutting edges.

Where wallboard is called out on the drawings to be applied directly to concrete or unit masonry, walls shall receive drywall adhesive prior to application of wallboard, according to manufacturer's recommendations for a secure and lasting installation.

JOINT TREATMENT:

Mix and use joint finishing materials in accordance with manufacturer's recommendations.

Allow a minimum drying time of 24 hours between coats.

Sand as necessary after each application without scuffing paper surface of board.

Apply at least two filler coats of joint compound to all screw depressions, holes and flanges or corner beads and other trim.

Apply finish coat and extend beyond filler coats, feather to smooth uniform finish, sand and prepare surface for finishing.

Where pipes, conduits, ducts, electrical devices and other items penetrate wallboard, caulk as described in Section 07 90 00, Sealants and Caulking. Assure all layout and locations of such are complete prior to application.

FINISHES:

Orange peel or splatter substrate prior to painting. Confirm architect's approval with sample prior to start. Mix and use finishing materials in accordance with manufacturer's recommendation.

Allow a minimum drying time of 24 hours between applications.

Apply only to drywall which has been taped and sanded smooth.

Apply uniform texture coat.

DAMAGES:

Small holes, punctures by fasteners and surface tears shall be dressed with joint compound and tape.

Large areas of drywall (over 1 s.f.) that have fractures, torn paper surfaces, water damage, broken core, etc., shall be rejected and replaced, or repaired to the satisfaction of the Architect.

Remove damaged boards, cracked or broken in handling or application and replace with new material.

END OF SECTION 09 29 00

SECTION 09 29 10 - INTERIOR TILE BACKER BOARD

PART 1 - GENERAL

SUMMARY OF WORK:

Provide tile backer wallboard products as substrate for tile on framed, masonry and concrete walls to receive full or partial covering of ceramic tile wall treatment.

SUBMITTALS:

In accordance with Section 01 33 00, Submittals, provide product data to describe all materials and installation methods to be used for this work.

PROJECT CONDITIONS:

Interior backerboard shall not be stored on the project site or installed in a project building until the building roof is dryed in.

PART 2 - PRODUCTS

ACCEPTABLE MANUFACTURERS:

Provide products manufactured by Georgia-Pacific Corporation. Equivalent products by other manufacturers will be considered per Section 01 60 00 - Products and Substitutions.

BACKER BOARD:

Type: "Dens-Shield" interior tile backer board.

Material: Silicone treated gypsum core penetrated front and back with inorganic fiberglas mats and treated with a coating.

Size: 5/8" thickness, maximum width and lengths.

ACCESSORIES:

Adhesive: Per manufacturer's written recommendations for the installation encountered.

Fasteners: Provide manufacturers' recommended stainless steel screws.

Joint Reinforcement: Fiber tape and joint compound per manufacturer's written instructions.

PART 3 - EXECUTION

Framing: Confirm that appropriate blocking or headers to support plumbing fixtures and other accessories and hardware is in place.

Tile Backer Panels: Install panels on framed partitions, masonry (CMU) and concrete walls. Precut board to required sizes and make necessary cut-outs. Fit ends and edges closely but not forced together. Fasten boards to appropriately spaced studs with approved fasteners spaced not more than 8" o.c. and to masonry or concrete walls with adhesive/fasteners per manufacturer's recommendations. Apply tape over joints and corners per manufacturer's written instructions.

END OF SECTION 09 29 10

SECTION 09 30 00 - CERAMIC TILE

PART 1 GENERAL

DESCRIPTION OF WORK:

The work includes, interior tiled floors and base as noted on the drawings and specified.

SUBMITTALS:

In accordance with Section 01 33 00, Submittals, provide product data, full size samples and color range samples for all available grades. Colors of tile and grout shall be selected by the Architect.

EXTRA STOCK:

Contractor, at close of project, shall supply the owner with 1% of each type and color used on the project, but not less than 1/2 case for each type and color used.

QUALITY ASSURANCE:

Installation shall be in accordance with standards established and published by A.N.S.I. and by the Tile Council of American (TCA). All products to be used in a room or for a particular application shall be from the same manufacturer and same product firing run. The installer shall be a certified and licensed installer who has performed this work for a minimum of five (5) preceding years.

PART 2 - PRODUCTS

GENERAL:

Product materials shall meet the standards set forth in A.N.S.I. A-137.1.

MANUFACTURER:

Products described herein are by DALTILE. Equivalent products having the same shapes and color range by other well known manufacturers are acceptable. All other manufacturers must be approved prior to bids or will be considered per Section 01600 Products and Substitutions.

INTERIOR TILE - FLOORS:

PORCELAIN TILE: "Continental Slate" in 6" x 6" at toilet rooms.

Mortar: Dryset on concrete or mud bed, TCA-F112 (at mud bed locations); TCA-F113 at non recessed slab area using 'Flex Bond' by Custom Building Products for both.

Grout: Latex Portland Cement (sanded) with Epoxy/Furan at shower rooms

INTERIOR TILE – TOILET ROOMS WALLS & BASE:

Walls and Base: "Semi-Gloss", 6" x 6" to price group 2, including cove and sanitary cove bases.

Trim for this work: Include bullnose at corners and edges.

Mortar for this work: Dryset on tile backer board TCA-W243

Grout for this work: Latex Portland cement

MISCELLANEOUS MATERIALS:

Soft Joint Sealant: Per tile manufacturer's recommendation.

Crack Isolation Sheet: Composite sheet membrane (i.e.: DAL-Seal CIS or Protecto Wrap)

Marble Thresholds: Provide marble thresholds complying with ASTM 503 requirements for heavy foot traffic, abrasion resistant. Locate at entrance doors to toilets, janitors closets, locker rooms, and kitchens. Use white honed marble.

Tile Cleaner: Product specifically acceptable to manufacturer of tile and grout for application indicated and as recommended by National Tile Promotion Federation, 112 North Alfred St., Alexandria, VA 22134 or Ceramic Tile Institute, 700 N. Virgil Ave., Los Angeles, CA 90029.

Tile Grout Sealer: Provide "Aquamix" product. Product shall be a protective sealer designed to waterproof and seal grout joints but shall not reduce slip resistant characteristics of the tiles.

PART 3 - EXECUTION

COORDINATION:

Coordinate with the contractor for placement of control joints in the floor slab during pre-pour planning efforts. Advise contractor for proper placement of joints such that crack control of the tile floors will eliminate probability of cracks in the tile flooring.

INSPECTION:

Examine surfaces to receive tile work and conditions under which tile will be installed. All floor surfaces should be adequately and properly sloped to drains. A water test should be provided to insure that drainage is proper. Do not proceed with tile work until surfaces and conditions comply with requirements of drainage/slope and those indicated in referenced tile installation standards.

INSTALLATION, GENERAL:

ANSI Tile Installation Standard: Comply with applicable parts of ANSI 108 series of tile installation standards included under "American National Standard Specifications for the Installation of Ceramic Tile".

TCA Installation Guidelines: TCA "Handbook for Ceramic Tile Installation"; comply with TCA installation methods previously indicated. TCA installation method noted in part 2 of this specification applies.

Extend tile work into recesses and under or behind equipment and fixtures, to form a complete covering without interruptions, except as otherwise shown. Terminate work neatly at obstructions, edges and corners without disrupting pattern or joint alignments.

Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures and other penetrations so that plates, collars, or covers overlap tile.

Jointing Pattern: Unless otherwise shown, lay tile in regular grid pattern. Align joints when adjoining tiles on floor, base, walls and trim are same size. Layout tile work and center tile fields in both directions in each space or on each wall area. Adjust to minimize tile cutting and pieces less than 1/2 tile width. Provide uniform joint widths, unless otherwise shown.

Lay out tile wainscots to next full tile beyond dimensions indicated.

Expansion Joints: Coordinate expansion joints and other sealant filled joints, including control, contraction and isolation joints, with control and expansion joints for floor slab wherever possible, at spacings and locations recommended in TCA "Handbook for Ceramic Tile Installation", and as recommended by the tile manufacturer. Include crack Isolation Sheets where necessary to eliminate probability of tile cracks. Fill control/expansion joints with soft sealant.

Marble Thresholds: Install thresholds at locations indicated; set in same type of setting bed as abutting field tile unless otherwise indicated.

CLEANING AND PROTECTION:

Cleaning: Upon completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.

Finished Tile Work: Leave finished installation clean and free of cracked, chipped, broken, unbonded, or otherwise defective tile work.

Protection: When recommended by tile manufacturer, apply a coat of neutral protective cleaner to completed tile walls and floors. Protect installed tile work with Kraft paper or other heavy covering during construction period to prevent staining, damage and wear.

Prohibit foot and wheel traffic from using tiled floors for at least 7 days after grouting is completed.

Before final inspection, remove protective coverings and rinse neutral cleaner from tile surfaces.

Apply tile grout sealer to all grout joints.

END OF SECTION 09 30 00

SECTION 09 31 00 - CULTURED MARBLE

PART 1 GENERAL

DESCRIPTION OF WORK:

The product described herein shall be cultured marble manufactured in accordance with specification of the Cultured Marble Institute. All products shall be labeled as manufactured according to the standards of the CMI.

Cultured marble products for this work include Window Sills/Ledges.

SUBMITTALS:

In accordance with Section 01 33 00, Submittals, provide product data for review by the Architect.

PART 2 - PRODUCTS

CULTURED MARBLE:

Composition: 80% granular marble and 20% polyester resin cured to a strong and rigid state.

Finished surfaces: Coating of approximately 20 mil (wet gauge) thickness of clear sanitary gel coat.

Style: Bullnose Cornish edge at window sills. Butt and sealed at stall joints (if necessary) and rounded at open edges.

Size: Minimum 3/8" thickness, by width and lengths required for the project. Overhanging sill bullnose section approx. 1 1/2".

Color: Shall be selected by the Architect.

OTHER MATERIALS:

Adhesives: As recommended by the manufacturer.

PART 3 - EXECUTION

<u>General:</u> Products shall be pre-sized and factory cut ready for installation.

Install and secure sill in accordance with the manufacturer's recommendations.

COORDINATION:

Field measure for all installations. Coordinate size and installation with manufacturer of the base cabinet.

END OF SECTION 09 31 00

SECTION 09 40 00 – SOLID SURFACE COUNTERTOPS

PART 1 – GENERAL

DESCRIPTION OF WORK:

Provide solid surface countertops without integral sink bowls where identified in the drawings and as specified herein.

SUBMITTALS:

In accordance with Section 01 33 00, Submittals, provide product data and color selection samples for review and acceptance by the architect.

PART 2 - PRODUCTS

MANUFACTURER:

This specification is based on "CORIAN" manufactured by the DuPont Company, Wilmington, Delaware. Equivalent products by other manufacturers will be considered, but subject to rejection should material composition; variety of colors; patters; or sink bowl and countertop shapes prove unacceptable to the architect.

PRODUCTS:

Material: Solid acrylic plastic and resins, i.e., Corian, Formstone or Solid polyester composition, i.e., Avonite, Surell:

Sizes: Use thickest sizes and largest sheet to fabricate the items as shown on the detail drawings and in the specifications. Piecing of material will not be acceptable if observed.

Shapes: Provide shape as detailed.

Finish and Color: The Architect will select the desired colors from all available colors from the manufacturer, including solids, patterns, granite patterns, etc.

- Lab Test Results:
- Fungus resistant
- NSF Standard #51
- Flammability Class I per ASTM E84-84a

Splashes: Back and sides typical at all locations

Fittings: Specified elsewhere if applicable to project. Locate sink bowl drain at rear on side opposite the faucet on same side as bubbler

PART 3 – INSTALLATION

Install or mount product on adequate blocking or shims on casework.

Coordinate installation of drop-in sinks where noted in Plumbing drawings.

END OF SECTION 09 40 00

SECTION 09 51 13 - ACOUSTICAL CEILING PANELS

PART 1 GENERAL

DESCRIPTION OF WORK:

The work includes lay-in ceiling panels as herein described, or shown on the drawings.

SUBMITTALS AND EXTRA STOCK:

In accordance with Section 01 33 00, Submittals, provide product data for review by the Architect.

Provide one carton for up to first 50 cartons and one for each additional 50 or fewer cartons thereafter.

WARRANTY:

Panels shall be warranted to be free of sagging and warping for a period of 10 years as a result of the extreme environmental conditions which are expected in the project location and for workmanship or material defects.

PART 2 - PRODUCTS

MANUFACTURER:

For the purpose of designating type and quality for the work under this section, drawings and specifications are based on products furnished by the Armstrong Contact Interiors. Equivalent products by other manufacturers will be considered prior to bid and in accordance with Section 01 60 00 Products and Substitutions. For all products under this section, manufacturer must supply evidence of compatibility between acoustical materials and suspension systems.

ACOUSTICAL PANELS:

Style: 'Fine Fissured', medium texture with antimicrobial treatmentDesignation: Mineral fiber - face painted with vinyl latex paintType: Grid Panel, lay-in, angled tegular edgeSize: 24" X 24" X 5/8" - see drawings and schedule for locations throughout the buildingAcoustical Properties: NRC: .55 minimumLight Reflectance: LR 0.84Flame Spread: Class A, 0-25 (ASTM E-1264)

PART 3 - EXECUTION

PANEL ERECTION:

Re-examine and adjust suspension systems so that acoustical panels can be installed and subsequently lifted or fitted in place from underside without contact to suspension systems (hanger wires, etc.)

Install acoustical panels and necessary trim taking care not to damage or smudge panels, trim, or grid systems.

Make necessary cut-outs in panels for penetrating devices.

END OF SECTION 09 51 13

SECTION 09 54 10 - ACOUSTICAL INSULATION

PART 1 GENERAL

DESCRIPTION OF WORK:

The extent of the work includes Acoustical Blanket Insulation in Walls as identified on the drawings and/or described herein.

SUBMITTALS:

In accordance with Division 1, Submittals, provide product data for review by the Architect.

PART 2 - PRODUCTS

ACOUSTICAL BLANKET INSULATION:

<u>Manufacturer:</u> This specification is based on mineral wool insulation products manufactured by Owens/Corning. Mineral Wool Products by other manufacturers which meet or exceed these specifications or that implied by reference to the named manufacturer will be considered.

Material: Size: 3 1/2" thick x 24" or 16" wide as required to suit stud spacings.

<u>Accessories:</u> Provide additional materials to complete the work including USG Acoustical sealant for application as recommended by the manufacturer.

PART 3 - EXECUTION

Install acoustical blanket in accordance with manufacturer's written recommendations. Do not install damp or wet material, and fill all voids.

END OF SECTION 09 54 10

SECTION 09 65 00 - RESILIENT FLOORING

PART 1 GENERAL

DESCRIPTION OF WORK:

Extent of resilient flooring and accessories is shown on drawings and in the finish schedule. Work includes: Vinyl tile flooring.

QUALITY ASSURANCE:

Manufacturers: Provide each type of resilient flooring and accessories as produced by a single manufacturer, including recommended primers, adhesives, sealants, and leveling compounds.

SUBMITTALS:

In accordance with Section 01 33 00, Submittals, provide product data; manufacturer's standard color charts in form of actual sections of resilient flooring, for each type of resilient flooring required; certification for fire test performance; and maintenance instructions.

EXTRA STOCK:

Deliver stock of maintenance materials to Owner. Furnish maintenance materials from same manufactured lot as materials installed and enclosed in protective packaging with appropriate identifying labels.

Tile Flooring: Furnish not less than one box for each 50 boxes or fraction thereof, for each type, color, pattern, and size installed.

PROJECT CONDITIONS:

Maintain minimum temperature of 65 degrees F. (18 degrees C.) in spaces to receive resilient flooring for at least 48 hours prior to installation, during installation, and for not less than 48 hours after installation.

Contractor shall make a thorough inspection of all surfaces to receive the specified product. If in the opinion of the Contractor, the substrate should receive a concrete sealing agent or waterproofing material prior to application of the resilient flooring, then the Contractor shall provide said product and apply it. In any case, once the Contractor has commenced with installation of the flooring, adhesive and tile, it shall be understood that the Contractor accepts the floor substrate as being satisfactory for installation of the finish material. If at a later date during the 1 year warranty period (from the date of overall substantial completion), there is delamination of tile or deterioration of the installation owing to improper substrate conditions, the Contractor shall immediately replace the specific material in total for the floor affected; and, properly install new material at no additional cost to the Owner.

PART 2 - PRODUCTS

MANUFACTURERS:

For the purpose of designating type and quality these specifications indicate products as a design basis for most items. Should a specific manufacturer and/or color be indicated on the finish schedule, that will govern. Similar products by other manufacturers which meet or exceed this specification will be considered prior to bids in accordance with Section 01 60 00 - Products and Substitutions.

RESILIENT/VINYL TILE FLOORING:

Vinyl Composition Tile: FS SS-T-312, Type IV; 12" x 12" unless otherwise indicated and as follows:

Mfg.: Tarkett Composition 1: Asbestos-free, Gage: 1/8". Color: Shall be as selected by Architect from manufacturer's standards including special accent bands or stripes as selected by architect.

RESILIENT EDGE STRIPS:

Resilient Edge Strips: 1/8" thick, homogeneous vinyl or rubber composition, tapered or bullnose edge not less than 1" wide, color to match flooring or as selected by Architect.

ACCESSORIES:

Adhesives (Cements): Waterproof, stabilized type as recommended by flooring manufacturer to suit material and substrate conditions.

Concrete Slab Primer, Sealing Compound or Waterproofing Material: Non-staining type as recommended by flooring manufacturer.

Leveling and Patching Compounds: Latex type as recommended by flooring manufacturer.

Caulk: Sealant material capable of minor traffic, see section 07900.

PART 3 - EXECUTION

INSPECTION:

Installer shall inspect subfloor surfaces to determine that they are satisfactory. A satisfactory subfloor surface is defined as one that is smooth and free from cracks, holes, ridges, coatings preventing adhesive bond, and other defects impairing performance or appearance.

Perform bond and moisture tests on concrete subfloors to determine if surfaces are sufficiently cured and dry as well as to ascertain presence of curing compounds.

PREPARATION:

Use leveling and patching compounds as recommended by resilient flooring manufacturer for filling small cracks, holes, and depressions in subfloors.

Remove coatings from subfloor surfaces that would prevent adhesive bond, including curing compounds incompatible with resilient flooring adhesives, paint, oils, waxes and sealers.

Broom clean or vacuum surfaces to be covered, and inspect subfloor.

Apply concrete slab primer, if recommended by flooring manufacturer, prior to application of adhesive. Apply in compliance with manufacturer's directions.

INSTALLATION OF TILE FLOORS:

Install resilient flooring using method indicated in strict compliance with manufacturer's printed instructions. Extend resilient flooring into toe spaces, door reveals, and into closets and similar openings.

Lay tile from center marks established with principal walls, discounting minor offsets, so that tile at opposite edges of room area of equal width.

Adjust as necessary to avoid use of cut widths less than 1/2 tile at room perimeters. Lay tile square to room axis, unless otherwise shown.

Match tiles for color and pattern by using tile from cartons in same sequence as manufactured and packaged if so numbered. Cut tile neatly around all fixtures. Broken, cracked, chipped, or deformed tiles are not acceptable.

Lay tile with grain running in direction as selected by architect.

Adhere tile flooring to substrates using full spread of adhesive applied in compliance with flooring manufacturer's directions.

In applications where no floor base is to be installed, provide a 1/8" uniform bead of traffic resistant caulk/sealant along the perimeter of the installation.

CLEANING AND PROTECTION:

Do not wash floor until time period recommended by resilient flooring manufacturer has elapsed to allow resilient flooring to become well-sealed in adhesive.

Damp-mop floor being careful to remove black marks and excessive soil.

Remove any excess adhesive or other surface blemishes, using appropriate cleaner recommended by resilient flooring manufacturers.

Refer to section 01 77 10 for cleaning of resilient flooring prior to date scheduled for inspections intended to establish date of substantial completion in each area of project. Clean resilient flooring by method recommended by resilient flooring manufacturer.

END OF SECTION 09 65 00

SECTION 09 65 10 VINYL BASE

PART 1 GENERAL

DESCRIPTION OF WORK:

Extent of vinyl base is shown on drawings and in the finish schedule.

QUALITY ASSURANCE:

Manufacturers: Provide vinyl base accessories as produced by a single manufacturer, including recommended primers, adhesives, and sealants.

SUBMITTALS:

In accordance with Section 01 33 00, Submittals, provide product data; fire test certifications and manufacturer's standard color charts in form of actual sections of vinyl base.

EXTRA STOCK:

Deliver stock of maintenance materials to Owner. Furnish maintenance materials from same manufactured lot as materials installed and enclosed in protective packaging with appropriate identifying labels.

Furnish not less than one box for each 50 boxes or fraction thereof, for each type, color, pattern, and size installed.

PROJECT CONDITIONS:

Maintain minimum temperature of 65 degrees F. (18 degrees C.) in spaces to receive base for at least 48 hours prior to installation, during installation, and for not less than 48 hours after installation.

PART 2 - PRODUCTS

MANUFACTURERS:

For the purpose of designating type and quality these specifications indicate products as a design basis for most items. Should a specific manufacturer and/or color be indicated on the finish schedule, that will govern. Similar products by other manufacturers which meet or exceed this specification will be considered prior to bids in accordance with Section 01 60 00 - Products and Substitutions.

VINYL BASE:

Provide vinyl base complying with FS SS-W-40, type II, with matching end stops and preformed or molded corner units and as follows:

- Height: 4" (unless noted otherwise)
- Thickness: 1/8"
- Style: Standard top-set cove
- Finish: Matte

- Color: To be selected by Architect from manufacturer's standard range. Manufacturers with a limited color range may be subject to rejection..

ACCESSORIES:

Adhesives (Cements): Waterproof, stabilized type as recommended by flooring manufacturer to suit material and substrate conditions.

Caulk: Sealant material, see section 07 90 00.

PART 3 - EXECUTION

INSPECTION:

Installer shall inspect subfloor surfaces to determine that they are satisfactory. A satisfactory surface is defined as one that is smooth and free from cracks, holes, ridges, coatings preventing adhesive bond, and other defects impairing performance or appearance.

PREPARATION:

Clean all surfaces as recommended by vinyl base manufacturer and fill small cracks, holes, and depressions in walls.

INSTALLATION OF VINYL BASE:

Install vinyl base using method indicated in strict compliance with manufacturer's printed instructions. Extend vinyl base into toe spaces, closets and similar openings. Use molded outside corners throughout.

Adhere to wall substrates using full spread of adhesive applied in compliance with manufacturer's directions.

In applications where no floor base is to be installed, provide a 1/8" uniform bead of traffic resistant caulk/sealant along the perimeter of the installation.

END OF SECTION 09 65 10

SECTION 09 68 13 - CARPET TILE

DESCRIPTION OF WORK

SCOPE OF WORK:

Provide all carpet installation work as required by contract documents and as indicated in the Room Finish Legend.

QUALITY ASSURANCE:

Carpet manufacturer shall have no less than five years of production experience with carpet similar to type specified in this document; and whose published product literature clearly indicates compliance of products with requirements of this section.

Single Source Responsibility: The selected provider must be directly responsible for the quality of the completed floorcovering installation, including both the quality of the materials and labor used in the installations. The selected provider must directly warrant to customer that all products, materials and services related to the floorcovering installation will meet specifications.

Trade Contractor: The selected firm must have no less than five (5) years of successful carpeting experience similar to work of this Section and recommended, trained and approved by the carpet manufacturer. Submit letter from carpet manufacturer stating certification qualifications and acceptance.

SUBMITTALS:

In accordance with Section 01 33 00, provide product and selection data, samples, test results and certification for product compliance.

Submit to Owner two (2) copies of the manufacturer's carpet maintenance instructions, including information needed for the removal of common stains from each type of carpet required.

EXTRA STOCK:

Provide minimum of three percent (3%) overage of calculated yardage for each type of carpet (calculated yardage shall include carpet needed for complete installation plus waste and usable scraps).

PRE-INSTALLATION MEETING:

The manufacturer shall meet at the project site with representatives of end user, General Contractor and the Trade Contractor to review the carpet installation procedure and coordination with other trades. The Trade Contractor must have available at this meeting the carpet manufacturer's installation procedures and instructions for the carpet types specified in the various applications required.

Store carpet in working areas that have been enclosed and have air conditioned environmental conditions as those planned for occupancy. Carpet shall be allowed to reach room temperature or minimum temperature recommended by manufacturer before installation.

Relative humidity in excess of 70 percent may cause moisture gain in carpet constructions and shall be kept to a minimum to avoid installation delays and seaming problems.
WARRANTY:

Provide warranties by Carpet Manufacturer agreeing to replace defective materials during one (1) year warranty period following substantial completion. Also submit the following agreed upon warranties:

- Wear Surface fiber wear shall not be more than 10% by weight in 15 years.
- Static Carpet will remain static generation at less than 3.0 kV at 70° F, and 20% R.H. for a period no less than 15 years.
- No Delamination (chair pads not required) for a period no less than 15 years Antimicrobial preservation properties warranted to be > 90% effective for a period no less than 15 years.
- No Edge Ravel for a period no less than 15 years.
- No Dimensional Instability, i.e. shrinkage, curling and doming which adversely affect the ability of the tile to lay flat for a period no less than 15 years. See Aachen Test.
- Antimicrobial preservation properties warranted to be
 <u>></u> 90% effective for a period no less than 15 years.

Submit manufacturer's certified test results to show that carpet meets or exceeds product performance specification criteria for carpet testing requirements (i.e. see section 2.3 flame, smoke, Aachen test, etc).

Installation service provider agrees to rework any defective carpet handling or installation workmanship during one (1) year warranty period following substantial completion.

PART 2 PRODUCTS

MANUFACTURER:

This specification is based on products manufactured by Tandus Flooring, Dalton, Georgia (800) 248-2878. Products of equal or better quality will be considered up to ten (10) days prior to the bid date.

CARPET TILE:

Styles which are to be considered:

• Abstraction 03590, Solution dyed, Antron Legacy

Colors to be selected by Owner and Architect.

CARPET CONSTRUCTION :

All yarn and carpet shall be manufacturer's first quality and recyclable through an existing Carpet Reclamation Program.

Cushion backing shall contain no PVC, no SB (styrene butadiene) latex or SBR (styrene butadiene rubber) latex. The product shall have a minimum density of 18 lbs. It shall be able to be installed in a manner allowing for future removal without delamination.

FACE CONSTRUCTION:

Construction: Stratatec® Patterned Loop

Face Weight:	18 oz./sq. yd.			
Gauge:	5/64			
Stitches per Inch:	8.8			
Pile Height Average:	0.187 inch			
Fiber System:	Antron Lumena® Minimum 10% Post Industrial Recycled Content			
Dye Method:	Solution Dyed			
Soil/Stain Protection:	Ensure			
Primary Tufting Substra	te: Syntł	netic Non-Woven		
Pattern				
PRODUCT TES	STING/IN	IFORMATION:		
Antimicrobial Chemicals: E2471-05)		No antimicrobials (EPA Registered pesticides) added to product (ASTM		
Electrostatic Propensity:		1.2 kV (AATCC 134), Permanent Conductive Fiber		
Surface Flammability:		Passes CPSC FF 1-70 (ASTM D-2859)		
Flooring Radiant Panel:		Class 1 (mean average CRF: 0.45 w/sq cm or higher)(ASTM E-648)		
Smoke Generation:		Less than 450 (ASTM E-662)		
INSTALLATION METHODS:				

MINIMUM CONSTRUCTION STANDARDS :

Nylon Specification - All nylon fiber shall be branded (premium) type 6,6 or type 6 nylon from DuPont, Solutia or Aquafil with performance certification from the fiber manufacturer.

RS Adhesive System – Full Coverage Peel and Stick

Average pile thickness as determined by ASTM D418.

Antimicrobial, registered by the EPA for use in carpeting, with broad spectrum efficacy against the growth of bacteria and fungi for a minimum of 15 years. The antimicrobial ingredient shall meet standards set by the U.S. General Services Administration (GSA) for Antimicrobial Carpet

Soil/Stain Blocking Treatment

Peel And Stick:

RELATED MATERIALS:

<u>Leveling Compound:</u> Latex type as recommended by carpet manufacturer and is compatible with carpet adhesive and curing/sealing compound on concrete.

<u>Releasable Pressure Sensitive Type Adhesive:</u> Use the following as recommended by the carpet manufacturer which will allow removal of carpet tile at any time without damage or adherence to carpet: Grid Set Adhesive 2000 or Spray Adhesive 5400 with Spray System for GlasBac and GlasBac RE OR Adhesive 2300 or Spray Adhesive 5400 with Spray System for NexStep. Adhesive must contain antimicrobial preservative, have "zero" calculated VOC's and be on "greenlist."

<u>Carpet Edge Guard, non-metallic:</u> Extruded or molded heavy duty vinyl or rubber carpet edge guard of size and profile indicated, and with minimum two inch wide anchorage flange; colors selected by architect/designer from among standard colors available within the industry.

<u>Miscellaneous Materials</u>: As recommended by manufacturer of carpet, cushion and other carpeting products and selected by Trade Contractor to meet project circumstance and requirements.

Electrostatic Dissipation:

- Static Propensity Low generation (\leq 3.0 kV for GlasBac; \leq 3.5 kV for NexStep)
- Surface Resistivity (Burrough's) Across face of carpet (< 2.0 x 10⁹ and >1.5 x 10⁵) or (0.15 to 2000 megaohms)
- Transverse or Volume Resistivity (IBM) Through face of carpet (<2.0 x 10¹⁰ and > 1.5 x 10⁵ ohms) or (0.15 to 2000 megaohms)
- Decay Time to be determined

PART 3 EXECUTION

PRE-INSTALLATION REQUIREMENTS AND PREPARATORY WORK:

The Trade Contractor shall measure all dimensions and other conditions in the field to insure proper fit. Trade Contractor shall be totally responsible for accuracy of his measurements on total yardage requirements. No request for carpet or installation extras from the owner will be considered due to measurement or takeoff errors by the Trade Contractor. The Trade Contractor shall confirm total yardage required, including 3% extra stock along with bid.

Sequence carpeting with other work so as to minimize possibility of damage and soiling of carpet during remainder of construction period. Do no commence carpet installation until painting and finishing work is complete and ceiling and other overhead work has been approved and completed, unless specifically approved by owner's Project Manager, in writing.

Trade Contractor and manufacturer's representative must examine substrates for conditions over which carpeting is to be installed.

New concrete shall be allowed to cure for at least ninety (90) days before carpet installation. Installation cannot begin before it is fully cured.

The temperature of the jobsite must stay within 60° F (15.5° C) and 85° F (29.5° C) throughout the installation and for 2-3 days beforehand. Be sure the heating and air conditioning system is operational.

Trade Contractor must perform moisture emission testing prior to installation over a new or old concrete subfloor. All concrete floors should be tested for moisture emission by using an anhydrous calcium chloride moisture test kit, and paying strict attention to the test kit manufacturer's detailed instructions, including requirements for controlled indoor climate, duration of testing and number of tests to be used. Moisture emissions should not exceed three (3) pounds per 1,000 square feet for 24 hours. If concrete tests higher than 3 pounds, do not proceed with installation.

Trade Contractor must perform alkalinity testing prior to installation over a new or old concrete floor using an alkalinity test kit. The pH test papers should be capable of measuring a range of 0-14. The area to be tested must be weather-tight and conditioned, via the building's HVAC system, to a temperature range of $65^{\circ} - 85^{\circ}$ F and a relative humidity range of 40-60%. This temperature and humidity range must be maintained for at least 48 hours immediately prior to commencing the test, and at all times during the test. Test kit manufacturer's instructions for performing the test must be strictly followed. The slab should have an alkalinity level between 7.0 - 9.0 to be suitable for carpet installation. Do not proceed with the installation if the pH levels fall outside of this range.

Cracks 1/16" or more, holes, unevenness and roughness must be filled, leveled and made smooth with a compatible latex floor patching compound. Prior to filling, the floor must be swept clean of all loose granular debris. After filling, allow filler to dry. Then damp mop the floor with warm water and allow to dry. Vacuum after mopping to insure all loose granular debris is removed and provide a proper substrate to install carpet.

All surfaces to receive carpet shall be clean and dry, and in a condition satisfactory to the Trade Contractor. Then, Trade Contractor shall notify Construction Manager in writing of any conditions which will prevent him from producing satisfactory finish work after above specified preparatory work is completed.

Trade Contractor shall vacuum floors again immediately before installation of carpeting.

Confirm compatibility of adhesive with curing compounds on concrete floors.

Environmental Conditions - Areas to be carpeted must be preheated at a minimum of 68° F for at least 72 hours prior to installation with the relative humidity not more than 65%. A minimum temperature of 50° F shall be maintained thereafter. Carpet and adhesives must be stored at a minimum temperature of 68° F for 72 hours prior to installation.

Once the Trade Contractor commences installation work under this contract, it shall be assumed that the condition of the floor has been accepted and any repairs or further corrections in the floor surface shall become the responsibility of the Trade Contractor.

INSTALLATION:

<u>General:</u> Comply with manufacturer's instructions and recommendations for uniformity of direction carpet installation.

Install carpet under open-bottom obstructions and under removable flanges and furnishings, and into alcoves and closets of each space.

Provide cut outs where required. Conceal cut edges with protective edge guards or overlapping flanges.

Run carpet under open bottom items such as heating convectors and install tight against walls, columns and cabinets so that the entire floor area is covered with carpet. Cover over all floor type door closures.

Install edging guard at all openings and doors wherever carpet terminates, unless indicated otherwise. Prior to installation, report to the Construction Manager all other obstructions which may occur.

Cutting shall be done in accordance with the manufacturer's recommendation, using the tools designed for the carpet being installed. Pattern size or loop integrity shall not be compromised by the trade contractor's use of trace cuts or double cuts on any side seam.

All carpet shall be installed with pile-lay in the same direction, except as indicated by manufacturer's instructions.

Use leveling compound where necessary. Any floor filling or leveling shall have a minimum of 4'0" of feather.

Expansion joints - Do not bridge building expansion joints with continuous carpeting. Provide for movements.

Installation: Install carpet according to carpet manufacturer's printed instructions and in keeping with the Carpet and Rug Institute's Installation Standard.

Installation contractor shall be a Carpet and Rug Institute's certified installation professional.

Tufted patterns must be row-cut on both side seams to maintain pattern integrity.

Maintain pattern integrity on all end seams.

CLEANING AND PROTECTION:

On completion of the installation in each area, all dirt, carpet scraps, etc. must be removed from the surface of the carpet. Any soiling spots or excessive adhesive on the carpet shall be removed with the proper spot remover.

Do not allow construction traffic, other than as may be required to fit up specific carpeted area, to traverse the completed work.

Remove debris, and sort pieces to be saved from scraps to be redirected and recycled.

General Contractor shall protect carpeting against damage during construction. Cover with 6-mil thick polyethylene covering with taped joints during the construction period, wherever protection is required, so that carpet will be without any indication of deterioration, wear or damage at the time of acceptance. Damaged carpeting will be rejected. As the carpet is laid, remove all trimmings, excess pieces of carpet and laying materials from each area as it is completed.

At the completion of the work and when directed by the GC, vacuum carpet using commercial dual motor vacuum of type recommended by carpet manufacturer. Remove spots and replace carpet where spots cannot be removed. Remove rejected carpeting and replace with new carpeting. Remove any protruding yarns with shears or sharp scissors.

Protection of carpeting with craft paper or other suitable covering shall be maintained on each floor or area until accepted, without waiting until the entire project is complete. Covering should permit curing of adhesives while protecting the carpet from construction traffic and debris.

If heavy furniture or equipment is to be moved over areas where carpet tile is already installed, plywood or Masonite board must completely cover area where heavy objects will be rolled or slid.

INSPECTION:

Preliminary Acceptance - Upon completion of the carpet installation of each floor, it shall be inspected by Owner, the GC and Trade Contractor.

Upon completion of the installation, verify that work is complete, properly installed and acceptable. Remove and replace all work not found acceptable to the owner at the installer's expense.

END OF SECTION 09 68 13

SECTION 09 91 00 - PAINTING

PART 1 GENERAL

DESCRIPTION OF WORK:

Extent of painting work is indicated on drawings and schedules, and as herein specified.

Note: The Contractor is advised to review the paint schedule. In all instances as may be possible, each coat of paint color in a multiple coat application will be installed a shade different in order to observe evidence of adequate and proper paint coverage.

Work includes caulking of joints and painting and finishing of interior and exterior exposed items and surfaces throughout project, except as otherwise indicated.

Initial coats of paint may be sprayed at the Contractor's risk, final coats of paint shall be brush or roller applied.

Work includes field painting of exposed bare and covered pipes and ducts (including color coding) and of hangers, exposed steel and iron work, and primed metal surfaces of equipment installed under mechanical and electrical work, except as otherwise indicated.

"Paint" as used herein means all coating systems materials, including primers, emulsions, enamels, stains, sealers and fillers, and other applied materials whether used as prime, intermediate or finish coats.

Surfaces to be Painted: Except where natural finish of material is specifically noted as a surface not to be painted, paint exposed. Where items or surfaces are not specifically mentioned, paint the same as similar adjacent materials or areas. If color of finish is not designated in the schedule, Architect will select these from standard colors or finishes available.

Following categories of work are not included as part of field-applied finish work under this section.

- Surfaces outside/beyond (i.e.: separate rooms) the new, remodeled or renovated areas
- Factory Final-Finished Items
- Concealed Surfaces (unless noted otherwise)
- Factory Final-Finished Metal Surfaces
- Operating Parts
- Sidewalks or other exterior pedestrian traffic surfaces which are specified under civil-site work

Shop priming is included under other sections of these specifications.

Do not paint over any code-required labels, such as Underwriters' Laboratories and Factory Mutual, or any equipment identification, performance rating, name, or nomenclature plates.

Lead based paint shall not be allowed for use on this work.

QUALITY ASSURANCE:

Single Source Responsibility: Provide primers and other undercoat paint produced by same manufacturer as finish coats. Use only thinners approved by paint manufacturer, and use only within recommended limits.

WARRANTY:

The Contractor and paint manufacturer shall jointly and fully warranty the product and installation for one year from the date of Substantial Completion as established by the Owner and Architect.

SUBMITTALS:

In accordance with Division 1, Submittals, provide product data, including paint label analysis and application instructions; architectural color chip selection binders by the manufacturer proposed for the Architect's use in preparing and furnishing the finish "Color Schedule" (This binder shall have colors in minimum 3" x 8" sheets); and samples. Provide a listing of material and application for each coat of each finish sample.

Provide written evidence that sufficient testing has been completed on both new and previously painted surfaces to insure that the new product is acceptable with each surface, material and condition. In the case of previously painted surfaces, the existing paint must be tested to insure it will continue to adhere. Should the existing surface or paint prove inadequate, the contractor shall take whatever steps necessary, including removal of all old coats down to the base material. For this reason, it is recommended that the bidders undertake all inspections and testing prior to or during the bid period.

Preliminary colors will be selected when all other items requiring color selection are received by the architect. The paint contractor must be aware that the number of paint colors is multiple within reason as judged solely by the architect.

- On 12" x 12" hardboard or gypsum board, provide a sample of each preliminary color, with texture to simulate actual conditions. Resubmit samples as requested by Architect until acceptable sheen, color, and texture is achieved.

- On actual wood surfaces, provide a 4" x 8" sample of natural and stained wood finish. Label and identify each as to location and application.

- On actual wall surfaces and other exterior and interior building components, duplicate painted finishes of prepared samples. Provide full-coat finish samples on at least 100 sq. ft. of surface, as directed, until required sheen, color and texture is obtained; simulate finished lighting conditions for review of in-place work.

Final acceptance of colors will be from samples applied on the job.

EXTRA STOCK:

Contractor, at close of project, shall supply to the owner one (1) gallon in unopened container for each type and color of paint selected on the project. Cans will be clearly labeled with color name and number. A list of locations where color was used shall also be provided.

JOB CONDITIONS:

<u>Do not apply paint</u> in rain, fog or mist, or when relative humidity exceeds that permitted by paint manufacturer's printed instructions.

PART 2 - PRODUCTS

ACCEPTABLE MANUFACTURERS:

Manufacturers: Subject to compliance with requirements, provide products of one of the following:

The Sherwin-Williams Co. (SW)

Alternative (equal) products by other manufacturers will be considered before the project bids upon receipt of sufficient product information provided to the Architect at least ten (10) days prior to the bid opening.

MATERIALS:

Material Quality: Provide best quality grade of various types of coatings required.

Color Pigments: Pure, non-fading, applicable types to suit substrates and service indicated.

ACCESSORIES:

Provide all necessary material, equipment and labor to complete the work in total.

INSPECTION:

Notify Contractor in writing of conditions detrimental to proper and timely completion of work. Do not proceed with work until unsatisfactory conditions have been corrected.

Starting of painting work will be construed as Applicator's acceptance of surfaces and conditions within any particular area. Refer to Submittals paragraphs under this section and provide written certification that all necessary inspections and testing have been performed.

Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions otherwise detrimental to formation of a durable paint film.

SURFACE PREPARATION:

General: Perform preparation and cleaning procedures in accordance with paint manufacturer's instructions and as herein specified or otherwise noted, for each particular substrate condition.

Remove hardware, hardware accessories, machined surfaces, plates, lighting fixtures, and similar items in place and not to be finish-painted, or provide surface-applied protection prior to surface preparation and painting operations. Remove, if necessary, for complete painting of items and adjacent surfaces. Following completion of painting of each space or area, reinstall removed items.

Fill small holes with appropriate filler as approved by the architect. Caulk all joints which are not specified to be filled by others.

Cementitious Materials: Determine alkalinity and moisture content of surfaces to be painted by performing appropriate tests. If surfaces are found to be sufficiently alkaline to cause blistering and burning of finish paint, correct this condition before application of paint. Do not paint over surfaces where moisture content exceeds that permitted in manufacturer's printed directions.

Clean concrete floor surfaces scheduled to be painted with a commercial solution of muriatic acid, or other etching cleaner. Flush floor with clean water to neutralize acid, and allow to dry before painting.

Wood: Scrape and clean small, dry, seasoned knots and apply a thin coat of white shellac or other recommended knot sealer, before application of priming coat. After priming, fill holes and imperfections in finish surfaces with putty or plastic wood-filler. Sandpaper smooth when dried.

Prime, stain, or seal wood required to be job-painted immediately upon delivery to job. Prime edges, ends, faces, undersides, and backsides of such wood, including cabinets, counters, cases, paneling.

When transparent finish is required, use spar varnish for backpriming.

Backprime paneling on interior partitions only where masonry, plaster, or other wet wall construction occurs on backside.

Ferrous Metals: Touch-up shop-applied prime coats wherever damaged or bare, where required by other sections of these specifications. Clean and touch-up with same type shop primer.

Galvanized Surfaces: Clean free of oil and surface contaminants with non-petroleum based solvent.

APPLICATION:

General: Apply paint in accordance with manufacturer's directions. Use applicators and techniques best suited for substrate and type of material being applied.

Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Paint surfaces behind permanently-fixed equipment or furniture with prime coat only before final installation of equipment.

Paint interior surfaces of ducts or coves, where visible through registers or grilles, with a flat, nonspecular black paint.

Paint back sides of access panels, and removable or hinged covers to match exposed surfaces.

Finish exterior doors on tops, bottoms and side edges same as exterior faces, unless otherwise indicated.

Sand lightly between each succeeding enamel or varnish coat.

Omit first coat (primer) on metal surfaces which have been shop-primed and touch-up painted, unless otherwise indicated.

Minimum Coating Thickness: Apply materials at not less than manufacturer's recommended spreading rate, to establish a total dry film thickness as indicated or, if not indicated, as recommended by coating manufacturer.

Mechanical and Electrical Work: Painting of mechanical and electrical work is limited to those items exposed in mechanical equipment rooms and in occupied spaces.

Mechanical items to be painted include, but are not limited to, the following:

Exposed piping, pipe hangers, and supports. Heat exchangers and supports. Tanks and supports. Exposed ductwork and insulation not in mechanical rooms. Mechanical equipment, and supports. Accessory items.

Electrical items to be painted include, but are not limited to, the following:

Conduit and fittings.

Switchgear.

Prime Coats: Apply prime coat of material which is required to be painted or finished, and which has not been prime coated by others.

Stipple Enamel Finish: Roll and redistribute paint to an even and fine texture. Leave no evidence of rolling such as laps, irregularity in texture, skid marks, or other surface imperfections.

Pigmented (Opaque) Finishes: Completely cover to provide an opaque, smooth surface of uniform finish, color, appearance and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness or other surface imperfections will not be acceptable.

Transparent (Clear) Finishes: Use multiple coats to produce glass-smooth surface film of even luster. Provide a finish free of laps, cloudiness, color irregularity, runs, brush marks, orange peel, nail holes, or other surface imperfections.

FIELD QUALITY CONTROL:

The right is reserved by Owner to invoke the following material testing procedure at any time, and any number of times during period of field painting:

- Engage services of an independent testing laboratory to sample paint being used. Samples of materials delivered to project site will be taken, identified and sealed, and certified in presence of Contractor.

- Testing laboratory will perform appropriate tests for any or all of following characteristics: Abrasion resistance, apparent reflectivity, flexibility, washability, absorption, accelerated weathering, dry opacity, accelerated yellowness, recoating, skinning, color retention, alkali resistance and quantitative materials analysis.

If test results show that material being used does not comply with specified requirements, Contractor may be directed to stop painting work, and remove non-complying paint; pay for testing; repaint surfaces coated with rejected paint; remove rejected paint from previously painted surfaces if, upon repainting with specified paint, the two coatings are non-compatible.

CLEAN-UP AND PROTECTION:

Clean-Up: During progress of work, remove from site discarded paint materials, rubbish, cans and rags at end of each work day.

Upon completion of painting work, clean window glass and other paint-spattered surfaces. Remove spattered paint by proper methods of washing and scraping, using care not to scratch or otherwise damage finished surfaces.

Protection: Protect work of other trades, whether to be painted or not, against damage by painting and finishing work. Correct any damage by cleaning, repairing or replacing, and repainting, as acceptable to Architect.

Provide "Wet Paint" signs as required to protect newly-painted finishes. Remove temporary protective wrappings provided by others for protection of their work, after completion of painting operations.

PART 4 - EXTERIOR PAINT SCHEDULE

<u>General</u>: Provide the following paint systems for the various substrates, as indicated or selected by the architect.

Concrete and Stucco: (typical exterior paint)

High Build Acrylic (semigloss) finish having two finish coats over base coat

- Base Coat:

SW: Loxon Acrylic Masonry Surfacer, A24W-200

- Base Coat:

SW: Ultra Crete, Acrylic Textured Coating, A44W800

- Third Coat: SW: DTM Acrylic Coating, B66-200

Brick:

- Single 'Flood' Coat: SW: HB150

Ferrous Metal:

Semi-Gloss Alkyd Enamel: 2 finish coats over primer.

- Prime Coat: Non-lead based primer. (Primer is not required on items delivered properly shop primed.):
- SW: Kem Kromik Universal Metal Primer B50NZ

- Second and Third Finish Coats: Semi-Gloss Alkyd Enamel (FS TT-E-529, Class A): SW: Metalastic DTM B55

Zinc-Coated Metal:

High Gloss Alkyd Enamel: 2 finish coats over primer

- Prime Coat: SW: Pro-Cryl Universal Metal Primer, B66-310

- Second and Third Finish Coats: High Gloss Alkyd Enamel (FS TT-E-489): SW: Industrial Enamel HS, B54WZ

<u>Aluminum</u>:

High Gloss Alkyd Enamel: 2 finish coats over primer

Same as above for Zinc-Coated Metal.

INTERIOR PAINT SCHEDULE:

<u>General</u>: Provide the following paint systems for the various substrates, as indicated or as selected by the architect.

<u>Concrete (floors):</u> Urethane high gloss finish: 1 coat over primer -Primer Coat: SW: Armorseal #33 – Epoxy Primer/Sealer

-Second Coat: Gloss Urethane paint SW: Armorseal #650 SL/RC – Self Leveling/Recoatable Epoxy

Concrete Masonry Units:

Semi-gloss Emulsion Finish: 2 finish coats over filled or primed surface.

- Primer Coat:

SW: Loxon Acrylic Masonry Surfacer, A24W-200

- Two Finish Coats: Interior Semi-Gloss Latex (FS TT-P-1511B)
- SW: Pro-Mar 200 Semi-Gloss Enamel Latex

Gypsum Drywall Systems:

Lusterless or Semi Gloss Emulsion Finish: 2 coats over primer - Primer Coat: Interior Latex Base Primer Coat (FS TT-P-650) SW: Pro-Mar Latex Wall Primer – B28W200

- Second and Third Coats: Interior Semi Gloss Latex Base Paint (FS TT-P-1151a) SW: Pro-Mar 200 Latex Semi Gloss Enamel Wall Paint – B31W200

Epoxy (catalyzed 2 part) Semi Gloss Finish: 3 coats with total dry film thickness not less than 2.5 mils finish coats

Primer Coat:

SW: ProMar 200 Latex Wall Primer – B28W200

- Second and Third Coats:

SW: Water Based Catalyzed Epoxy B70 with B60V25

Ferrous Metal:

Semi-Gloss Enamel Finish: 2 coats over primer, with total dry film thickness not less than 2.5 mils.

- Prime Coat: Use applicable non-lead based primer (prime coat is not required on items delivered shop primed.)
- Second and Third Finish Coats: Interior Enamel SW: Pro-Mar Alkyd Semi-Gloss Enamel

Zinc-Coated Metal:

Semi-Gloss Finish: 2 coats over primer, with total dry film thickness not less than 2.5 mils - Prime Coat: Zinc Dust - Zinc Chromate Primer Coating (FS TT-P-641).

- Second and Third Coats: Interior Enamel SW: Pro-Mar Alkyd Semi-Gloss

Painted Woodwork and Hardboard Faced Doors:

Semi-Gloss Enamel Finish: 3 coats

- First Coat: Interior Enamel Undercoat (FS TT-E-543) SW: Wall and Wood Primer

-Second and Third Coats: Odorless Interior Semi-Gloss Enamel (FS TT-E-509) SW: Pro-Mar Alkyd Semi-Gloss Enamel

Factory Finished Wood Doors:

Wood doors are specified in Section 08 20 00, page 4, are to be factory finished; therefore, do not include cost of painting those doors in bid.

Note that hardboard faced doors require field painting and are specified in Section 08 21 00.

See door schedule to determine which doors are hardboard which are wood faced. END OF SECTION 09 91 00

SECTION 10 11 00 - MARKERBOARDS

PART 1 - GENERAL

DESCRIPTION OF WORK:

Extent of markerboards is shown on drawings.

QUALITY ASSURANCE:

Manufacturer: Unless otherwise acceptable to Architect, furnish all markerboards by one manufacturer for entire project.

SUBMITTALS:

In accordance with Division 1, Submittals, provide product data, shop drawings, samples, color selection chips and certification for review.

SPECIAL PROJECT WARRANTY:

Provide written warranty, signed by manufacturer, agreeing to replace, within warranty period, porcelain enamel markerboards which do not retain original writing and erasing qualities defined to include surfaces which exhibit crazing, shadowing, discoloration, cracking or flaking; provided manufacturer's instructions for handling, installing, protecting and maintaining boards have been adhered to during the warranty period. Replacement is limited to material only and does not include labor for removal and reinstallation.

Warranty Period: 25 years from date of substantial completion.

PART 2 - PRODUCTS

MANUFACTURER:

Subject to compliance with requirements, products which may be included into the work include those by Greensteel, Inc. or Claridge Products and Equipment, Inc. Other manufacturers will be considered prior to bids per Section 01600, Products and Substitutions.

MATERIALS:

Colors: Provide colors as selected by Architect from manufacturer's full range of standards. Selections will be made once all items requiring color selection are received.

Markerboards:

Markerboards shall be porcelain enamel on metal, factory laminated to backer board and framed.

Facing Sheet: As required for size 18-23 gage.

Core: Minimum 1/2 " particleboard bonded to moisture proof aluminum foil (0.015" thick) backing sheet with flexible adhesive.

Frame: Extruded aluminum complete with tray and display rail with cork insert, side trim and mullions.

Fastening: Concealed continuous hanger.

Trim and Accessories:

General: Fabricate frames and trim of not less than 0.062" thick aluminum alloy, size and shape as indicated, to suit type of installation. Provide straight, single-length units wherever possible and keep joints to minimum. Miter corners to neat, hairline closure.

Where size of boards or other conditions exist which require support in addition to normal trim, provide structural supports or modify trim as indicated or if not indicated, as selected by Architect from manufacturer's standard structural support accessories to suit condition shown.

Clear Anodized Finish: Manufacturer's standard satin anodized finish with clear anodic coating complying with AA requirements for Class II Architectural Coating (AA-A31).

Field-Applied Trim: Provide snap-on trim, with no visible screws or exposed joints, or slip-on trim, to eliminate grounds.

Marker Trough: Furnish continuous aluminum troughs for each markerboard of solid extrusion, manufacturer's standard ribbed section, with exposed ends smoothly curved.

PART 3 - EXECUTION

PREPARATION:

Field Measurements: Take field measurements prior to fabrication where possible, to ensure proper fitting of work. However, allow for trimming and fitting wherever taking of field measurements before fabrication might delay work.

INSTALLATION:

Deliver factory-built markerboard units completely assembled in one piece without joints, whenever possible. Where dimensions exceed panel size, provide 2 or more pieces of equal length as acceptable to Architect. When overall dimensions require delivery in separate units, prefit at factory, disassembled for delivery, and make final joints at site. Use splines at joints to maintain surface alignment.

Install units in locations and mounting heights as shown on drawings and in accordance with manufacturer's instructions, keeping perimeter lines straight, plumb, and level. Provide all grounds, clips, backing materials, adhesives, brackets, anchors, trim and accessories for complete installation.

Coordinate job-assembled units with grounds trim, and accessories. Join all parts with neat, precision fit.

ADJUST AND CLEAN:

Verify accessories required for each unit properly installed and operating units properly functioning.

END OF SECTION 10 11 00

SECTION 10 11 13 - TACKABLE WALL PANELS

PART 1 GENERAL

DESCRIPTION OF WORK:

The extent of this work is identified on the drawings.

SUBMITTALS:

In accordance with Section 01 33 00, Submittals, provide product data, manufacturers color samples and charts, large samples of selected items, certificate regarding fire resistance and copies of product warranty for review by the Architect.

<u>Extra Materials</u>: Provide extra wall panel materials in unopened, clearly marked cartons equivalent to 2% of the total quantity of installed acoustical panel material for each color selected.

QUALITY CONTROL:

<u>Environmental Requirements:</u> The building shall be enclosed; the air conditioning system shall be operating with proper filters in place; and the proper temperature and humidity conditions shall be stabilized before, during and following installation until substantial completion. Building areas to receive walls shall be free of construction dust and debris.

PART 2 - PRODUCTS

MANUFACTURER:

This specification is based on wall system products manufactured by USG Interiors. Equal products by other manufacturers which meet or exceed this specification will be considered per Section 01 60 00 Products and Substitutions.

VERTICAL PANELS:

Model: MICOR "300" Substrate: Mineral fiber, Class 'A', perforated Panel Width: 48" Panel Height: As required Thickness: 1/2" core for vinyl with bevelled edge NRC: .35

Fabric: Factory laminated tack-tex, self healing, Class 'A", vinyl, in color(s) as selected by Architect.

ACCESSORIES:

Provide edge trim, concealed fasteners, clips, adhesive, 'J' moldings, etc. to complete installation of system. Where available in colors, provide samples for Architect's selection.

PART 3 - EXECUTION

INSTALLATION:

Install the specified products in accordance with the manufacturer's written recommendations for the substrate type. Refer to interior elevations and plans for exact position of certain locations.

When acoustical wall treatment extends full height and full length of wall, it shall be installed from 1/4" above the finish wall base and extend above the ceiling track. When acoustical wall treatment is not noted to cover the entire wall, it shall start at top of wall base and extend to touch ceiling track and be wrapped with extruded aluminum trim.

Provide cut outs and adequate back blocking for wall mounted item in order that these items are flush to the front face of the acoustical surface. This includes light switches, outlets, light fixtures, etc.

Provide adequate edging and trim as detailed or as selected by the architect via submittals. Panel edges and joints shall be planned in a manner to be uniform, protected and symmetrical.

All edges at tops, bottoms and sides shall receive metal (extruded aluminum) trim except as follows:

- Where acoustical panel butts another acoustical panel
- Where acoustical panel extends above the suspended acoustical ceiling track
- Where acoustical panel is covered by trim by others

Any relatively smooth interior surface such as drywall or plaster is suitable. For block, brick or concrete, first apply a polyethylene film to the wall as an airflow and vapor barrier, and then apply horizontal furring strips.

PROTECTION:

Protect wall covering from damage prior to turning over the building to the Owner.

END OF SECTION 10 11 13

SECTION 10 14 00 - IDENTIFYING DEVICES

PART 1 - GENERAL

DESCRIPTION OF WORK:

The work includes various signs to be provided as noted or scheduled.

SUBMITTALS:

In accordance with Division 1, Submittals, provide product data on sign material and accessories, mock up drawings of actual signs to be provided for review by Architect.

QUALITY ASSURANCE:

Signage shall be provided by a company that has been producing signage of the specified type for at least 5 years. The manufacturer and supplier shall be fully familiar with the requirements of "ADA" guidelines and shall notify the Architect of any discrepancies 10 days <u>prior</u> to the bid opening or will be prepared to rectify the problem at no cost to the owner thereafter.

PART 2 - PRODUCTS

ROOM/BUILDING DIRECTIONAL SIGNS:

Style: Flat panel (wall mount) ULTRAMATTES front engraveable.

Construction: 1/8" thick acrylic plastic substrate, exterior quality.

Letters, Pictograms and Braille: Raised image relief height 1/32" by chemical weld process using 3M464XL adhesive.

Letter Style: Helvetica or equivalent, caps only.

Background Colors: To be as selected by Architect.

Manufacturer: This specification is based on products manufactured by The ROWMARK Company. Products of other manufacturers will be considered prior to bids in accordance with Section 01600 Products and Substitutions.

MISCELLANEOUS SIGNAGE:

Provide miscellaneous signage for fire or smoke walls/partitions (painted stencil) locations.

Miscellaneous signage/markings for mechanical and electrical piping and equipment is noted under Division 15 and 16 sections.

ACCESSORIES:

Provide other items as necessary to complete the installation of work specified in this section.

PART 3 - EXECUTION

Install signs in locations as indicated by the sign schedule or directed by the Architect. Install interior signs to meet with ADA requirements.

Room identification signs are separate from symbols signs and are to be mounted in combinations as directed by the architect.

Affix signs to surfaces in a manner as recommended by the manufacturer and accepted by the Architect. Corridor partitions, smoke-stop partitions, horizontal exit partitions, exit enclosures, and fire walls shall be effectively and permanently identified with stenciling (in concealed areas) in a manner acceptable to the authority having jurisdiction. Such identification shall be above any decorative ceiling and in concealed spaces. Suggested wording, "Fire Barrier, Protect All Openings", or "Fire and Smoke Barrier - Protect All Openings", as applicable.

PART 4 - SIGN SCHEDULE

It is the intent of this specification to require at least one (1) room sign for each and every room in the new facility.

INDIVIDUAL TOILET ROOMS

Quantity	Size	Copy (plus room #)
1 each 1 each 1 each	4.5" x 9" 4.5" x 4.5"	BOYS, GIRLS, MEN OR WOMEN Gender symbol HDCP symbol

UNISEX TOILET ROOMS
QuantityCopy (plus room #)1 each4.5" x 9"FAMILY
HDCP symbol

ALL OTHER ROOMS OR ROOMS WITHIN ROOMS				
Quantity	Size	Copy (plus room #)		
1 each *	4.5" x 9	As directed by architect		

* Unless room has multiple entry doors from main corridors or from exterior, then provide on sign at each entry door

ADDITIONA	L SIGNAGE	
Quantity	Size	Сору
2 each	4.5" x 9"	MAXIMUM OCCUPANCY # (at Multipurpose, # by Architect)
4 each	4.5" x 9'	MAXIMUM OCCUPANCY # (at Media Center, # by Architect)

END OF SECTION 10 14 00

SECTION 10 26 13 HIGH IMPACT CORNER GUARDS

PART 1 GENERAL

SUMMARY OF WORK:

Provide all material, including standard accessories and trim, and installation of corner guards where noted on the drawings.

SUBMITTALS:

In accordance with Section 01 33 00, Submittals, provide product data, shop drawings and color and pattern samples of sufficient magnitude and detail to fully describe the final application as intended.

PROJECT CONDITIONS:

Wallcovering shall not be stored on site or installed until the building is dried-in; and the HVAC system operating in order that humidity control is achieved. All windows, doors and openings shall be completed so as to insure closing for the structure.

PART 2 - PRODUCTS

ACCEPTABLE MANUFACTURERS:

This specification is based on products as manufactured by Construction Specialties, 800-233-8493 (<u>www.c-sgroup.com</u>). Equal products will be considered prior to bid and in accordance with Section 01 60 00 - Products and Substitutions.

RECESSED MOUNTED CORNER GUARDS:

Cover guard material shall be vinyl acrylic extrusions in nominal wall thickness of .078.

Style shall be the Flush series, ACROVYN FS Series and FS-20R or 1-HR series (full height from base top to finish ceiling).

ACCESSORIES:

Cover guards shall be provided complete with all necessary accessories including but not limited to anchors, end caps, adhesives and etc.

INSTALLATION:

Installation shall be in strict accordance with manufacture's written recommendations and as accepted by the architect thru the submittal review.

END OF SECTION 10 26 13

SECTION 10 28 00 - TOILET AND BATH ACCESSORIES

PART 1 - GENERAL

DESCRIPTION OF WORK:

The work includes the items specified herein and/or shown in the drawings.

SUBMITTALS:

In accordance with Section 01 33 00, Submittals, provide product data for review by the Architect.

PART 2 - PRODUCTS

MANUFACTURER:

Product described herein are manufactured by A & J Washroom Accessories of New Windsor, New York (914) 562-3332. Similar products by other manufacturers which meet or exceed these specifications may be considered.

SOAP DISPENSERS (MARK 'A'):

Type: Surface mounted disposable valve cartridge soap dispenser, #U144.

PAPER TOWEL DISPENSER (MARK 'B'):

Model: Surface mounted 'C' fold/multifold paper towels, #U180A.

MIRRORS (MARK 'C'):

Flush Wall Mounted: #U700 18" X 30" over each lavatory.

Mirror: No. 1 quality, 1/4" tempered glass silver coated and sealed with electrolytic copper plating.

TOILET PAPER DISPENSER (MARK 'D'):

Type: Surface Mounted TP dispenser, #U814.

GRAB BARS (MARK 'E'):

Type: Concealed flange style #UG30X, Type A

Sizes: One 36" and one 42" Type A at each restroom/stall noted with grab bars.

SURFACE SANITARY NAPKIN DISPOSAL (MARK 'F'):

Model: Surface Mounted Disposal: #U590.

PAPER TOWEL DISPENSER & DISPOSAL (MARK 'G'):

Model: Surface mounted towel dispenser and disposal unit (recessed) #U648.

PART 3 - EXECUTION

GENERAL:

Install each item in accordance with the manufacturer's instructions and as required by current accessibility codes. Confirm all items, particularly owner furnished items, types and mounting locations prior to installation of any blocking. Review all heights with Architect prior to installation and rough-in.

Provide concealed, pressure treated blocking in wall for all items.

Provide fasteners as appropriate to the wall construction.

END OF SECTION 10 28 00

SECTION 10 44 00 - FIRE EXTINGUISHERS & CABINETS

PART 1 - GENERAL

DESCRIPTION OF WORK:

This work includes new fire extinguishers, cabinets and wall brackets where located on the drawings.

SUBMITTALS:

In accordance with Division 1, Submittals, Section 01 33 00, provide product data.

PART 2 - PRODUCTS

MANUFACTURER:

Products identified here are manufactured by J.L. Industries, Bloomington Minnesota and Larsen Manufacturing Co., Minneapolis, Minnesota. Similar products by other manufacturers which meet or exceed the specification may be considered.

EXTINGUISHERS:

Designation: Cosmic E for wall and cabinet mounting, J-L Model #5.

Style: Multi-purpose, dry chemical type for Class A, B, and C fires.

Rating: Minimum UL rating = 4A-60BC, meeting Underwriter's Standard 299.

Capacity: 10 lb., minimum.

Construction: Seamless steel shell, high test UL hose and horn, red enamel finish.

Features: Machined aluminum valve, visual pressure gauge.

FIRE EXTINGUISHER CABINET:

Fire extinguisher cabinet shall be equal to model C3115 as manufactured by Larsen's Manufacturing Co.

Mounting type - recessed /or semi recessed and fire rated depending on substrate or wall.

Trim - Flat, brushed satin finished aluminum.

Door: Clear plexiglass door convex bubble with aluminum frame.

Hardware: Provide handle, matching trim, continuous hinge and self adjusting roller catch.

Sign: Provide die cut lettering that adheres to inside of bubble or wall of cabinet.

ACCESSORIES:

Where cabinets are not shown required, provide wall brackets which hold extinguisher securely in place via ledger and strap with finger release. Provide other materials as necessary to complete the work.

PART 3 - EXECUTION

Contractor shall install Portable Fire Extinguishers with top not more than 54" above the floor, recessed or flush mounted, in locations as indicated by Architect.

Contractor shall be responsible for filling and servicing Extinguishers until final acceptance.

Upon completion of installation, contractor shall verify that all units have and are maintaining a full charge, are in proper operating order and bear appropriate inspection tags with expiration date of not less than 11 months after substantial completion.

END OF SECTION 10 44 00

SECTION 10 67 00 - SHELVING

PART 1 - GENERAL

DESCRIPTION OF WORK:

Provide shelving units for use in Storage Closets, where shown on the drawings.

SUBMITTALS:

In accordance with Section 01 33 00, submittals, provide product data for review by Architect.

PART 2 - PRODUCTS

MANUFACTURER:

Products described herein are manufactured by PENCO PRODUCTS, Oaks, Pennsylvania. Products by other manufacturers which meet or exceed these specifications will be considered prior to bids per section 01 60 00.

SHELVING UNITS:

Type: Heavy duty industrial grade steel shelving.

Size: 36" width, 18" depth (unless noted otherwise)

Number of Shelves: 7 shelves

Construction: Posts, roll formed box posts punched on 1" centers, offset angle posts at rear Clips, heavy duty compression clips, 14 gauge, zinc plated Shelves, 1 3/16" high flange with (2) 7/16" return flanges and welded corners, 18 gauge, positive shelf seating Sides and back panels, 24 gauge steel, punched for bolting

ACCESSORIES:

Provide fasteners, panels, braces, etc. as required for a sturdy, free standing rigid shelf unit.

PART 3 - EXECUTION

GENERAL:

Erect shelving units in accordance with manufacturer's recommendations.

Set in place as shown on drawings.

Adjust and level shelving unit to prevent rocking and sway and attach to wall stud with two screws/fasteners per shelving unit.

END OF SECTION 10 67 00

SECTION 11 52 13 - MANUAL PROJECTION SCREENS

PART 1 - GENERAL

DESCRIPTION OF WORK:

Extent of projection screens is shown on drawings and specified and scheduled herein.

Types of projection screens required include:

- Front projection screens, manually operated.

QUALITY ASSURANCE:

Provide each type of projection screen as a complete unit produced by a single manufacturer, including necessary mounting brackets, accessories, fittings and fastenings.

FIRE PERFORMANCE CHARACTERISTICS:

Provide projection screen fabrics identical to those materials which have undergone testing and passed requirements for flame resistance as indicated below:

NFPA 701 per small scale test.

Federal Standard 191A/5903 for test method. FS GG-S-00172D(1) for flame resistance.

MILDEW RESISTANCE:

Provide mildew resistant screen fabrics as determined by Federal Standard 191A/5960.

SUBMITTALS:

In accordance with Division 1, Submittals, provide product data, shop drawings and color chips for review.

DELIVERY, STORAGE & HANDLING:

Do not deliver projection screens until building is enclosed and ready for screen installation. Protect screens from damage during delivery, handling, storage and installation.

PART 2 - PRODUCTS

MANUALLY-OPERATED FRONT PROJECTION SCREENS:

General: Provide manufacturer's standard units consisting of case, screen, mounting accessories and other components as required for a complete installation and complying with descriptive requirements indicated below.

Spring-Roller-Operated Projection Screens: Units designed and fabricated for wall or ceiling installation and complying with the following requirements.

Screen Case: Fabricated in one piece from not less than 22-gage steel with flat back design, vinyl-covered or baked-enamel finish as selected by the Architect, and end caps with integral roller brackets and furnished with universal mounting brackets in finish matching end caps to enable attachment to wall or ceiling.

Screen: Mildew and flame resistant glass fiber fabric with vinyl-coated viewing surface complying with requirements indicated below, the top edge mounted on, and securely anchored to a 3" diameter rigid steel spring roller and bottom edge formed into a pocket holding a tubular metal slat, with ends of rod protected by plastic caps containing a screw-attached saddle and pull.

Size of Viewing Surface: 70" X 70" (classrooms)

Type of Viewing Surface: Matte white with minimum gain characteristics complying with FS GG-S-00172D(1) for Type A screen surface.

Edge Treatment: Black masking borders.

Accessories: Provide pull cord, wall brackets and other miscellaneous accessories as required to install projection screens at heights and locations noted.

Products: Subject to compliance with requirements, manufacturers offering products which may be incorporated into the work include those listed below. Other manufacturers may be considered prior to acceptance of bids.

"Vidio" B; Da-Lite Screen Co., Inc. Luma 2; Draper Shade & Screen Co. 200 Series; Bredford Manufacturing, Ltd.

PART 3 - EXECUTION

INSTALLATION:

Install projection screen units and accessories at locations shown in accordance with manufacturer's instructions. Install level, plumb, secure, and recessed at proper height. Coordinate with other trades to provide blocking for securing projection screen units to finished surfaces. Repair or replace damaged units as directed by Architect.

Provide protections for installed units so that they will be in satisfactory operating condition, without damage at completion of project.

END OF SECTION 11 52 13

SECTION 220500 - COMMON WORK RESULTS FOR PLUMBING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Piping materials and installation instructions common to most piping systems.
 - 2. Transition fittings.
 - 3. Dielectric fittings.
 - 4. Sleeves.
 - 5. Escutcheons.
 - 6. Grout.
 - 7. Plumbing demolition.
 - 8. Equipment installation requirements common to equipment sections.
 - 9. Painting and finishing.
 - 10. Concrete bases.
 - 11. Supports and anchorages.

1.3 DEFINITIONS

- A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.
- B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
- C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
- D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in chases.
- E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.
- F. The following are industry abbreviations for plastic materials:
 - 1. CPVC: Chlorinated polyvinyl chloride plastic.

COMMON WORK RESULTS FOR PLUMBING

- 2. PE: Polyethylene plastic.
- 3. PVC: Polyvinyl chloride plastic.

1.4 SUBMITTALS

- A. Product Data: For the following:
 - 1. Transition fittings.
 - 2. Dielectric fittings.
 - 3. Escutcheons.

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 Plumbing Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

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 plumbing installations.
- B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.
- C. Coordinate requirements for access panels and doors for plumbing items requiring access that are concealed behind finished surfaces. Access panels and doors are specified in Division 08 Section "Access Doors and Frames."

PART 2 - PRODUCTS

2.1 PIPE, TUBE, AND FITTINGS

- A. Refer to individual Division 22 piping Sections for pipe, tube, and fitting materials and joining methods.
- B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.2 JOINING MATERIALS

- A. Refer to individual Division 22 piping Sections for special joining materials not listed below.
- B. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
 - 1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.
 - a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
 - b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.
 - 2. AWWA C110, rubber, flat face, 1/8 inch thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.
- C. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.
- D. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
- E. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated; and AWS A5.8, BAg1, silver alloy for refrigerant piping, unless otherwise indicated.
- F. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
- G. 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.

2.3 TRANSITION FITTINGS

- A. AWWA Transition Couplings: Same size as, and with pressure rating at least equal to and with ends compatible with, piping to be joined.
 - 1. Underground Piping NPS 2 and Larger: AWWA C219, metal sleeve-type coupling.

B. Flexible Transition Couplings for Underground Nonpressure Drainage Piping: ASTM C 1173 with elastomeric sleeve, ends same size as piping to be joined, and corrosion-resistant metal band on each end.

2.4 DIELECTRIC FITTINGS

- A. Description: Combination fitting of copper alloy and ferrous materials with threaded, solderjoint, 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.
- D. Dielectric-Flange Kits: Companion-flange assembly for field assembly. Include flanges, fullface- or ring-type neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.
 - 1. Separate companion flanges and steel bolts and nuts shall have 150- or 300-psig minimum working pressure where required to suit system pressures.
- E. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig minimum working pressure at 225 deg F.

2.5 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. Molded PVC: Permanent, with nailing flange for attaching to wooden forms.
- D. PVC Pipe: ASTM D 1785, Schedule 40.
- E. Molded PE: Reusable, PE, tapered-cup shaped, and smooth-outer surface with nailing flange for attaching to wooden forms.

2.6 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 and rough brass.
- D. Split-Casting, Cast-Brass Type: With concealed hinge and set screw.
 - 1. Finish: Polished chrome-plated and rough brass.
- E. One-Piece, Stamped-Steel Type: With set screw or spring clips and chrome-plated finish.
- F. Split-Plate, Stamped-Steel Type: With hinge, set screw or spring clips, and chrome-plated finish.

2.7 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 PLUMBING DEMOLITION

- A. Refer to Division 01 Section "Cutting and Patching" and Division 02 Section "Selective Structure Demolition" for general demolition requirements and procedures.
- B. Disconnect, demolish, and remove plumbing systems, equipment, and components indicated to be removed.
 - 1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap 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. Equipment to Be Removed: Disconnect and cap services and remove equipment.
 - 4. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
 - 5. 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 22 Sections specifying piping systems.
- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.
- D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- F. Install piping to permit valve servicing. Valves located above ceilings shall be positioned no further than arms length away from accessible ceiling opening.
- 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. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, castbrass type with polished chrome-plated finish.
 - d. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, cast-brass type with polished chrome-plated finish.
 - 2. Existing Piping: Use the following:
 - a. Chrome-Plated Piping: Split-casting, cast-brass type with chrome-plated finish.
 - b. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split-casting, castbrass type with chrome-plated finish.
 - c. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split-plate, stamped-steel type with concealed hinge and spring clips.

- d. Bare Piping at Ceiling Penetrations in Finished Spaces: Split-casting, cast-brass type with chrome-plated finish.
- e. Bare Piping at Ceiling Penetrations in Finished Spaces: Split-plate, stamped-steel type with concealed hinge and set screw.
- M. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs.
- N. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.
 - 1. Cut sleeves to length for mounting flush with both surfaces.
 - a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring 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. Steel Pipe Sleeves: For pipes smaller than NPS 6.
 - b. Steel Sheet Sleeves: For pipes NPS 6 and larger, penetrating gypsum-board partitions.
 - 4. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using joint sealants appropriate for size, depth, and location of joint. Refer to Division 07 Section "Joint Sealants" for materials and installation.
- O. 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.
- P. Verify final equipment locations for roughing-in.
- Q. 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 22 Sections specifying piping systems.
- B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.

- E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.
- F. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - 1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
 - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- G. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.
- H. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.
- I. 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.

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. 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 plumbing equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.

D. Install equipment to allow right of way for piping installed at required slope.

3.6 PAINTING

- A. Painting of plumbing systems, equipment, and components is specified in Division 09 Sections "Interior Painting" and "Exterior Painting."
- B. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.7 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. As specified in Division 03 Section.

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 plumbing 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 plumbing materials and equipment.
- B. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.
- C. Attach to substrates as required to support applied loads.

3.10 GROUTING

- A. Mix and install grout for plumbing equipment base bearing surfaces, pump and other equipment base plates, and anchors.
- B. Clean surfaces that will come into contact with grout.
- C. Provide forms as required for placement of grout.
- D. Avoid air entrapment during placement of grout.
- E. Place grout, completely filling equipment bases.
- F. Place grout on concrete bases and provide smooth bearing surface for equipment.
- G. Place grout around anchors.
- H. Cure placed grout.

END OF SECTION 220500
SECTION 220517 - SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Sleeves.
 - 2. Sleeve-seal systems.
 - 3. Grout.

1.2 ACTION SUBMITTALS

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

PART 2 - PRODUCTS

2.1 SLEEVES

- A. Cast-Iron Wall Pipes: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.
- B. Galvanized-Steel Wall Pipes: ASTM A 53/A 53M, Schedule 40, with plain ends and welded steel collar; zinc coated.
- C. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, with plain ends.

2.2 SLEEVE-SEAL SYSTEMS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Advance Products & Systems, Inc.
 - 2. CALPICO, Inc.
 - 3. Metraflex Company (The).
 - 4. Pipeline Seal and Insulator, Inc.
 - 5. Proco Products, Inc.
- B. Description: Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.
 - 1. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.

- 2. Pressure Plates: Carbon steel.
- 3. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, of length required to secure pressure plates to sealing elements.

2.3 GROUT

- A. Standard: ASTM C 1107/C 1107M, 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 SLEEVE INSTALLATION

- A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.
- B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch annular clear space between piping and concrete slabs and walls.
 - 1. Sleeves are not required for core-drilled holes.
- C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.
 - 1. Cut sleeves to length for mounting flush with both surfaces.
 - 2. Using grout, seal the space outside of sleeves in slabs and walls without sleeve-seal system.
- D. Install sleeves for pipes passing through interior partitions.
 - 1. Cut sleeves to length for mounting flush with both surfaces.
 - 2. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
 - 3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint. Comply with requirements for sealants specified in Division 07 Section "Joint Sealants."
- E. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Division 07 Section "Penetration Firestopping."

3.2 SLEEVE-SEAL-SYSTEM INSTALLATION

- A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.
- B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

3.3 SLEEVE AND SLEEVE-SEAL SCHEDULE

- A. Use sleeves and sleeve seals for the following piping-penetration applications:
 - 1. Concrete Slabs-on-Grade:
 - a. Piping Smaller Than NPS 6: Cast-iron wall sleeves with sleeve-seal system.
 - 1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
 - 2. Interior Partitions:
 - a. Piping Smaller Than NPS 6: Galvanized-steel-pipe sleeves.

END OF SECTION 220517

SECTION 220518 - ESCUTCHEONS FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Escutcheons.
 - 2. Floor plates.

1.2 ACTION SUBMITTALS

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

PART 2 - PRODUCTS

2.1 ESCUTCHEONS

- A. One-Piece, Cast-Brass Type: With polished, chrome-plated and rough-brass finish and setscrew fastener.
- B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with chrome-plated finish and spring-clip fasteners.
- C. One-Piece, Stamped-Steel Type: With chrome-plated finish and spring-clip fasteners.

2.2 FLOOR PLATES

A. One-Piece Floor Plates: Cast-iron flange with holes for fasteners.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.
- B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.
 - 1. Escutcheons for New Piping:
 - a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.

ESCUTCHEONS FOR PLUMBING PIPING

- b. Insulated Piping: One-piece, stamped-steel type.
- c. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, castbrass type with polished, chrome-plated finish.
- d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, stamped-steel type.
- e. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, cast-brass type with polished, chrome-plated finish.
- f. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, stamped-steel type.
- C. Install floor plates with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.
 - 1. New Piping: One-piece, floor-plate type.

3.2 FIELD QUALITY CONTROL

A. Replace broken and damaged escutcheons and floor plates using new materials.

END OF SECTION 220518

SECTION 220523 - GENERAL-DUTY VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Brass ball valves.
 - 2. Bronze gate valves.
 - 3. Bronze 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.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of valve indicated.

1.3 QUALITY ASSURANCE

- A. ASME Compliance: ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
- B. NSF Compliance: NSF 61 for valve materials for potable-water service.

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. Handwheel: For valves other than quarter-turn types.
- 2. Handlever: For quarter-turn valves NPS 6 and smaller.
- 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.
- F. Valve-End Connections:
 - 1. Flanged: With flanges according to ASME B16.1 for iron valves.
 - 2. Solder Joint: With sockets according to ASME B16.18.
 - 3. Threaded: With threads according to ASME B1.20.1.

2.2 BRASS BALL VALVES

- A. 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. Kitz Corporation.
 - g. Legend Valve.
 - h. Marwin Valve; a division of Richards Industries.
 - i. Milwaukee Valve Company.
 - j. NIBCO INC.
 - k. Red-White Valve Corporation.
 - l. 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.

2.3 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.
 - 1. 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.
 - e. Stem: Bronze.
 - f. Disc: Solid wedge; bronze.
 - g. Packing: Asbestos free.
 - h. Handwheel: Malleable iron.

2.4 BRONZE GLOBE VALVES

- A. 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.
 - e. Stem: Bronze.

- f. Disc: PTFE or TFE.
- g. Packing: Asbestos free.
- h. Handwheel: Malleable iron.

PART 3 - EXECUTION

3.1 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.

3.2 ADJUSTING

A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

3.3 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

- A. If valve applications are not indicated, use the following:
 - 1. Shutoff Service: Ball or butterfly valves.
- B. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP class or CWP ratings may be substituted.
- C. Select valves, except wafer types, with the following end connections:
 - 1. For Copper Tubing, NPS 2 and Smaller: Threaded ends except where solder-joint valveend option is indicated in valve schedules below.
 - 2. For Steel Piping, NPS 2 and Smaller: Threaded ends.
 - 3. For Steel Piping, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve-end option is indicated in valve schedules below.

3.4 DOMESTIC, HOT- AND COLD-WATER VALVE SCHEDULE

- A. Pipe NPS 2 and Smaller:
 - 1. Bronze and Brass Valves: May be provided with solder-joint ends instead of threaded ends.
 - 2. Ball Valves: Two piece, full port, brass with brass trim.
 - 3. Bronze Gate Valves: Class 125, NRS.

4. Bronze Globe Valves: Class 125, nonmetallic disc.

END OF SECTION 220523

SECTION 220529 - HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Metal pipe hangers and supports.
 - 2. Thermal-hanger shield inserts.
 - 3. Pipe positioning systems.
 - 4. Equipment supports.

1.2 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design trapeze pipe hangers and equipment supports, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. Structural Performance: Hangers and supports for plumbing piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.
 - 1. Design supports for multiple pipes capable of supporting combined weight of supported systems, system contents, and test water.
 - 2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Show fabrication and installation details and include calculations for the following; include Product Data for components:
 - 1. Equipment supports.

1.4 QUALITY ASSURANCE

- A. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code Steel."
- B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

PART 2 - PRODUCTS

2.1 METAL PIPE HANGERS AND SUPPORTS

- A. Carbon-Steel Pipe Hangers and Supports:
 - 1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
 - 2. Galvanized Metallic Coatings: Pregalvanized or hot dipped.
 - 3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
 - 4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
 - 5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.
- B. Copper Pipe Hangers:
 - 1. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.
 - 2. Hanger Rods: Continuous-thread rod, nuts, and washer made of copper-coated steel.

2.2 THERMAL-HANGER SHIELD INSERTS

- A. Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with 100-psig or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig minimum compressive strength and vapor barrier.
- B. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate with 100-psig ASTM C 552, Type II cellular glass with 100-psig or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig minimum compressive strength.
- C. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.
- D. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.3 PIPE POSITIONING SYSTEMS

A. Description: IAPMO PS 42, positioning system of metal brackets, clips, and straps for positioning piping in pipe spaces; for plumbing fixtures in commercial applications.

2.4 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural carbonsteel shapes.

2.5 MISCELLANEOUS MATERIALS

- A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.
- B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.
 - 1. Properties: Nonstaining, noncorrosive, and nongaseous.
 - 2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT INSTALLATION

- A. Metal 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 the building structure.
- B. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.
- C. Pipe Positioning-System Installation: Install support devices to make rigid supply and waste piping connections to each plumbing fixture. See Division 22 plumbing fixture Sections for requirements for pipe positioning systems for plumbing fixtures.
- D. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.
- E. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
- F. 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.
- G. Install lateral bracing with pipe hangers and supports to prevent swaying.
- H. Install building attachments to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, 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.
- I. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- J. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.
- K. Insulated Piping:
 - 1. Attach clamps and spacers to piping.

- a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
- b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
- c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.
- 2. 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.
- 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.
- 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.
- 5. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.2 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for equipment supports.

3.3 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.

3.4 HANGER AND SUPPORT SCHEDULE

- A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.
- B. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.
- C. 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 carbon-steel pipe hangers and supports and attachments for general service applications.

- F. Use copper-plated pipe hangers and copper or stainless-steel attachments for copper piping and tubing.
- G. Use padded hangers for piping that is subject to scratching.
- H. Use thermal-hanger shield inserts for insulated piping and tubing.
- I. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, 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. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
- J. 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 24.
 - 2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.
- K. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
- L. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.
 - 2. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
 - 3. 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.
- M. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
 - 2. Thermal-Hanger Shield Inserts: For supporting insulated pipe.
- N. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.

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- O. Use powder-actuated fasteners instead of building attachments where required in concrete construction.
- P. Use pipe positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

END OF SECTION 220529

SECTION 220553 - IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Equipment labels.
 - 2. Warning signs and labels.
 - 3. Pipe labels.

1.2 ACTION SUBMITTAL

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

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 Aluminum, 0.032inch 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. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified.
- C. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch 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: Red.
- 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. 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.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 EQUIPMENT LABEL INSTALLATION

- A. Install or permanently fasten labels on each major item of mechanical equipment.
- B. Locate equipment labels where accessible and visible.

3.3 PIPE LABEL INSTALLATION

- A. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
 - 1. Near each valve and control device.
 - 2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
 - 3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
 - 4. Near major equipment items and other points of origination and termination.
 - 5. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
 - 6. On piping above removable acoustical ceilings. Omit intermediately spaced labels.
- B. Pipe Label Color Schedule:
 - 1. Domestic Water Piping:
 - a. Background Color: Green.
 - b. Letter Color: White.
 - 2. Sanitary Waste Piping:
 - a. Background Color: Black.
 - b. Letter Color: White.

END OF SECTION 220553

SECTION 220719 - PLUMBING PIPING INSULATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes insulating the following plumbing piping services:
 - 1. Domestic hot-water piping.
 - 2. Supplies and drains for handicap-accessible lavatories and sinks.
- B. Related Sections:
 - 1. Division 22 Section "Plumbing Equipment Insulation."

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
 - 1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
 - 2. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
 - 3. Detail removable insulation at piping specialties, equipment connections, and access panels.
 - 4. Detail application of field-applied jackets.
 - 5. Detail application at linkages of control devices.

1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.4 QUALITY ASSURANCE

- A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84 by a testing 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 agency.
 - 1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
 - 2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

- B. Comply with the following applicable standards and other requirements specified for miscellaneous components:
 - 1. Supply and Drain Protective Shielding Guards: ICC A117.1.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

- A. Comply with requirements in "Piping Insulation Schedule, General," "Indoor Piping Insulation Schedule," "Outdoor, Aboveground Piping Insulation Schedule," and "Outdoor, Underground Piping Insulation 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. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
- E. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Aeroflex USA, Inc.; Aerocel.
 - b. Armacell LLC; AP Armaflex.
 - c. K-Flex USA; Insul-Lock, Insul-Tube, and K-FLEX LS.
- F. Mineral-Fiber, Preformed Pipe Insulation:
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Fibrex Insulations Inc.; Coreplus 1200.
 - b. Johns Manville; Micro-Lok.
 - c. Knauf Insulation; 1000-Degree Pipe Insulation.
 - d. Manson Insulation Inc.; Alley-K.
 - e. Owens Corning; Fiberglas Pipe Insulation.
 - 2. Type I, 850 Deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

2.2 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.

- B. Flexible Elastomeric Adhesive: Comply with MIL-A-24179A, Type II, Class I.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Aeroflex USA, Inc.; Aeroseal.
 - b. Armacell LLC; Armaflex 520 Adhesive.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-75.
 - d. K-Flex USA; R-373 Contact Adhesive.
 - 2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- C. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-127.
 - b. Eagle Bridges Marathon Industries; 225.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-60/85-70.
 - d. Mon-Eco Industries, Inc.; 22-25.
 - 2. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- D. ASJ Adhesive, and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-82.
 - b. Eagle Bridges Marathon Industries; 225.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-20.
 - d. Mon-Eco Industries, Inc.; 22-25.
 - 2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

- E. PVC Jacket Adhesive: Compatible with PVC jacket.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Dow Corning Corporation; 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; Polyco VP Adhesive.
 - 2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.3 MASTICS

- A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.
 - 1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below-ambient services.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-80/30-90.
 - b. Vimasco Corporation; 749.
 - 2. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm at 43-mil dry film thickness.
 - 3. Service Temperature Range: Minus 20 to plus 180 deg F.
 - 4. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
 - 5. Color: White.
- C. Breather Mastic: Water based; suitable for indoor and outdoor use on above-ambient services.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-10.
 - b. Eagle Bridges Marathon Industries; 550.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 46-50.
 - d. Mon-Eco Industries, Inc.; 55-50.
 - e. Vimasco Corporation; WC-1/WC-5.
 - 2. Water-Vapor Permeance: ASTM F 1249, 1.8 perms at 0.0625-inch dry film thickness.

- 3. Service Temperature Range: Minus 20 to plus 180 deg F.
- 4. Solids Content: 60 percent by volume and 66 percent by weight.
- 5. Color: White.

2.4 SEALANTS

- A. Joint Sealants:
 - 1. Joint Sealants for Cellular-Glass Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.
 - b. Eagle Bridges Marathon Industries; 405.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-45.
 - d. Mon-Eco Industries, Inc.; 44-05.
 - e. Pittsburgh Corning Corporation; Pittseal 444.
 - 2. Materials shall be compatible with insulation materials, jackets, and substrates.
 - 3. Permanently flexible, elastomeric sealant.
 - 4. Service Temperature Range: Minus 100 to plus 300 deg F.
 - 5. Color: White or gray.
 - 6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 7. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- B. FSK and Metal Jacket Flashing Sealants:
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.
 - b. Eagle Bridges Marathon Industries; 405.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 95-44.
 - d. Mon-Eco Industries, Inc.; 44-05.
 - 2. Materials shall be compatible with insulation materials, jackets, and substrates.
 - 3. Fire- and water-resistant, flexible, elastomeric sealant.
 - 4. Service Temperature Range: Minus 40 to plus 250 deg F.
 - 5. Color: Aluminum.
 - 6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 7. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

- C. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:
 - 1. Products: Subject to compliance with requirements, provide the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.
 - 2. Materials shall be compatible with insulation materials, jackets, and substrates.
 - 3. Fire- and water-resistant, flexible, elastomeric sealant.
 - 4. Service Temperature Range: Minus 40 to plus 250 deg F.
 - 5. Color: White.
 - 6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 7. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.5 FACTORY-APPLIED JACKETS

- A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:
 - 1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
 - 2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.
 - 3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.

2.6 FIELD-APPLIED FABRIC-REINFORCING MESH

- A. Woven Polyester Fabric: Approximately 1 oz./sq. yd. with a thread count of 10 strands by 10 strands/sq. in., in a Leno weave, for pipe.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; Mast-A-Fab.
 - b. Vimasco Corporation; Elastafab 894.

2.7 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 one of the following:

- a. Johns Manville; Zeston.
- b. P.I.C. Plastics, Inc.; FG Series.
- c. Proto 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.
- C. Aluminum Jacket: Comply with ASTM B 209, Alloy 3003, 3005, 3105, or 5005, Temper H-14.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; Metal Jacketing Systems.
 - b. ITW Insulation Systems; Aluminum and Stainless Steel Jacketing.
 - c. RPR Products, Inc.; Insul-Mate.
 - 2. Sheet and roll stock ready for shop or field sizing.
 - 3. Finish and thickness are indicated in field-applied jacket schedules.
 - 4. Moisture Barrier for Indoor Applications: 1-mil- thick, heat-bonded polyethylene and kraft paper.
 - 5. Moisture Barrier for Outdoor Applications: 3-mil- thick, heat-bonded polyethylene and kraft paper.
 - 6. Factory-Fabricated Fitting Covers:
 - a. Same material, finish, and thickness as jacket.
 - b. Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.
 - c. Tee covers.
 - d. Flange and union covers.
 - e. End caps.
 - f. Beveled collars.
 - g. Valve covers.
 - h. Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

2.8 TAPES

- A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. ABI, Ideal Tape Division; 428 AWF ASJ.
 - b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0836.
 - c. Compac Corporation; 104 and 105.

- 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 one of the following:
 - a. ABI, Ideal Tape Division; 491 AWF FSK.
 - b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0827.
 - c. Compac Corporation; 110 and 111.
 - d. Venture Tape; 1525 CW NT, 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 one of the following:
 - a. ABI, Ideal Tape Division; 370 White PVC tape.
 - b. Compac Corporation; 130.
 - c. 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.

2.9 SECUREMENTS

- A. Aluminum Bands: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 1/2 inch wide with wing seal or closed seal.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. ITW Insulation Systems; Gerrard Strapping and Seals.
 - b. RPR Products, Inc.; Insul-Mate Strapping and Seals.

- B. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel or Monel.
- C. Wire: 0.080-inch nickel-copper alloy.
 - 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. C & F Wire.

PART 3 - EXECUTION

3.1 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

3.2 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.
- B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of 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, according to insulation material manufacturer's written instructions, 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. Cleanouts.

3.3 PENETRATIONS

- A. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
 - 1. Seal penetrations with flashing sealant.

- 2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
- 3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
- 4. Seal jacket to wall flashing with flashing sealant.
- B. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- C. 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" for firestopping and fire-resistive joint sealers.

3.4 GENERAL PIPE INSULATION INSTALLATION

- A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.
- B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:
 - 1. 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. 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.

3.5 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

- A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- B. Insulation Installation on Pipe Flanges:
 - 1. Install 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 cut sections of sheet insulation of same thickness as pipe insulation.
- 4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- C. Insulation Installation on Pipe Fittings and Elbows:
 - 1. Install mitered sections of pipe insulation.
 - 2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- D. Insulation Installation on Valves and Pipe Specialties:
 - 1. Install preformed valve covers manufactured of same material as pipe insulation when available.
 - 2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
 - 3. Install insulation to flanges as specified for flange insulation application.
 - 4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.6 INSTALLATION OF MINERAL-FIBER PREFORMED PIPE INSULATION

- 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. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.
- B. Insulation Installation on Pipe Flanges:
 - 1. Install preformed pipe insulation to outer diameter of pipe flange.
 - 2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
 - 3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
 - 4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.
- C. Insulation Installation on Pipe Fittings and Elbows:

- 1. Install preformed sections of same material as straight segments of pipe insulation when available.
- 2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.
- D. Insulation Installation on Valves and Pipe Specialties:
 - 1. Install preformed sections of same material as straight segments of pipe insulation when available.
 - 2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
 - 3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
 - 4. Install insulation to flanges as specified for flange insulation application.

3.7 FIELD-APPLIED JACKET INSTALLATION

- A. Where FSK jackets are indicated, install as follows:
 - 1. Draw jacket material smooth and tight.
 - 2. Install lap or joint strips with same material as jacket.
 - 3. Secure jacket to insulation with manufacturer's recommended adhesive.
 - 4. Install jacket with 1-1/2-inch laps at longitudinal seams and 3-inch- wide joint strips at end joints.
 - 5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.
- B. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints. Seal with manufacturer's recommended adhesive.
 - 1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.
- C. 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 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections:
 - 1. 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, two locations of threaded strainers, three locations of threaded valves,

and three locations of flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.

C. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.9 PIPING INSULATION SCHEDULE, GENERAL

- A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.
- B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:
 - 1. Underground piping.

3.10 INDOOR PIPING INSULATION SCHEDULE

- A. Domestic Hot Water: Insulation shall be one of the following:
 - 1. Flexible Elastomeric: 1 inch thick.
 - 2. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
- B. Exposed Sanitary Drains, Domestic Water, Domestic Hot Water, and Stops for Plumbing Fixtures for People with Disabilities: Insulation shall be one of the following:
 - 1. Flexible Elastomeric: 3/4 inch thick.
 - 2. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

3.11 INDOOR, FIELD-APPLIED JACKET SCHEDULE

- A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.
- B. If more than one material is listed, selection from materials listed is Contractor's option.
- C. Piping, Concealed:
 - 1. PVC: 20 mils thick.
 - 2. Aluminum, Smooth: 0.016 inch thick.

END OF SECTION 220719

SECTION 221116 - DOMESTIC WATER PIPING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Under-building slab and aboveground domestic water pipes, tubes, fittings, and specialties inside the building.
 - 2. Specialty valves.

B. Related Section:

1. Division 22 Section "Facility Water Distribution Piping" for water-service piping outside the building from source to the point where water-service piping enters the building.

1.2 ACTION SUBMITTALS

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

1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.4 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.

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.

DOMESTIC WATER PIPING

- 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-andsocket, 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.
- B. Soft Copper Tube: ASTM B 88, Type K and 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 Oring seal in each end.

2.3 PVC PIPE AND FITTINGS

- A. PVC Pipe: ASTM D 1785, Schedule 40.
 - 1. PVC Socket Fittings: ASTM D 2466 for Schedule 40.

2.4 PIPING JOINING MATERIALS

- A. Pipe-Flange Gasket Materials: AWWA C110, rubber, flat face, 1/8 inch thick or ASME B16.21, nonmetallic and asbestos free, unless otherwise indicated; full-face or ring type unless otherwise indicated.
- B. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
- C. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for generalduty brazing unless otherwise indicated.
- D. Solvent Cements for Joining CPVC Piping and Tubing: ASTM F 493.
- E. Solvent Cements for Joining PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.
 - 1. PVC solvent cement shall have a VOC content of 510 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 2. Adhesive primer shall have a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 3. Solvent cement and adhesive primer shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.5 SPECIALTY VALVES

- A. Comply with requirements in Division 22 Section "General-Duty Valves for Plumbing Piping" for general-duty metal valves.
- B. Comply with requirements in Division 22 Section "Domestic Water Piping Specialties" for balancing valves, drain valves, backflow preventers, and vacuum breakers.
- C. PVC Union Ball Valves:
 - 1. Description:
 - a. Standard: MSS SP-122.
 - b. Pressure Rating: 125 psig at 73 deg F.
 - c. Body Material: PVC.
 - d. Body Design: Union type.
 - e. End Connections for Valves NPS 2 and Smaller: Detachable, socket.
 - f. End Connections for Valves NPS 2-1/2 to NPS 4: Detachable, socket.
 - g. Ball: PVC; full port.
 - h. Seals: PTFE or EPDM-rubber O-rings.
 - i. Handle: Tee shaped.
- D. PVC Butterfly Valves:
 - 1. Description:
 - a. Pressure Rating: 125 psig at 73 deg F.
 - b. Body Material: PVC.
 - c. Body Design: Lug or wafer type.
 - d. Seat: EPDM rubber.
 - e. Seals: PTFE or EPDM-rubber O-rings.
 - f. Disc: PVC.
 - g. Stem: Stainless steel.

- h. Handle: Lever.
- E. PVC Ball Check Valves:
 - 1. Description:
 - a. Pressure Rating: 125 psig at 73 deg F.
 - b. Body Material: PVC.
 - c. Body Design: Union-type ball check.
 - d. End Connections for Valves NPS 2 and Smaller: Detachable, socket.
 - e. End Connections for Valves NPS 2-1/2 to NPS 4: Detachable, socket.
 - f. Ball: PVC.
 - g. Seals: EPDM- or FKM-rubber O-rings.
- F. CPVC Gate Valves:
 - 1. Description:
 - a. Pressure Rating: 125 psig at 73 deg F.
 - b. Body Material: CPVC.
 - c. Body Design: Nonrising stem.
 - d. End Connections for Valves NPS 2 and Smaller: Socket.
 - e. End Connections for Valves NPS 2-1/2 to NPS 4: Socket.
 - f. Gate and Stem: Plastic.
 - g. Seals: EPDM rubber.
 - h. Handle: Wheel.
- G. PVC Gate Valves:
 - 1. Description:
 - a. Pressure Rating: 125 psig at 73 deg F.
 - b. Body Material: PVC.
 - c. Body Design: Nonrising stem.
 - d. End Connections for Valves NPS 2 and Smaller: Socket.
 - e. End Connections for Valves NPS 2-1/2 to NPS 4: Socket.
 - f. Gate and Stem: Plastic.
 - g. Seals: EPDM rubber.
 - h. Handle: Wheel.

2.6 TRANSITION FITTINGS

- A. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.
- B. Sleeve-Type Transition Coupling: AWWA C219.
- C. Plastic-to-Metal Transition Fittings:

- 1. Description: CPVC or PVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions; one end with threaded brass insert and one solvent-cement-socket end.
- D. Plastic-to-Metal Transition Unions:
 - 1. Description: CPVC or PVC four-part union. Include brass or stainless-steel threaded end, solvent-cement-joint plastic end, rubber O-ring, and union nut.

2.7 DIELECTRIC FITTINGS

- A. General Requirements: Assembly of copper alloy and ferrous materials or ferrous material body with separating nonconductive insulating material suitable for system fluid, pressure, and temperature.
- B. Dielectric Unions:
 - 1. Description:
 - a. Pressure Rating: 150 psig at 180 deg F.
 - b. End Connections: Solder-joint copper alloy and threaded ferrous.
- C. Dielectric Flanges:
 - 1. Description:
 - a. Factory-fabricated, bolted, companion-flange assembly.
 - b. Pressure Rating: 175 psig minimum.
 - c. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solderjoint copper alloy and threaded ferrous.
- D. Dielectric Nipples:
 - 1. Description:
 - a. Electroplated steel nipple.
 - b. Pressure Rating: 300 psig at 225 deg F.
 - c. End Connections: Male threaded or grooved.
 - d. Lining: Inert and noncorrosive, propylene.

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 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.
- E. Install shutoff valve immediately upstream of each dielectric fitting.
- F. Install water-pressure-reducing valves downstream from shutoff valves. Comply with requirements in Division 22 Section "Domestic Water Piping Specialties" for pressure-reducing valves.
- G. Install domestic water piping level with 0.25 percent slope downward toward drain and plumb.
- H. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.
- I. 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.
- J. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.
- K. Install piping adjacent to equipment and specialties to allow service and maintenance.
- L. Install piping to permit valve servicing.
- M. 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.
- N. Install piping free of sags and bends.
- O. Install fittings for changes in direction and branch connections.
- P. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.
- Q. Install thermometers on outlet piping from each water heater. Comply with requirements in Division 22 Section "Meters and Gages for Plumbing Piping" for thermometers.

- R. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Division 22 Section "Sleeves and Sleeve Seals for Plumbing Piping."
- S. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Division 22 Section "Sleeves and Sleeve Seals for Plumbing Piping."
- T. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Division 22 Section "Escutcheons for Plumbing Piping."

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," "Brazed 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. 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.
- 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. Apply primer.
 - 2. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.
 - 3. PVC Piping: Join according to ASTM D 2855.

J. 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.

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-tometal 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 nipples.
- C. Dielectric Fittings for NPS 2-1/2 to NPS 4: Use dielectric flanges.

3.7 HANGER AND SUPPORT INSTALLATION

- A. Comply with requirements in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment" for pipe hanger and support products and installation.
 - 1. Vertical Piping: MSS Type 8 or 42, clamps.
 - 2. Individual, Straight, Horizontal Piping Runs:
 - a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.

- 3. Base of Vertical Piping: MSS Type 52, spring hangers.
- B. Support vertical piping and tubing at base.
- C. Rod diameter may be reduced one size for double-rod hangers, to a minimum of 3/8 inch.
- D. 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.
- E. Install supports for vertical copper tubing every 10 feet.
- F. 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.
- G. Install supports for vertical steel piping every 15 feet.
- H. Install vinyl-coated hangers for CPVC piping with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 1 and Smaller: 36 inches with 3/8-inch rod.
 - 2. NPS 1-1/4 to NPS 2: 48 inches with 3/8-inch rod.
- I. Install supports for vertical CPVC piping every 60 inches for NPS 1 and smaller, and every 72 inches for NPS 1-1/4 and larger.
- J. Install vinyl-coated hangers for PVC piping with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 2 and Smaller: 48 inches with 3/8-inch rod.
 - 2. NPS 2-1/2 to NPS 3-1/2: 48 inches with 1/2-inch rod.
 - 3. NPS 4 and NPS 5: 48 inches with 5/8-inch rod.
- K. Install supports for vertical PVC piping every 48 inches.
- L. Support piping and tubing not listed in this article according to MSS SP-69 and manufacturer's written instructions.

3.8 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. Water Heaters: Cold-water inlet and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.
 - 2. 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.
 - 3. 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.

3.9 IDENTIFICATION

A. Identify system components. Comply with requirements in Division 22 Section "Identification for Plumbing Piping and Equipment" for identification materials and installation.

3.10 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Piping Inspections:
 - 1. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
 - 2. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:
 - a. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
 - b. Final Inspection: Arrange final inspection for authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
 - 3. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.
 - 4. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
- C. Piping Tests:

- 1. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
- 2. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.
- 3. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
- 4. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
- 5. Repair leaks and defects with new materials and retest piping or portion thereof until satisfactory results are obtained.
- 6. Prepare reports for tests and for corrective action required.
- D. Domestic water piping will be considered defective if it does not pass tests and inspections.
- E. Prepare test and inspection reports.

3.11 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.

3.12 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 piping, NPS 2 and smaller, shall be one of the following:
- D. Aboveground domestic water piping, NPS 2 and smaller, shall be one of the following:
 - 1. Hard copper tube, ASTM B 88, Type L; wrought-copper solder-joint fittings; and brazed joints.
 - 2. PVC, Schedule 40 pipe; PVC, Schedule 40 socket fittings; and solvent-cemented joints.

3.13 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.
 - 2. Throttling Duty: Use ball or globe valves for piping NPS 2 and smaller.
 - 3. 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. PVC valves matching piping materials may be used.

SECTION 221316 - SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Pipe, tube, and fittings.
 - 2. Specialty pipe fittings.

B. Related Section:

1. Division 22 Section "Facility Sanitary Sewers" for sanitary sewerage piping and structures outside the building.

1.2 ACTION SUBMITTALS

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

1.3 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with NSF/ANSI 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-dwv" for plastic drain, waste, and vent piping and "NSF-sewer" for plastic sewer piping.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.2 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS

- A. Pipe and Fittings: ASTM A 74, Service class.
- B. Gaskets: ASTM C 564, rubber.

2.3 HUBLESS, CAST-IRON SOIL PIPE AND FITTINGS

- A. Pipe and Fittings: ASTM A 888 or CISPI 301.
- B. CISPI, Hubless-Piping Couplings:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ANACO-Husky.
 - b. Dallas Specialty & Mfg. Co.
 - c. Fernco Inc.
 - d. Matco-Norca, Inc.
 - e. MIFAB, Inc.
 - f. Mission Rubber Company; a division of MCP Industries, Inc.
 - g. Stant.
 - h. Tyler Pipe.
 - 2. Standards: ASTM C 1277 and CISPI 310.
 - 3. Description: Stainless-steel corrugated shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

2.4 PVC PIPE AND FITTINGS

- A. Solid-Wall PVC Pipe: ASTM D 2665, drain, waste, and vent.
- B. Cellular-Core PVC Pipe: ASTM F 891, Schedule 40.
- C. PVC Socket Fittings: ASTM D 2665, made to ASTM D 3311, drain, waste, and vent patterns and to fit Schedule 40 pipe.
- D. Adhesive Primer: ASTM F 656.
 - 1. Adhesive primer shall have a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 2. Adhesive primer shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- E. Solvent Cement: ASTM D 2564.
 - 1. PVC solvent cement shall have a VOC content of 510 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 2. Solvent cement shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.5 SPECIALTY PIPE FITTINGS

A. Transition Couplings:

SANITARY WASTE AND VENT PIPING

- 1. General Requirements: Fitting or device for joining piping with small differences in OD's or of different materials. Include end connections same size as and compatible with pipes to be joined.
- 2. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.
- 3. Unshielded, Nonpressure Transition Couplings:
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) Dallas Specialty & Mfg. Co.
 - 2) Fernco Inc.
 - 3) Mission Rubber Company; a division of MCP Industries, Inc.
 - 4) Plastic Oddities; a division of Diverse Corporate Technologies, Inc.
 - b. Standard: ASTM C 1173.
 - c. Description: Elastomeric, sleeve-type, reducing or transition pattern. Include shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.
 - d. Sleeve Materials:
 - 1) For Cast-Iron Soil Pipes: ASTM C 564, rubber.
 - 2) For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
 - 3) For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.

PART 3 - EXECUTION

3.1 EARTH MOVING

A. Comply with requirements for excavating, trenching, and backfilling specified in Division 31 Section "Earth Moving."

3.2 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.
- B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- C. 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.
- D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

- E. Install piping at indicated slopes.
- F. Install piping free of sags and bends.
- G. Install fittings for changes in direction and branch connections.
- H. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch and 1/8-bend fittings if two fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. 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.
- I. 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.
- J. 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; 2 percent downward in direction of flow for piping NPS 4 and larger.
 - 2. Horizontal Sanitary Drainage Piping: 2 percent downward in direction of flow.
 - 3. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.
- K. 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."
- L. Install aboveground PVC piping according to ASTM D 2665.
- M. Install underground PVC piping according to ASTM D 2321.
- N. Plumbing Specialties:
 - 1. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers in sanitary drainage gravity-flow piping. Comply with requirements for cleanouts specified in Division 22 Section "Sanitary Waste Piping Specialties."
 - 2. Install drains in sanitary drainage gravity-flow piping. Comply with requirements for drains specified in Division 22 Section "Sanitary Waste Piping Specialties."
- O. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.
- P. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Division 22 Section "Sleeves and Sleeve Seals for Plumbing Piping."

- Q. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Division 22 Section "Sleeves and Sleeve Seals for Plumbing Piping."
- R. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Division 22 Section "Escutcheons for Plumbing Piping."

3.3 JOINT CONSTRUCTION

- A. Join hub-and-spigot, cast-iron soil piping with gasket joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.
- B. Join hubless, cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-piping coupling joints.
- C. Flanged Joints: Align bolt holes. Select appropriate gasket material, size, type, and thickness. Install gasket concentrically positioned. Use suitable lubricants on bolt threads. Torque bolts in cross pattern.
- D. Plastic, Nonpressure-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. PVC Piping: Join according to ASTM D 2855 and ASTM D 2665 Appendixes.

3.4 SPECIALTY PIPE FITTING INSTALLATION

- A. Transition Couplings:
 - 1. Install transition couplings at joints of piping with small differences in OD's.
 - 2. In Drainage Piping: Unshielded, nonpressure transition couplings.

3.5 HANGER AND SUPPORT INSTALLATION

- A. Comply with requirements for pipe hanger and support devices and installation specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."
 - 1. Install carbon-steel pipe hangers for horizontal piping in noncorrosive environments.
 - 2. Install carbon-steel pipe support clamps for vertical piping in noncorrosive environments.
 - 3. Vertical Piping: MSS Type 8 or Type 42, clamps.
 - 4. Install individual, straight, horizontal piping runs:
 - a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
 - 5. Base of Vertical Piping: MSS Type 52, spring hangers.
- B. Support horizontal piping and tubing within 12 inches of each fitting and coupling.

- C. Support vertical piping and tubing at base.
- D. Rod diameter may be reduced one size for double-rod hangers, with 3/8-inch minimum rods.
- E. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 1-1/2 and NPS 2: 60 inches with 3/8-inch rod.
 - 2. NPS 3: 60 inches with 1/2-inch rod.
 - 3. NPS 4 and NPS 5: 60 inches with 5/8-inch rod.
 - 4. Spacing for 10-foot lengths may be increased to 10 feet. Spacing for fittings is limited to 60 inches.
- F. Install supports for vertical cast-iron soil piping every 15 feet.
- G. Install hangers for PVC piping with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 1-1/2 and NPS 2: 48 inches with 3/8-inch rod.
 - 2. NPS 3: 48 inches with 1/2-inch rod.
 - 3. NPS 4 and NPS 5: 48 inches with 5/8-inch rod.
- H. Install supports for vertical PVC piping every 48 inches.
- I. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.6 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect 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. Install test tees (wall cleanouts) in conductors near floor and floor cleanouts with cover flush with floor.
 - 5. Comply with requirements for cleanouts and drains specified in Division 22 Section "Sanitary Waste Piping Specialties."
 - 6. 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. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.
- E. 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.

3.7 IDENTIFICATION

A. Identify exposed sanitary waste and vent piping. Comply with requirements for identification specified in Division 22 Section "Identification for Plumbing Piping and Equipment."

3.8 FIELD QUALITY CONTROL

- A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.
 - 1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
 - 2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
- B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
- C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
- D. Test sanitary drainage and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
 - 1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
 - 2. Leave uncovered and unconcealed new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
 - 3. Roughing-in Plumbing Test Procedure: Test drainage and vent piping except outside leaders on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water. From 15 minutes before inspection starts to completion of inspection, water level must not drop. Inspect joints for leaks.
 - 4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1-inch wg. Use U-tube or manometer inserted in trap of water closet to measure this pressure. Air pressure must remain constant without

introducing additional air throughout period of inspection. Inspect plumbing fixture connections for gas and water leaks.

- 5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
- 6. Prepare reports for tests and required corrective action.

3.9 CLEANING AND PROTECTION

- 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.
- D. Exposed PVC Piping: Protect plumbing vents exposed to sunlight with two coats of waterbased latex paint.

3.10 PIPING SCHEDULE

- A. Flanges and unions may be used on aboveground pressure piping unless otherwise indicated.
- B. Aboveground, soil and waste 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; CISPI hubless-piping couplings; and coupled joints.
 - 3. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
 - 4. Dissimilar Pipe-Material Couplings: Unshielded, non-pressure transition couplings.
- C. 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; CISPI hubless-piping couplings; and coupled joints.
 - 3. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
 - 4. Dissimilar Pipe-Material Couplings: Unshielded, non-pressure transition couplings.
- D. Underground, soil, waste, and vent piping NPS 4 and smaller shall be the following:
 - 1. Service class, cast-iron soil piping; gaskets; and gasketed joints.
 - 2. Dissimilar Pipe-Material Couplings: Unshielded, non-pressure transition couplings.

SECTION 221319 - SANITARY WASTE PIPING SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following sanitary drainage piping specialties:
 - 1. Cleanouts.
 - 2. Roof flashing assemblies.
 - 3. Flashing materials.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and accessories for grease interceptors.

1.3 QUALITY ASSURANCE

A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.

PART 2 - PRODUCTS

2.1 CLEANOUTS

- A. Exposed Cast-Iron Cleanouts:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Josam Company; Josam Div.
 - b. MIFAB, Inc.
 - c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - d. Tyler Pipe; Wade Div.
 - e. Watts Drainage Products Inc.
 - f. Zurn Plumbing Products Group; Specification Drainage Operation.
 - 2. Standard: ASME A112.36.2M for cast iron for cleanout test tee.
 - 3. Size: Same as connected drainage piping
 - 4. Body Material: Hub-and-spigot, cast-iron soil pipe T-branch as required to match connected piping.
 - 5. Closure: Countersunk, brass plug.
 - 6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.

- B. Cast-Iron Floor Cleanouts:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Josam Company; Josam Div.
 - b. Oatey.
 - c. Sioux Chief Manufacturing Company, Inc.
 - d. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - e. Tyler Pipe; Wade Div.
 - f. Watts Drainage Products Inc.
 - g. Zurn Plumbing Products Group; Light Commercial Operation.
 - h. Zurn Plumbing Products Group; Specification Drainage Operation.
 - 2. Standard: ASME A112.36.2M for adjustable housing cleanout.
 - 3. Size: Same as connected branch.
 - 4. Type: Adjustable housing.
 - 5. Body or Ferrule: Cast iron.
 - 6. Clamping Device: Not required.
 - 7. Outlet Connection: Inside calk.
 - 8. Closure: Brass plug with straight threads and gasket.
 - 9. Adjustable Housing Material: Cast iron with threads.
 - 10. Frame and Cover Material and Finish: Nickel-bronze, copper alloy.
 - 11. Frame and Cover Shape: Round.
 - 12. Top Loading Classification: Heavy Duty.
 - 13. Riser: ASTM A 74, Service class, cast-iron drainage pipe fitting and riser to cleanout.
- C. Cast-Iron Wall Cleanouts:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Josam Company; Josam Div.
 - b. MIFAB, Inc.
 - c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - d. Tyler Pipe; Wade Div.
 - e. Watts Drainage Products Inc.
 - f. Zurn Plumbing Products Group; Specification Drainage Operation.
 - 2. Standard: ASME A112.36.2M. Include wall access.
 - 3. Size: Same as connected drainage piping.
 - 4. Body: Hub-and-spigot, cast-iron soil pipe T-branch as required to match connected piping.
 - 5. Closure: Countersunk, brass plug.
 - 6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
 - 7. Wall Access: Round, deep, chrome-plated bronze cover plate with screw.
 - 8. Wall Access: Round, nickel-bronze, copper-alloy, or stainless-steel wall-installation frame and cover.

2.2 ROOF FLASHING ASSEMBLIES

- A. Roof Flashing Assemblies:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Acorn Engineering Company; Elmdor/Stoneman Div.
 - b. Thaler Metal Industries Ltd.
- B. Description: Manufactured assembly made of 3.0-lb/sq. ft., 0.0469-inch thick, lead flashing collar and skirt extending at least 8 inches from pipe, with galvanized-steel boot reinforcement and counterflashing fitting.
 - 1. Open-Top Vent Cap: Without cap.
 - 2. Low-Silhouette Vent Cap: With vandal-proof vent cap.
 - 3. Extended Vent Cap: With field-installed, vandal-proof vent cap.

2.3 MISCELLANEOUS SANITARY DRAINAGE PIPING SPECIALTIES

- A. Vent Caps:
 - 1. Description: Cast-iron body with threaded or hub inlet and vandal-proof design. Include vented hood and setscrews to secure to vent pipe.
 - 2. Size: Same as connected stack vent or vent stack.

2.4 FLASHING MATERIALS

- A. Lead Sheet: ASTM B 749, Type L51121, copper bearing, with the following minimum weights and thicknesses, unless otherwise indicated:
 - 1. General Use: 4.0-lb/sq. ft., 0.0625-inch thickness.
 - 2. Vent Pipe Flashing: 3.0-lb/sq. ft., 0.0469-inch thickness.
- B. Fasteners: Metal compatible with material and substrate being fastened.
- C. Metal Accessories: Sheet metal strips, clamps, anchoring devices, and similar accessory units required for installation; matching or compatible with material being installed.
- D. Solder: ASTM B 32, lead-free alloy.
- E. Bituminous Coating: SSPC-Paint 12, solvent-type, bituminous mastic.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:
 - 1. Size same as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless larger cleanout is indicated.
 - 2. Locate at each change in direction of piping greater than 45 degrees.
 - 3. Locate at minimum intervals of 50 feet for piping NPS 4 and smaller and 100 feet for larger piping.
 - 4. Locate at base of each vertical soil and waste stack.
- B. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.
- C. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.
- D. Install roof flashing assemblies on vent stacks that extend through roof.
- E. Install flashing fittings on sanitary vent stacks that extend through roof.
- F. Install vent caps on each vent pipe passing through roof.

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 equipment to allow service and maintenance.

3.3 FLASHING INSTALLATION

- A. Fabricate flashing from single piece unless large pans, sumps, or other drainage shapes are required. Join flashing according to the following if required:
 - 1. Lead Sheets: Solder joints of lead sheets 4.0-lb/sq. ft., 0.0625-inch thickness or thinner.
- B. Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with waterproof membrane.
 - 1. Pipe Flashing: Sleeve type, matching pipe size, with minimum length of 10 inches, and skirt or flange extending at least 8 inches around pipe.
 - 2. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches around sleeve.
 - 3. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches around specialty.

- C. Set flashing on floors and roofs in solid coating of bituminous cement.
- D. Secure flashing into sleeve and specialty clamping ring or device.
- E. Install flashing for piping passing through roofs with counterflashing or commercially made flashing fittings, according to Division 07 Section "Sheet Metal Flashing and Trim."
- F. Extend flashing up vent pipe passing through roofs and turn down into pipe, or secure flashing into cast-iron sleeve having calking recess.

3.4 **PROTECTION**

- A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.
- B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

SECTION 223300 - ELECTRIC, DOMESTIC-WATER HEATERS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Electric, storage, domestic-water heaters.
 - 2. Domestic-water heater accessories.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type and size of domestic-water heater indicated.
- B. Shop Drawings:
 - 1. Wiring Diagrams: For power, signal, and control wiring.

1.3 INFORMATIONAL SUBMITTALS

- A. Domestic-Water Heater Labeling: Certified and labeled by testing agency acceptable to authorities having jurisdiction.
- B. Source quality-control reports.
- C. Field quality-control reports.
- D. Warranty: Sample of special warranty.

1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.5 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1.
- C. ASME Compliance: Where ASME-code construction is indicated, fabricate and label commercial, domestic-water heater storage tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.

D. NSF Compliance: Fabricate and label equipment components that will be in contact with potable water to comply with NSF 61, "Drinking Water System Components - Health Effects."

1.6 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of electric, domestic-water heaters that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Periods: From date of Substantial Completion.
 - a. Electric, Storage, Domestic-Water Heaters:
 - 1) Storage Tank: Five years.
 - 2) Controls and Other Components: Two years.

PART 2 - PRODUCTS

2.1 ELECTRIC, domestic-WATER HEATERS

- A. Electric, Storage, Domestic-Water Heaters:
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - a. American Water Heaters.
 - b. Bradford White Corporation.
 - c. Electric Heater Company (The).
 - d. GSW Water Heating.
 - e. Heat Transfer Products, Inc.
 - f. HESco Industries, Inc.
 - g. Lochinvar Corporation.
 - h. Rheem Manufacturing Company.
 - i. Smith, A. O. Water Products Co.; a division of A. O. Smith Corporation.
 - j. State Industries.
 - k. Vaughn Manufacturing Corporation.
 - 2. Standard: UL 174.
 - 3. Storage-Tank Construction: Steel.
 - a. Tappings: ASME B1.20.1 pipe thread.
 - b. Pressure Rating: 150 psig.
 - c. Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending lining material into tappings.
 - 4. Factory-Installed Storage-Tank Appurtenances:
 - a. Anode Rod: Replaceable magnesium.
 - b. Dip Tube: Required unless cold-water inlet is near bottom of tank.

- c. Drain Valve: ASSE 1005.
- d. Insulation: Comply with ASHRAE 90.2.
- e. Jacket: Steel, cylindrical, with enameled finish.
- f. Heat-Trap Fittings: Inlet type in cold-water inlet and outlet type in hot-water outlet.
- g. Heating Elements: Two; electric, screw-in immersion type; wired for nonsimultaneous operation unless otherwise indicated. Limited to 12 kW total.
- h. Temperature Control: Adjustable thermostat.
- i. Safety Control: High-temperature-limit cutoff device or system.
- j. Relief Valve: ASME rated and stamped for combination temperature-and-pressure relief valves. Include relieving capacity at least as great as heat input, and include pressure setting less than domestic-water heater working-pressure rating. Select relief valve with sensing element that extends into storage tank.

2.2 Domestic-WATER HEATER ACCESSORIES

- A. Domestic-Water Compression Tanks:
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - a. AMTROL Inc.
 - b. Flexcon Industries.
 - c. Honeywell International Inc.
 - d. Pentair Pump Group (The); Myers.
 - e. Smith, A. O. Water Products Co.; a division of A. O. Smith Corporation.
 - f. State Industries.
 - g. Taco, Inc.
 - 2. Description: Steel pressure-rated tank constructed with welded joints and factoryinstalled butyl-rubber diaphragm. Include air precharge to minimum system-operating pressure at tank.
 - 3. Construction:
 - a. Tappings: Factory-fabricated steel, welded to tank before testing and labeling. Include ASME B1.20.1 pipe thread.
 - b. Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.
 - c. Air-Charging Valve: Factory installed.
 - 4. Capacity and Characteristics:
 - a. Working-Pressure Rating: 100 psig.
 - b. Capacity Acceptable: 4 gal. minimum.
 - c. Air Precharge Pressure: 60 psi.
- B. Drain Pans: Corrosion-resistant metal with raised edge. Comply with ANSI/CSA LC 3. Include dimensions not less than base of domestic-water heater, and include drain outlet not less than NPS 3/4 with ASME B1.20.1 pipe threads or with ASME B1.20.7 garden-hose threads.

- C. Piping-Type Heat Traps: Field-fabricated piping arrangement according to ASHRAE/IESNA 90.1.
- D. Pressure-Reducing Valves: ASSE 1003 for water. Set at 25-psig- maximum outlet pressure unless otherwise indicated.
- E. Combination Temperature-and-Pressure Relief Valves: ASME rated and stamped. Include relieving capacity at least as great as heat input, and include pressure setting less than domestic-water heater working-pressure rating. Select relief valves with sensing element that extends into storage tank.
- F. Pressure Relief Valves: ASME rated and stamped. Include pressure setting less than domesticwater heater working-pressure rating.
- G. Vacuum Relief Valves: ANSI Z21.22/CSA 4.4.
- H. Domestic-Water Heater Mounting Brackets: Manufacturer's factory-fabricated steel bracket for wall mounting, capable of supporting domestic-water heater and water.

2.3 SOURCE QUALITY CONTROL

- A. Factory Tests: Test and inspect domestic-water heaters specified to be ASME-code construction, according to ASME Boiler and Pressure Vessel Code.
- B. Hydrostatically test domestic-water heaters to minimum of one and one-half times pressure rating before shipment.
- C. Electric, domestic-water heaters will be considered defective if they do not pass tests and inspections. Comply with requirements in Division 01 Section "Quality Requirements" for retesting and reinspecting requirements and Division 01 Section "Execution" for requirements for correcting the Work.
- D. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 DOMESTIC-WATER HEATER INSTALLATION

- A. Electric, Domestic-Water Heater Mounting: Install electric, domestic-water heaters on domestic-water heater mounting bracket.
 - 1. Maintain manufacturer's recommended clearances.
 - 2. Arrange units so controls and devices that require servicing are accessible.
 - 3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 4. Install anchor bolts to elevations required for proper attachment to supported equipment.
 - 5. Anchor domestic-water heaters to substrate.

- B. Install electric, domestic-water heaters level and plumb, according to layout drawings, original design, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.
 - 1. Install shutoff valves on domestic-water-supply piping to domestic-water heaters and on domestic-hot-water outlet piping. Comply with requirements for shutoff valves specified in Division 22 Section "General-Duty Valves for Plumbing Piping."
- C. Install combination temperature-and-pressure relief valves in top portion of storage tanks. Use relief valves with sensing elements that extend into tanks. Extend commercial-water-heater relief-valve outlet, with drain piping same as domestic-water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.
- D. Install water-heater drain piping as indirect waste to spill by positive air gap into open drains or over floor drains. Install hose-end drain valves at low points in water piping for electric, domestic-water heaters that do not have tank drains. Comply with requirements for hose-end drain valves specified in Division 22 Section "Domestic Water Piping Specialties."
- E. Install thermometers on outlet piping of electric, domestic-water heaters. Comply with requirements for thermometers specified in Division 22 Section "Meters and Gages for Plumbing Piping."
- F. Install pressure-reducing valve with integral bypass relief valve in electric, domestic-water booster-heater inlet piping and water hammer arrester in booster-heater outlet piping. Set pressure-reducing valve for outlet pressure of 25 psig. Comply with requirements for pressure-reducing valves and water hammer arresters specified in Division 22 Section "Domestic Water Piping Specialties."
- G. Install piping-type heat traps on inlet and outlet piping of electric, domestic-water heater storage tanks without integral or fitting-type heat traps.
- H. Fill electric, domestic-water heaters with water.
- I. Charge domestic-water compression tanks with air.

3.2 CONNECTIONS

- A. Comply with requirements for piping specified in Division 22 Section "Domestic Water Piping." Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Where installing piping adjacent to electric, domestic-water heaters, allow space for service and maintenance of water heaters. Arrange piping for easy removal of domestic-water heaters.

3.3 IDENTIFICATION

A. Identify system components. Comply with requirements for identification specified in Division 22 Section "Identification for Plumbing Piping and Equipment."

3.4 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
 - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
 - 2. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
 - 3. Operational Test: After electrical circuitry has been energized, start units to confirm proper operation.
 - 4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- B. Electric, domestic-water heaters will be considered defective if they do not pass tests and inspections. Comply with requirements in Division 01 Section "Quality Requirements" for retesting and reinspecting requirements and Division 01 Section "Execution" for requirements for correcting the Work.
- C. Prepare test and inspection reports.

SECTION 230513 - COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.1 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.

1.2 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.

2.2 MOTOR CHARACTERISTICS

- A. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 3300 feet (1000 m) above sea level.
- B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

2.3 POLYPHASE MOTORS

- A. Description: NEMA MG 1, Design B, medium induction motor.
- B. Efficiency: 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. Rotor: Random-wound, squirrel cage.
- F. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.
- G. Temperature Rise: Match insulation rating.
- H. Insulation: Class F.
- I. Code Letter Designation:
 - 1. Motors Smaller than 15 HP: Manufacturer's standard starting characteristic.
- J. Enclosure Material: 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.

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)

SECTION 230517 - SLEEVES AND SLEEVE SEALS FOR HVAC PIPING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Sleeves.
 - 2. Sleeve-seal systems.
 - 3. Grout.

PART 2 - PRODUCTS

2.1 SLEEVES

A. Cast-Iron Wall Pipes: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.

2.2 SLEEVE-SEAL SYSTEMS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Advance Products & Systems, Inc.
 - 2. CALPICO, Inc.
 - 3. Metraflex Company (The).
 - 4. Pipeline Seal and Insulator, Inc.
 - 5. Proco Products, Inc.
- B. Description: Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.
 - 1. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
 - 2. Pressure Plates: Carbon steel.
 - 3. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, of length required to secure pressure plates to sealing elements.

2.3 GROUT

- A. Standard: ASTM C 1107/C 1107M, 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 SLEEVE INSTALLATION

- A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.
- B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch annular clear space between piping and concrete slabs and walls.
 - 1. Sleeves are not required for core-drilled holes.
- C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.
 - 1. Cut sleeves to length for mounting flush with both surfaces.
 - 2. Using grout, seal the space outside of sleeves in slabs and walls without sleeve-seal system.

3.2 SLEEVE-SEAL-SYSTEM INSTALLATION

- A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.
- B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

3.3 SLEEVE AND SLEEVE-SEAL SCHEDULE

- A. Use sleeves and sleeve seals for the following piping-penetration applications:
 - 1. Exterior Concrete Walls above Grade:
 - a. Piping Smaller Than NPS 6: Cast-iron wall sleeves.

SECTION 230518 - ESCUTCHEONS FOR HVAC PIPING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Escutcheons.

PART 2 - PRODUCTS

2.1 ESCUTCHEONS

- A. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with chrome-plated finish and spring-clip fasteners.
- B. One-Piece, Stamped-Steel Type: With chrome-plated finish and spring-clip fasteners.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install escutcheons for piping penetrations of walls.
- B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.
 - 1. Escutcheons for New Piping:
 - a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
 - b. Insulated Piping: One-piece, stamped-steel type.
 - c. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, stamped-steel type.

3.2 FIELD QUALITY CONTROL

A. Replace broken and damaged escutcheons and floor plates using new materials.

SECTION 230553 - IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Equipment labels.
 - 2. Warning signs and labels.
 - 3. Pipe labels.
 - 4. Duct labels.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

- A. 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 self-tapping screws.
 - 8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- B. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified.
- C. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch 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: Red.
- 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 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. 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, 1/16 inch thick, and having predrilled holes for attachment hardware.
- B. Letter Color: White.
- C. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

- D. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
- E. 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.
- F. Fasteners: Stainless-steel self-tapping screws.
- G. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- H. 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.

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. 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. Near major equipment items and other points of origination and termination.
 - 5. Spaced at maximum intervals of 50 feet along each run.
 - 6. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

- C. Pipe Label Color Schedule:
 - 1. Refrigerant Piping:
 - a. Background Color: Green.
 - b. Letter Color: White.

3.4 DUCT LABEL INSTALLATION

- A. Install plastic-laminated duct labels with permanent adhesive on air ducts in the following color codes:
 - 1. Blue: For cold-air supply ducts.
 - 2. Green: For exhaust-, outside-, relief-, return-, and mixed-air ducts.
 - 3. ASME A13.1 Colors and Designs: For hazardous material exhaust.
- B. 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.

END OF SECTION 230553

SECTION 230593 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Balancing Air Systems:
 - a. Constant-volume air systems.

1.2 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.

1.3 INFORMATIONAL SUBMITTALS

- A. Strategies and Procedures Plan: Within 60 days of Contractor's Notice to Proceed, submit TAB strategies and step-by-step procedures as specified in "Preparation" Article.
- B. Certified TAB reports.

1.4 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. 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.

- C. TAB Report Forms: Use standard TAB contractor's forms approved by Architect.
- D. Instrumentation Type, Quantity, Accuracy, and Calibration: As described in ASHRAE 111, Section 5, "Instrumentation."
- E. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 7.2.2 "Air Balancing."
- F. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.7.2.3 "System Balancing."

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 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 strainers. Verify that startup screens are replaced by permanent screens with indicated perforations.
- K. Examine heat-transfer coils for correct piping connections and for clean and straight fins.
- L. Examine operating safety interlocks and controls on HVAC equipment.
- M. 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. Automatic temperature-control systems are operational.
 - 3. Equipment and duct access doors are securely closed.
 - 4. Balance, smoke, and fire dampers are open.
 - 5. Isolating and balancing valves are open and control valves are operational.
 - 6. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.
 - 7. 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 the standard accepted by the contractor's certifying agency and in this Section.
 - 1. Comply with requirements in ASHRAE 62.1, Section 7.2.2 "Air Balancing."
- 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. 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. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.
- D. 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.
- E. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.
- F. Verify that motor starters are equipped with properly sized thermal protection.
- G. Check dampers for proper position to achieve desired airflow path.
- H. Check for airflow blockages.
- I. Check condensate drains for proper connections and functioning.
- J. Check for proper sealing of air-handling-unit components.
- K. 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.

- 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. 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.
- 5. 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.
- 6. 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 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.

3.7 PROCEDURES FOR CONDENSING UNITS

- A. Verify proper rotation of fans.
- B. Measure entering- and leaving-air temperatures.
- C. Record compressor data.

3.8 PROCEDURES FOR HEAT-TRANSFER COILS

- A. Measure, adjust, and record the following data for each electric heating coil:
 - 1. Nameplate data.
 - 2. Airflow.
 - 3. Entering- and leaving-air temperature at full load.
 - 4. Voltage and amperage input of each phase at full load and at each incremental stage.
 - 5. Calculated kilowatt at full load.
 - 6. Fuse or circuit-breaker rating for overload protection.
- B. Measure, adjust, and record the following data for each refrigerant coil:
 - 1. Dry-bulb temperature of entering and leaving air.
 - 2. Wet-bulb temperature of entering and leaving air.
 - 3. Airflow.
 - 4. Air pressure drop.
 - 5. Refrigerant suction pressure and temperature.

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.

3.10 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.

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. Fan curves.
 - 2. Manufacturers' test data.
 - 3. Field test reports prepared by system and equipment installers.
 - 4. 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. Fan drive settings including settings and percentage of maximum pitch diameter.
 - e. Settings for supply-air, static-pressure controller.

- f. 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. Duct, outlet, and inlet sizes.
 - 3. Pipe and valve sizes and locations.
 - 4. Terminal units.
 - 5. Balancing stations.
 - 6. Position of balancing devices.

3.12 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 230593

SECTION 230713 - DUCT INSULATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes insulating the following duct services:
 - 1. Indoor, concealed supply.
 - 2. Indoor, exposed supply.
 - 3. Indoor, concealed exhaust between isolation damper and penetration of building exterior.

B. Related Sections:

- 1. Division 23 Section "HVAC Equipment Insulation."
- 2. Division 23 Section "HVAC Piping Insulation."
- 3. Division 23 Section "Metal Ducts" for duct liners.

1.2 ACTION SUBMITTALS

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

1.3 QUALITY ASSURANCE

- A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing 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 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.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

- A. Comply with requirements in "Duct Insulation Schedule, General," "Indoor Duct and Plenum Insulation Schedule," and "Aboveground, Outdoor Duct and Plenum Insulation Schedule" articles for where insulating materials shall be applied.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

- C. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
- D. 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 one of the following:
 - a. CertainTeed Corp.; SoftTouch Duct Wrap.
 - b. Johns Manville; Microlite.
 - c. Knauf Insulation; Friendly Feel Duct Wrap.
 - d. Manson Insulation Inc.; Alley Wrap.
 - e. Owens Corning; SOFTR All-Service Duct Wrap.
- E. Mineral-Fiber Board Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type IA or Type IB. For duct and plenum applications, provide insulation with factory-applied FSK jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. CertainTeed Corp.; Commercial Board.
 - b. Fibrex Insulations Inc.; FBX.
 - c. Johns Manville; 800 Series Spin-Glas.
 - d. Knauf Insulation; Insulation Board.
 - e. Manson Insulation Inc.; AK Board.
 - f. Owens Corning; Fiberglas 700 Series.

2.2 ADHESIVES

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.
- B. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-127.
 - b. Eagle Bridges Marathon Industries; 225.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-60/85-70.
 - d. Mon-Eco Industries, Inc.; 22-25.
 - 2. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

- C. FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-82.
 - b. Eagle Bridges Marathon Industries; 225.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-50.
 - d. Mon-Eco Industries, Inc.; 22-25.
 - 2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.3 MASTICS

- A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.
 - 1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below ambient services.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-80/30-90.
 - b. Vimasco Corporation; 749.
 - 2. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm at 43-mil dry film thickness.
 - 3. Service Temperature Range: Minus 20 to plus 180 deg F.
 - 4. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
 - 5. Color: White.
- C. Breather Mastic: Water based; suitable for indoor and outdoor use on above ambient services.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-10.
 - b. Eagle Bridges Marathon Industries; 550.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 46-50.
 - d. Mon-Eco Industries, Inc.; 55-50.

- e. Vimasco Corporation; WC-1/WC-5.
- 2. Water-Vapor Permeance: ASTM F 1249, 1.8 perms at 0.0625-inch dry film thickness.
- 3. Service Temperature Range: Minus 20 to plus 180 deg F.
- 4. Solids Content: 60 percent by volume and 66 percent by weight.
- 5. Color: White.

2.4 SEALANTS

- A. FSK and Metal Jacket Flashing Sealants:
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.
 - b. Eagle Bridges Marathon Industries; 405.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 95-44.
 - d. Mon-Eco Industries, Inc.; 44-05.
 - 2. Materials shall be compatible with insulation materials, jackets, and substrates.
 - 3. Fire- and water-resistant, flexible, elastomeric sealant.
 - 4. Service Temperature Range: Minus 40 to plus 250 deg F.
 - 5. Color: Aluminum.
 - 6. For indoor applications, use sealants that have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 7. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.5 FACTORY-APPLIED JACKETS

- A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:
 - 1. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.

2.6 FIELD-APPLIED JACKETS

- A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.
- B. Aluminum Jacket: Comply with ASTM B 209, Alloy 3003, 3005, 3105, or 5005, Temper H-14.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; Metal Jacketing Systems.
 - b. ITW Insulation Systems; Aluminum and Stainless Steel Jacketing.

DUCT INSULATION

- c. RPR Products, Inc.; Insul-Mate.
- 2. Sheet and roll stock ready for shop or field sizing.
- 3. Finish and thickness are indicated in field-applied jacket schedules.
- 4. Moisture Barrier for Indoor Applications: 1-mil- thick, heat-bonded polyethylene and kraft paper.
- 5. Moisture Barrier for Outdoor Applications: 3-mil- thick, heat-bonded polyethylene and kraft paper.

2.7 TAPES

- A. 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 one of the following:
 - a. ABI, Ideal Tape Division; 491 AWF FSK.
 - b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0827.
 - c. Compac Corporation; 110 and 111.
 - d. Venture Tape; 1525 CW NT, 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.
- B. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. ABI, Ideal Tape Division; 488 AWF.
 - b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0800.
 - c. Compac Corporation; 120.
 - d. Venture Tape; 3520 CW.
 - 2. Width: 2 inches.
 - 3. Thickness: 3.7 mils.
 - 4. Adhesion: 100 ounces force/inch in width.
 - 5. Elongation: 5 percent.
 - 6. Tensile Strength: 34 lbf/inch in width.

2.8 SECUREMENTS

- A. Aluminum Bands: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 1/2 inch wide with wing seal or closed seal.
 - 1. Products: Subject to compliance with requirements, provide one of the following:

- a. ITW Insulation Systems; Gerrard Strapping and Seals.
- b. RPR Products, Inc.; Insul-Mate Strapping, Seals, and Springs.
- B. Insulation Pins and Hangers:
 - 1. Metal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
 - a. Products: Subject to compliance with requirements, provide one of the following:
 - 1) AGM Industries, Inc.; Tactoo Perforated Base Insul-Hangers.
 - 2) GEMCO; Perforated Base.
 - 3) Midwest Fasteners, Inc.; Spindle.
 - b. Baseplate: Perforated, galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
 - c. Spindle: Copper- or zinc-coated, low-carbon steel, fully annealed, 0.106-inchdiameter shank, length to suit depth of insulation indicated.
 - d. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.
 - 2. Nonmetal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate fastened to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
 - a. Products: Subject to compliance with requirements, provide one of the following:
 - 1) GEMCO; Nylon Hangers.
 - 2) Midwest Fasteners, Inc.; Nylon Insulation Hangers.
 - b. Baseplate: Perforated, nylon sheet, 0.030 inch thick by 1-1/2 inches in diameter.
 - c. Spindle: Nylon, 0.106-inch- diameter shank, length to suit depth of insulation indicated, up to 2-1/2 inches.
 - d. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.
 - 3. Self-Sticking-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
 - a. Products: Subject to compliance with requirements, provide one of the following:
 - 1) AGM Industries, Inc.; Tactoo Self-Adhering Insul-Hangers.
 - 2) GEMCO; Peel & Press.
 - 3) Midwest Fasteners, Inc.; Self Stick.

- b. Baseplate: Galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
- c. Spindle: Copper- or zinc-coated, low-carbon steel, fully annealed, 0.106-inchdiameter shank, length to suit depth of insulation indicated.
- d. Adhesive-backed base with a peel-off protective cover.
- 4. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- thick, galvanized-steel sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.
 - a. Products: Subject to compliance with requirements, provide one of the following:
 - 1) AGM Industries, Inc.; RC-150.
 - 2) GEMCO; R-150.
 - 3) Midwest Fasteners, Inc.; WA-150.
 - 4) Nelson Stud Welding; Speed Clips.
 - b. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.
- 5. Nonmetal Insulation-Retaining Washers: Self-locking washers formed from 0.016-inchthick nylon sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) GEMCO.
 - 2) Midwest Fasteners, Inc.
- C. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel or Monel.
- D. Wire: 0.080-inch nickel-copper alloy.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. C & F Wire.

2.9 CORNER ANGLES

A. 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.

PART 3 - EXECUTION

3.1 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

DUCT INSULATION

3.2 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of ducts and fittings.
- B. Install insulation materials, vapor barriers or retarders, jackets, and thicknesses required for each item of duct system as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, 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. Keep insulation materials dry during application and finishing.
- G. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- H. Install insulation with least number of joints practical.
- I. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
 - 1. Install insulation continuously through hangers and around anchor attachments.
 - 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
 - 3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
- J. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- K. 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. 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, according to insulation material manufacturer's written instructions, to maintain vapor seal.

- 5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct flanges and fittings.
- L. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- M. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- N. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

3.3 PENETRATIONS

- A. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
 - 1. Seal penetrations with flashing sealant.
 - 2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 - 3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
 - 4. Seal jacket to wall flashing with flashing sealant.
- B. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- C. Insulation Installation at Fire-Rated Wall and Partition Penetrations: 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" for firestopping and fire-resistive joint sealers.

3.4 INSTALLATION OF MINERAL-FIBER INSULATION

- A. 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, capacitordischarge-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 one edge and one 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 vaporbarrier 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 two 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.
- B. Board Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.
 - 1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 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, capacitordischarge-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 one edge and one 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 vaporbarrier 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 two 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.

3.5 FIELD-APPLIED JACKET INSTALLATION

- A. Where FSK jackets are indicated, install as follows:
 - 1. Draw jacket material smooth and tight.
 - 2. Install lap or joint strips with same material as jacket.
 - 3. Secure jacket to insulation with manufacturer's recommended adhesive.
 - 4. Install jacket with 1-1/2-inch laps at longitudinal seams and 3-inch- wide joint strips at end joints.
 - 5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.

3.6 FINISHES

A. Insulation with ASJ 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. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.
- C. Do not field paint aluminum or stainless-steel jackets.

3.7 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. 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.
- C. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.8 DUCT INSULATION SCHEDULE, GENERAL

- A. Plenums and Ducts Requiring Insulation:
 - 1. Indoor, concealed supply.
 - 2. Indoor, exposed supply.
 - 3. Indoor, concealed exhaust between isolation damper and penetration of building exterior.
- B. Items Not Insulated:
 - 1. Metal ducts with duct liner of sufficient thickness to comply with energy code and ASHRAE/IESNA 90.1.
 - 2. Factory-insulated flexible ducts.
 - 3. Factory-insulated plenums and casings.
 - 4. Flexible connectors.
 - 5. Vibration-control devices.
 - 6. Factory-insulated access panels and doors.

3.9 INDOOR DUCT AND PLENUM INSULATION SCHEDULE

- A. Concealed, Supply-Air Duct and Plenum Insulation: Mineral-fiber blanket, 2 inches thick and 0.75-lb/cu. ft. nominal density.
- B. Concealed, Exhaust-Air Duct and Plenum Insulation: Mineral-fiber blanket, 1-1/2 inches thick and 0.75-lb/cu. ft. nominal density.

C. Exposed, Supply-Air Duct and Plenum Insulation: Mineral-fiber board, 2 inches thick and 0.75-lb/cu. ft. nominal density.

3.10 INDOOR, FIELD-APPLIED JACKET SCHEDULE

- A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.
- B. If more than one material is listed, selection from materials listed is Contractor's option.
- C. Ducts and Plenums, Exposed:
 - 1. Aluminum, Smooth: 0.016 inch thick.

3.11 OUTDOOR, FIELD-APPLIED JACKET SCHEDULE

- A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.
- B. If more than one material is listed, selection from materials listed is Contractor's option.
- C. Ducts and Plenums, Exposed, up to 48 Inches in Diameter or with Flat Surfaces up to 72 Inches:
 - 1. Aluminum, Smooth: 0.020 inch thick.

END OF SECTION 230713

SECTION 230719 - HVAC PIPING INSULATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes insulating the following HVAC piping systems:
 - 1. Refrigerant suction and hot-gas piping, indoors and outdoors.
- B. Related Sections:
 - 1. Division 23 Section "Duct Insulation."

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
 - 1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
 - 2. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation and hanger.type of insulation.
 - 3. Detail removable insulation at piping specialties.
 - 4. Detail application of field-applied jackets.
 - 5. Detail application at linkages of control devices.

1.3 QUALITY ASSURANCE

- A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to 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 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.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

- A. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- B. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
- C. 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. Pittsburgh Corning Corporation; Foamglas.
 - 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.
- D. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Aeroflex USA, Inc.; Aerocel.
 - b. Armacell LLC; AP Armaflex.
 - c. K-Flex USA; Insul-Lock, Insul-Tube, and K-FLEX LS.
- E. Polyolefin: Unicellular, polyethylene thermal plastic insulation. Comply with ASTM C 534 or ASTM C 1427, Type I, Grade 1 for tubular materials and Type II, Grade 1 for sheet materials.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Armacell LLC; Tubolit.
 - b. Nomaco Insulation; IMCOLOCK, IMCOSHEET, NOMALOCK, and NOMAPLY.

2.2 INSULATING CEMENTS

- A. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449.
 - 1. Products: Subject to compliance with requirements, provide the following:
 - a. Ramco Insulation, Inc.; Ramcote 1200 and Quik-Cote.

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. Cellular-Glass Adhesive: Two-component, thermosetting urethane adhesive containing no flammable solvents, with a service temperature range of minus 100 to plus 200 deg F.
 - 1. Products: Subject to compliance with requirements, provide the following:
 - a. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 81-84.
 - 2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- C. Flexible Elastomeric and Polyolefin Adhesive: Comply with MIL-A-24179A, Type II, Class I.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Aeroflex USA, Inc.; Aeroseal.
 - b. Armacell LLC; Armaflex 520 Adhesive.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-75.
 - d. K-Flex USA; R-373 Contact Adhesive.
 - 2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- D. ASJ Adhesive, and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-82.
 - b. Eagle Bridges Marathon Industries; 225.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-50.
 - d. Mon-Eco Industries, Inc.; 22-25.
 - 2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

- 3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- E. PVC Jacket Adhesive: Compatible with PVC jacket.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Dow Corning Corporation; 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; Polyco VP Adhesive.
 - 2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.4 MASTICS

- A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.
 - 1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below-ambient services.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-80/30-90.
 - b. Vimasco Corporation; 749.
 - 2. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm at 43-mil dry film thickness.
 - 3. Service Temperature Range: Minus 20 to plus 180 deg F.
 - 4. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
 - 5. Color: White.
- C. Breather Mastic: Water based; suitable for indoor and outdoor use on above-ambient services.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-10.
 - b. Eagle Bridges Marathon Industries; 550.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 46-50.

- d. Mon-Eco Industries, Inc.; 55-50.
- e. Vimasco Corporation; WC-1/WC-5.
- 2. Water-Vapor Permeance: ASTM F 1249, 1.8 perms at 0.0625-inch dry film thickness.
- 3. Service Temperature Range: Minus 20 to plus 180 deg F.
- 4. Solids Content: 60 percent by volume and 66 percent by weight.
- 5. Color: White.

2.5 SEALANTS

- A. Joint Sealants:
 - 1. Joint Sealants for Cellular-Glass Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.
 - b. Eagle Bridges Marathon Industries; 405.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-45.
 - d. Mon-Eco Industries, Inc.; 44-05.
 - e. Pittsburgh Corning Corporation; Pittseal 444.
 - 2. Materials shall be compatible with insulation materials, jackets, and substrates.
 - 3. Permanently flexible, elastomeric sealant.
 - 4. Service Temperature Range: Minus 100 to plus 300 deg F.
 - 5. Color: White or gray.
 - 6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 7. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- B. FSK and Metal Jacket Flashing Sealants:
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.
 - b. Eagle Bridges Marathon Industries; 405.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 95-44.
 - d. Mon-Eco Industries, Inc.; 44-05.
 - 2. Materials shall be compatible with insulation materials, jackets, and substrates.
 - 3. Fire- and water-resistant, flexible, elastomeric sealant.
 - 4. Service Temperature Range: Minus 40 to plus 250 deg F.
 - 5. Color: Aluminum.
 - 6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

- 7. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- C. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:
 - 1. Products: Subject to compliance with requirements, provide the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.
 - 2. Materials shall be compatible with insulation materials, jackets, and substrates.
 - 3. Fire- and water-resistant, flexible, elastomeric sealant.
 - 4. Service Temperature Range: Minus 40 to plus 250 deg F.
 - 5. Color: White.
 - 6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 7. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

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. FSP Jacket: Aluminum-foil, fiberglass-reinforced scrim with polyethylene backing; complying with ASTM C 1136, Type II.

2.7 FIELD-APPLIED FABRIC-REINFORCING MESH

- A. Woven Polyester Fabric: Approximately 1 oz./sq. yd. with a thread count of 10 strands by 10 strands/sq. in., in a Leno weave, for pipe.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; Mast-A-Fab.
 - b. Vimasco Corporation; Elastafab 894.

2.8 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. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Johns Manville; Zeston.
 - b. P.I.C. Plastics, Inc.; FG Series.
 - c. Proto 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.
- D. Aluminum Jacket: Comply with ASTM B 209, Alloy 3003, 3005, 3105, or 5005, Temper H-14.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; Metal Jacketing Systems.
 - b. ITW Insulation Systems; Aluminum and Stainless Steel Jacketing.
 - c. RPR Products, Inc.; Insul-Mate.
 - 2. Sheet and roll stock ready for shop or field sizing.
 - 3. Finish and thickness are indicated in field-applied jacket schedules.
 - 4. Moisture Barrier for Indoor Applications: 1-mil- thick, heat-bonded polyethylene and kraft paper.
 - 5. Moisture Barrier for Outdoor Applications: 3-mil- thick, heat-bonded polyethylene and kraft paper.
 - 6. Factory-Fabricated Fitting Covers:
 - a. Same material, finish, and thickness as jacket.
 - b. Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.
 - c. Tee covers.
 - d. Flange and union covers.
 - e. End caps.
 - f. Beveled collars.
 - g. Valve covers.
 - h. Field fabricate fitting covers only if factory-fabricated fitting covers are not available.
- E. Self-Adhesive Outdoor Jacket: 60-mil- thick, laminated vapor barrier and waterproofing membrane for installation over insulation located aboveground outdoors; consisting of a rubberized bituminous resin on a crosslaminated polyethylene film covered with white aluminum-foil facing.

- 1. Products: Subject to compliance with requirements, provide the following:
 - a. Polyguard Products, Inc.; Alumaguard 60.

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 one of the following:
 - a. ABI, Ideal Tape Division; 428 AWF ASJ.
 - b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0836.
 - c. Compac Corporation; 104 and 105.
 - 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 one of the following:
 - a. ABI, Ideal Tape Division; 491 AWF FSK.
 - b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0827.
 - c. Compac Corporation; 110 and 111.
 - d. Venture Tape; 1525 CW NT, 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 one of the following:
 - a. ABI, Ideal Tape Division; 370 White PVC tape.
 - b. Compac Corporation; 130.
 - c. 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.
- D. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. ABI, Ideal Tape Division; 488 AWF.
 - b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0800.
 - c. Compac Corporation; 120.
 - d. Venture Tape; 3520 CW.
 - 2. Width: 2 inches.
 - 3. Thickness: 3.7 mils.
 - 4. Adhesion: 100 ounces force/inch in width.
 - 5. Elongation: 5 percent.
 - 6. Tensile Strength: 34 lbf/inch in width.

2.10 SECUREMENTS

- A. Aluminum Bands: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 1/2 inch wide with wing seal or closed seal.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. ITW Insulation Systems; Gerrard Strapping and Seals.
 - b. RPR Products, Inc.; Insul-Mate Strapping, Seals, and Springs.
- B. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel or Monel.
- C. Wire: 0.080-inch nickel-copper alloy.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. C & F Wire.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.
- B. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.2 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.
- B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of 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, according to insulation material manufacturer's written instructions, 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.

3.3 PENETRATIONS

- A. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
 - 1. Seal penetrations with flashing sealant.
 - 2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 - 3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
 - 4. Seal jacket to wall flashing with flashing sealant.
- B. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

3.4 GENERAL PIPE INSULATION INSTALLATION

- A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.
- B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:

- 1. 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. 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.

3.5 INSTALLATION OF CELLULAR-GLASS INSULATION

- A. Insulation Installation on Straight Pipes and Tubes:
 - 1. Secure each layer of 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 services, secure laps with outward-clinched staples at 6 inches o.c.
 - 4. For insulation with factory-applied jackets on below-ambient services, do not staple longitudinal tabs. Instead, 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 cut sections of cellular-glass block insulation of same thickness as pipe insulation.
 - 4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.
- C. Insulation Installation on Pipe Fittings and Elbows:
 - 1. Install preformed sections of same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
 - 2. When preformed sections of insulation are not available, install mitered sections of cellular-glass insulation. Secure insulation materials with wire or bands.
- D. Insulation Installation on Valves and Pipe Specialties:
 - 1. Install preformed sections of cellular-glass 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.

3.6 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

- A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- B. Insulation Installation on Pipe Flanges:
 - 1. Install 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 cut sections of sheet insulation of same thickness as pipe insulation.
 - 4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- C. Insulation Installation on Pipe Fittings and Elbows:
 - 1. Install mitered sections of pipe insulation.
 - 2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- D. Insulation Installation on Valves and Pipe Specialties:
 - 1. Install preformed valve covers manufactured of same material as pipe insulation when available.
 - 2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
 - 3. Install insulation to flanges as specified for flange insulation application.
 - 4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.7 INSTALLATION OF POLYOLEFIN INSULATION

- A. Insulation Installation on Straight Pipes and Tubes:
 - 1. Seal split-tube longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- B. Insulation Installation on Pipe Flanges:
 - 1. Install 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 cut sections of polyolefin sheet insulation of same thickness as pipe insulation.
- 4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- C. Insulation Installation on Pipe Fittings and Elbows:
 - 1. Install mitered sections of polyolefin pipe insulation.
 - 2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- D. Insulation Installation on Valves and Pipe Specialties:
 - 1. Install cut sections of polyolefin pipe and sheet 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.
 - 4. Secure insulation to valves and specialties, and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.8 FIELD-APPLIED JACKET INSTALLATION

- A. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints; for horizontal applications. Seal with manufacturer's recommended adhesive.
 - 1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.
- B. 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.

3.9 FINISHES

- A. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.
- B. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.
- C. Do not field paint aluminum or stainless-steel jackets.

3.10 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections:
 - 1. 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.
- C. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.11 PIPING INSULATION SCHEDULE, GENERAL

A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

3.12 INDOOR PIPING INSULATION SCHEDULE

- A. Refrigerant Suction and Hot-Gas Piping: Flexible elastomeric, 1 inch thick.
- B. Refrigerant Suction and Hot-Gas Flexible Tubing: Flexible elastomeric, 1 inch thick.

3.13 OUTDOOR, ABOVEGROUND PIPING INSULATION SCHEDULE

- A. Refrigerant Suction and Hot-Gas Piping: Insulation shall be one of the following:
 - 1. Cellular Glass: 2 inches thick.
 - 2. Flexible Elastomeric: 2 inches thick.
 - 3. Mineral-Fiber, Preformed Pipe Insulation, Type I: 2 inches thick.
 - 4. Polyolefin: 2 inches thick.
- B. Refrigerant Suction and Hot-Gas Flexible Tubing: Insulation shall be one of the following:
 - 1. Flexible Elastomeric: 2 inches thick.
 - 2. Polyolefin: 2 inches thick.

3.14 INDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

- B. If more than one material is listed, selection from materials listed is Contractor's option.
- C. Piping, Concealed:
 - 1. PVC: 20 mils thick.
 - 2. Aluminum, Smooth: 0.020 inch thick.
- D. Piping, Exposed:
 - 1. PVC: 20 mils thick.
 - 2. Aluminum, Smooth: 0.020 inch thick.

3.15 OUTDOOR, FIELD-APPLIED JACKET SCHEDULE

- A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.
- B. If more than one material is listed, selection from materials listed is Contractor's option.
- C. Piping, Exposed:
 - 1. PVC: 30 mils thick.

END OF SECTION 230719

SECTION 232300 - REFRIGERANT PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes refrigerant piping used for air-conditioning applications.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of valve and refrigerant piping specialty indicated. Include pressure drop based on manufacturer's test data.
- B. Shop Drawings: Show layout of refrigerant piping and specialties, including pipe, tube, and fitting sizes, flow capacities, valve arrangements and locations, slopes of horizontal runs, oil traps, double risers, wall and floor penetrations, and equipment connection details. Show interface and spatial relationships between piping and equipment.
 - 1. Refrigerant piping indicated on Drawings is schematic only. Size piping and design actual piping layout, including oil traps, double risers, specialties, and pipe and tube sizes to accommodate, as a minimum, equipment provided, elevation difference between compressor and evaporator, and length of piping to ensure proper operation and compliance with warranties of connected equipment.

1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control test reports.

1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.5 QUALITY ASSURANCE

- A. Comply with ASHRAE 15, "Safety Code for Refrigeration Systems."
- B. Comply with ASME B31.5, "Refrigeration Piping and Heat Transfer Components."

1.6 PRODUCT STORAGE AND HANDLING

A. Store piping in a clean and protected area with end caps in place to ensure that piping interior and exterior are clean when installed.

PART 2 - PRODUCTS

2.1 COPPER TUBE AND FITTINGS

- A. Copper Tube: ASTM B 280, Type ACR.
- B. Wrought-Copper Fittings: ASME B16.22.
- C. Wrought-Copper Unions: ASME B16.22.
- D. Solder Filler Metals: ASTM B 32. Use 95-5 tin antimony or alloy HB solder to join copper socket fittings on copper pipe.
- E. Brazing Filler Metals: AWS A5.8.
- F. Flexible Connectors:
 - 1. Body: Tin-bronze bellows with woven, flexible, tinned-bronze-wire-reinforced protective jacket.
 - 2. End Connections: Socket ends.
 - 3. Offset Performance: Capable of minimum 3/4-inch misalignment in minimum 7-inchlong assembly.
 - 4. Pressure Rating: Factory test at minimum 500 psig.
 - 5. Maximum Operating Temperature: 250 deg F.

2.2 VALVES AND SPECIALTIES

- A. Diaphragm Packless Valves:
 - 1. Body and Bonnet: Forged brass or cast bronze; globe design with straight-through or angle pattern.
 - 2. Diaphragm: Phosphor bronze and stainless steel with stainless-steel spring.
 - 3. Operator: Rising stem and hand wheel.
 - 4. Seat: Nylon.
 - 5. End Connections: Socket, union, or flanged.
 - 6. Working Pressure Rating: 500 psig.
 - 7. Maximum Operating Temperature: 275 deg F.
- B. Check Valves:
 - 1. Body: Ductile iron, forged brass, or cast bronze; globe pattern.
 - 2. Bonnet: Bolted ductile iron, forged brass, or cast bronze; or brass hex plug.
 - 3. Piston: Removable polytetrafluoroethylene seat.
 - 4. Closing Spring: Stainless steel.
 - 5. Manual Opening Stem: Seal cap, plated-steel stem, and graphite seal.
 - 6. End Connections: Socket, union, threaded, or flanged.
 - 7. Maximum Opening Pressure: 0.50 psig.
 - 8. Working Pressure Rating: 500 psig.
 - 9. Maximum Operating Temperature: 275 deg F.

C. Service Valves:

- 1. Body: Forged brass with brass cap including key end to remove core.
- 2. Core: Removable ball-type check valve with stainless-steel spring.
- 3. Seat: Polytetrafluoroethylene.
- 4. End Connections: Copper spring.
- 5. Working Pressure Rating: 500 psig.
- D. Solenoid Valves: Comply with ARI 760 and UL 429; listed and labeled by an NRTL.
 - 1. Body and Bonnet: Plated steel.
 - 2. Solenoid Tube, Plunger, Closing Spring, and Seat Orifice: Stainless steel.
 - 3. Seat: Polytetrafluoroethylene.
 - 4. End Connections: Threaded.
 - 5. Electrical: Molded, watertight coil in NEMA 250 enclosure of type required by location with 1/2-inch conduit adapter, and 115-V ac coil.
 - 6. Working Pressure Rating: 400 psig.
 - 7. Maximum Operating Temperature: 240 deg F.
 - 8. Manual operator.
- E. Safety Relief Valves: Comply with ASME Boiler and Pressure Vessel Code; listed and labeled by an NRTL.
 - 1. Body and Bonnet: Ductile iron and steel, with neoprene O-ring seal.
 - 2. Piston, Closing Spring, and Seat Insert: Stainless steel.
 - 3. Seat Disc: Polytetrafluoroethylene.
 - 4. End Connections: Threaded.
 - 5. Working Pressure Rating: 400 psig.
 - 6. Maximum Operating Temperature: 240 deg F.
- F. Thermostatic Expansion Valves: Comply with ARI 750.
 - 1. Body, Bonnet, and Seal Cap: Forged brass or steel.
 - 2. Diaphragm, Piston, Closing Spring, and Seat Insert: Stainless steel.
 - 3. Packing and Gaskets: Non-asbestos.
 - 4. Capillary and Bulb: Copper tubing filled with refrigerant charge.
 - 5. Suction Temperature: 40 deg F.
 - 6. Superheat: Adjustable.
 - 7. End Connections: Socket, flare, or threaded union.
 - 8. Working Pressure Rating: 700 psig.
- G. Straight-Type Strainers:
 - 1. Body: Welded steel with corrosion-resistant coating.
 - 2. Screen: 100-mesh stainless steel.
 - 3. End Connections: Socket or flare.
 - 4. Working Pressure Rating: 500 psig.
 - 5. Maximum Operating Temperature: 275 deg F.
- H. Angle-Type Strainers:

- 1. Body: Forged brass or cast bronze.
- 2. Drain Plug: Brass hex plug.
- 3. Screen: 100-mesh monel.
- 4. End Connections: Socket or flare.
- 5. Working Pressure Rating: 500 psig.
- 6. Maximum Operating Temperature: 275 deg F.
- I. Moisture/Liquid Indicators:
 - 1. Body: Forged brass.
 - 2. Window: Replaceable, clear, fused glass window with indicating element protected by filter screen.
 - 3. Indicator: Color coded to show moisture content in ppm.
 - 4. Minimum Moisture Indicator Sensitivity: Indicate moisture above 60 ppm.
 - 5. End Connections: Socket or flare.
 - 6. Working Pressure Rating: 500 psig.
 - 7. Maximum Operating Temperature: 240 deg F.
- J. Replaceable-Core Filter Dryers: Comply with ARI 730.
 - 1. Body and Cover: Painted-steel shell with ductile-iron cover, stainless-steel screws, and neoprene gaskets.
 - 2. Filter Media: 10 micron, pleated with integral end rings; stainless-steel support.
 - 3. Desiccant Media: Activated alumina.
 - 4. End Connections: Socket.
 - 5. Access Ports: NPS 1/4 connections at entering and leaving sides for pressure differential measurement.
 - 6. Maximum Pressure Loss: 2 psig.
 - 7. Rated Flow: 8 tons.
 - 8. Working Pressure Rating: 500 psig.
 - 9. Maximum Operating Temperature: 240 deg F.
- K. Liquid Accumulators: Comply with ARI 495.
 - 1. Body: Welded steel with corrosion-resistant coating.
 - 2. End Connections: Socket or threaded.
 - 3. Working Pressure Rating: 500 psig.
 - 4. Maximum Operating Temperature: 275 deg F.

2.3 REFRIGERANTS

- 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. Atofina Chemicals, Inc.
 - 2. DuPont Company; Fluorochemicals Div.
 - 3. Honeywell, Inc.; Genetron Refrigerants.

4. INEOS Fluor Americas LLC.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

- A. Suction Lines NPS 1-1/2 and Smaller for Conventional Air-Conditioning Applications: Copper, Type ACR, annealed-temper tubing and wrought-copper fittings with brazed or soldered joints.
- B. Hot-Gas and Liquid Lines:
 - 1. NPS 1-1/2 and Smaller: Copper, Type ACR, annealed-temper tubing and wrought-copper fittings with brazed or soldered joints.
- C. Safety-Relief-Valve Discharge Piping: Copper, Type ACR, drawn-temper tubing and wrought-copper fittings with soldered joints.

3.2 VALVE AND SPECIALTY APPLICATIONS

- A. Install diaphragm packless valves in suction and discharge lines of compressor.
- B. Install service valves for gage taps at strainers if they are not an integral part of strainers.
- C. Install a check valve at the compressor discharge and a liquid accumulator at the compressor suction connection.
- D. Except as otherwise indicated, install diaphragm packless valves on inlet and outlet side of filter dryers.
- E. Install a full-sized, three-valve bypass around filter dryers.
- F. Install solenoid valves upstream from each expansion valve. Install solenoid valves in horizontal lines with coil at top.
- G. Install thermostatic expansion valves as close as possible to distributors on evaporators.
 - 1. Install valve so diaphragm case is warmer than bulb.
 - 2. Secure bulb to clean, straight, horizontal section of suction line using two bulb straps. Do not mount bulb in a trap or at bottom of the line.
 - 3. If external equalizer lines are required, make connection where it will reflect suction-line pressure at bulb location.
- H. Install safety relief valves where required by ASME Boiler and Pressure Vessel Code. Pipe safety-relief-valve discharge line to outside according to ASHRAE 15.
- I. Install moisture/liquid indicators in liquid line at the inlet of the thermostatic expansion valve or at the inlet of the evaporator coil capillary tube.

- J. Install strainers upstream from and adjacent to the following unless they are furnished as an integral assembly for device being protected:
 - 1. Solenoid valves.
 - 2. Thermostatic expansion valves.
 - 3. Compressor.
- K. Install filter dryers in liquid line between compressor and thermostatic expansion valve.
- L. Install flexible connectors at compressors.

3.3 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems; indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Shop Drawings.
- B. Install refrigerant piping according to ASHRAE 15.
- 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 adjacent to machines to allow service and maintenance.
- G. Install piping free of sags and bends.
- H. Install fittings for changes in direction and branch connections.
- I. Select system components with pressure rating equal to or greater than system operating pressure.
- J. Install piping as short and direct as possible, with a minimum number of joints, elbows, and fittings.
- K. Arrange piping to allow inspection and service of refrigeration equipment. Install valves and specialties in accessible locations to allow for service and inspection. Install access doors or panels as specified in Division 08 Section "Access Doors and Frames" if valves or equipment requiring maintenance is concealed behind finished surfaces.
- L. Install refrigerant piping in rigid or flexible conduit in locations where exposed to mechanical injury.
- M. Slope refrigerant piping as follows:

- 1. Install horizontal hot-gas discharge piping with a uniform slope downward away from compressor.
- 2. Install horizontal suction lines with a uniform slope downward to compressor.
- 3. Install traps and double risers to entrain oil in vertical runs.
- 4. Liquid lines may be installed level.
- N. When brazing or soldering, remove solenoid-valve coils and sight glasses; also remove valve stems, seats, and packing, and accessible internal parts of refrigerant specialties. Do not apply heat near expansion-valve bulb.
- O. Install piping with adequate clearance between pipe and adjacent walls and hangers or between pipes for insulation installation.
- P. Identify refrigerant piping and valves according to Division 23 Section "Identification for HVAC Piping and Equipment."
- Q. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Division 23 Section "Sleeves and Sleeve Seals for HVAC Piping."
- R. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Division 23 Section "Escutcheons for HVAC Piping."

3.4 PIPE JOINT CONSTRUCTION

- A. Soldered Joints: Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook."
- B. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," Chapter "Pipe and Tube."
 - 1. Use Type BcuP, copper-phosphorus alloy for joining copper socket fittings with copper pipe.
 - 2. Use Type BAg, cadmium-free silver alloy for joining copper with bronze or steel.

3.5 HANGERS AND SUPPORTS

- A. Hanger, support, and anchor products are specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment."
- B. Install the following pipe attachments:
 - 1. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 feet or longer, supported on a trapeze.
 - 2. Copper-clad supports for supports in direct contact with copper pipe.
- C. Install hangers for copper tubing with the following maximum spacing and minimum rod sizes:
 - 1. NPS 1/2: Maximum span, 60 inches; minimum rod size, 1/4 inch.
 - 2. NPS 5/8: Maximum span, 60 inches; minimum rod size, 1/4 inch.
 - 3. NPS 1: Maximum span, 72 inches; minimum rod size, 1/4 inch.

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- 4. NPS 1-1/4: Maximum span, 96 inches; minimum rod size, 3/8 inch.
- 5. NPS 1-1/2: Maximum span, 96 inches; minimum rod size, 3/8 inch.

3.6 FIELD QUALITY CONTROL

- A. Perform tests and inspections and prepare test reports.
- B. Tests and Inspections:
 - 1. Comply with ASME B31.5, Chapter VI.
 - 2. Test refrigerant piping and specialties. Isolate compressor, condenser, evaporator, and safety devices from test pressure if they are not rated above the test pressure.
 - 3. Test high- and low-pressure side piping of each system separately at not less than the pressures indicated in Part 1 "Performance Requirements" Article.
 - a. Fill system with nitrogen to the required test pressure.
 - b. System shall maintain test pressure at the manifold gage throughout duration of test.
 - c. Test joints and fittings with electronic leak detector or by brushing a small amount of soap and glycerin solution over joints.
 - d. Remake leaking joints using new materials, and retest until satisfactory results are achieved.

3.7 SYSTEM CHARGING

- A. Charge system using the following procedures:
 - 1. Install core in filter dryers after leak test but before evacuation.
 - 2. Evacuate entire refrigerant system with a vacuum pump to 500 micrometers. If vacuum holds for 12 hours, system is ready for charging.
 - 3. Break vacuum with refrigerant gas, allowing pressure to build up to 2 psig.
 - 4. Charge system with a new filter-dryer core in charging line.

3.8 ADJUSTING

- A. Adjust thermostatic expansion valve to obtain proper evaporator superheat.
- B. Adjust high- and low-pressure switch settings to avoid short cycling in response to fluctuating suction pressure.
- C. Adjust set-point temperature of air-conditioning controllers to the system design temperature.
- D. Perform the following adjustments before operating the refrigeration system, according to manufacturer's written instructions:
 - 1. Open shutoff valves in condenser water circuit.
 - 2. Verify that compressor oil level is correct.
 - 3. Open compressor suction and discharge valves.
 - 4. Open refrigerant valves except bypass valves that are used for other purposes.

- 5. Check open compressor-motor alignment and verify lubrication for motors and bearings.
- E. Replace core of replaceable filter dryer after system has been adjusted and after design flow rates and pressures are established.

END OF SECTION 232300

SECTION 233113 - METAL DUCTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Rectangular ducts and fittings.
 - 2. Round ducts and fittings.
 - 3. Sheet metal materials.
 - 4. Sealants and gaskets.
 - 5. 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 "Air Duct Accessories" for dampers, sound-control devices, ductmounting access doors and panels, turning vanes, and flexible ducts.

1.2 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 SMACNA's "Seismic Restraint Manual: Guidelines for Mechanical Systems."
- C. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- 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, 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, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation for selecting hangers and supports.

1.4 INFORMATIONAL SUBMITTALS

- A. 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.

1.5 QUALITY ASSURANCE

- A. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 "Systems and Equipment" and Section 7 "Construction and System Start-up."
- B. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.4.4 "HVAC System Construction and Insulation."

PART 2 - PRODUCTS

2.1 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 2-1, "Rectangular Duct/Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards Metal and Flexible."
- C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards Metal and Flexible."
- 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 4, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.2 ROUND 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, provide products by one of the following:
 - a. Lindab Inc.
 - b. McGill AirFlow LLC.
 - c. SEMCO Incorporated.
 - d. Sheet Metal Connectors, Inc.
 - e. Spiral Manufacturing Co., Inc.
- B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards Metal and Flexible," Figure 3-1, "Round Duct Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards Metal and Flexible."
- C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards Metal and Flexible," Figure 3-2, "Round Duct Longitudinal Seams,"

for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

D. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.3 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. 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.

2.4 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.
 - 10. For indoor applications, sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

- 11. Sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- C. 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. 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.
 - 6. For indoor applications, sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 7. Sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- E. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.
- F. 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.

2.5 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 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct."

- D. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.
- E. 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.
- F. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.
- G. Trapeze and Riser Supports:
 - 1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.

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 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 "IAQ Guidelines for Occupied Buildings Under Construction," Appendix G, "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.
- 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."
- B. Seal ducts to the following seal classes according to SMACNA's "HVAC Duct Construction Standards Metal and Flexible":
 - 1. Comply with SMACNA's "HVAC Duct Construction Standards Metal and Flexible."
 - 2. Outdoor, Supply-Air Ducts: Seal Class A.
 - 3. Outdoor, Return-Air Ducts: Seal Class C.
 - 4. Conditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class C.
 - 5. Conditioned Space, Exhaust Ducts: Seal Class B.
 - 6. Conditioned Space, Return-Air Ducts: Seal Class C.

3.4 HANGER AND SUPPORT INSTALLATION

- A. Comply with SMACNA's "HVAC Duct Construction Standards Metal and Flexible," Chapter 5, "Hangers and Supports."
- B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.
 - 1. Where practical, install concrete inserts before placing concrete.

- 2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
- 3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.
- 4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.
- 5. Do not use powder-actuated concrete fasteners for seismic restraints.
- C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches 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 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.

3.6 DUCT CLEANING

- A. Clean new duct system(s) before testing, adjusting, and balancing.
- B. Use service openings for entry and inspection.
 - 1. Create new openings and install access panels appropriate for duct static-pressure class if required for cleaning access. Provide insulated panels for insulated or lined duct. Patch insulation and liner as recommended by duct liner manufacturer. Comply with Division 23 Section "Air Duct Accessories" for access panels and doors.
 - 2. Disconnect and reconnect flexible ducts as needed for cleaning and inspection.
 - 3. Remove and reinstall ceiling to gain access during the cleaning process.
- C. Particulate Collection and Odor Control:
 - 1. When venting vacuuming system inside the building, use HEPA filtration with 99.97 percent collection efficiency for 0.3-micron-size (or larger) particles.
 - 2. When venting vacuuming system to outdoors, use filter to collect debris removed from HVAC system, and locate exhaust downwind and away from air intakes and other points of entry into building.

- D. Clean the following components by removing surface contaminants and deposits:
 - 1. Air outlets and inlets (registers, grilles, and diffusers).
 - 2. Supply, return, and exhaust fans including fan housings, plenums (except ceiling supply and return plenums), scrolls, blades or vanes, shafts, baffles, dampers, and drive assemblies.
 - 3. Air-handling unit internal surfaces and components including mixing box, coil section, air wash systems, spray eliminators, condensate drain pans, humidifiers and dehumidifiers, filters and filter sections, and condensate collectors and drains.
 - 4. Coils and related components.
 - 5. Return-air ducts, dampers, actuators, and turning vanes except in ceiling plenums and mechanical equipment rooms.
 - 6. Supply-air ducts, dampers, actuators, and turning vanes.
 - 7. Dedicated exhaust and ventilation components and makeup air systems.
- E. Mechanical Cleaning Methodology:
 - 1. Clean metal duct systems using mechanical cleaning methods that extract contaminants from within duct systems and remove contaminants from building.
 - 2. Use vacuum-collection devices that are operated continuously during cleaning. Connect vacuum device to downstream end of duct sections so areas being cleaned are under negative pressure.
 - 3. Use mechanical agitation to dislodge debris adhered to interior duct surfaces without damaging integrity of metal ducts, duct liner, or duct accessories.
 - 4. Clean coils and coil drain pans according to NADCA 1992. Keep drain pan operational. Rinse coils with clean water to remove latent residues and cleaning materials; comb and straighten fins.
 - 5. Provide drainage and cleanup for wash-down procedures.
 - 6. Antimicrobial Agents and Coatings: Apply EPA-registered antimicrobial agents if fungus is present. Apply antimicrobial agents according to manufacturer's written instructions after removal of surface deposits and debris.

3.7 START UP

A. Air Balance: Comply with requirements in Division 23 Section "Testing, Adjusting, and Balancing for HVAC."

3.8 DUCT SCHEDULE

- A. Fabricate ducts with galvanized sheet steel except as otherwise indicated and as follows:
- B. Supply Ducts:
 - 1. 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.

- C. Return Ducts:
 - 1. Ducts Connected to Air-Handling Units:
 - a. Pressure Class: Positive or negative 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.
- D. Exhaust Ducts:
 - 1. Ducts Connected to Fans Exhausting (ASHRAE 62.1, Class 1 and 2) Air:
 - a. Pressure Class: Negative 2-inch wg.
 - b. Minimum SMACNA Seal Class: A if negative pressure, and A if positive pressure.
 - c. SMACNA Leakage Class for Rectangular: 12.
 - d. SMACNA Leakage Class for Round and Flat Oval: 12.
- E. 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.
- F. Elbow Configuration:
 - 1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards Metal and Flexible," Figure 4-2, "Rectangular Elbows."
 - a. Velocity 1000 fpm or Lower:
 - 1) Radius Type RE 1 with minimum 0.5 radius-to-diameter ratio.
 - 2) Mitered Type RE 4 without vanes.
 - b. Velocity 1000 to 1500 fpm:
 - 1) Radius Type RE 1 with minimum 1.0 radius-to-diameter ratio.
 - 2) Radius Type RE 3 with minimum 0.5 radius-to-diameter ratio and two vanes.
 - 3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."
 - c. Velocity 1500 fpm or Higher:
 - 1) Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
 - 2) Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.

- 3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."
- 2. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards Metal and Flexible," Figure 4-2, "Rectangular Elbows."
 - a. Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
 - b. Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
 - c. Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."
- 3. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards Metal and Flexible," Figure 3-4, "Round Duct Elbows."
 - a. Minimum Radius-to-Diameter Ratio and Elbow Segments: Comply with SMACNA's "HVAC Duct Construction Standards Metal and Flexible," Table 3-1, "Mitered Elbows." Elbows with less than 90-degree change of direction have proportionately fewer segments.
 - 1) Velocity 1000 fpm or Lower: 0.5 radius-to-diameter ratio and three segments for 90-degree elbow.
 - 2) Velocity 1000 to 1500 fpm: 1.0 radius-to-diameter ratio and four segments for 90-degree elbow.
 - 3) Velocity 1500 fpm or Higher: 1.5 radius-to-diameter ratio and five segments for 90-degree elbow.
 - 4) Radius-to Diameter Ratio: 1.5.
 - b. Round Elbows, 12 Inches and Smaller in Diameter: Stamped or pleated.
 - c. Round Elbows, 14 Inches and Larger in Diameter: Standing seam.
- G. Branch Configuration:
 - 1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards Metal and Flexible," Figure 4-6, "Branch Connection."
 - a. Rectangular Main to Rectangular Branch: 45-degree entry.
 - b. Rectangular Main to Round Branch: Spin in.
 - 2. Round: Comply with SMACNA's "HVAC Duct Construction Standards Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees." Saddle taps are permitted in existing duct.
 - a. Velocity 1000 fpm 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 233113

SECTION 233300 - AIR DUCT ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Backdraft and pressure relief dampers.
 - 2. Manual volume dampers.
 - 3. Flange connectors.
 - 4. Turning vanes.
 - 5. Duct-mounted access doors.
 - 6. Flexible connectors.
 - 7. Flexible ducts.
 - 8. Duct accessory hardware.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- 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 and smoke-damper installations, including sleeves; and duct-mounted access doors.
 - e. Wiring Diagrams: For power, signal, and control wiring.

1.3 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

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.

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. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts.
- D. 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:
 - 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 and mounting flange.
- 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: Extruded vinyl, mechanically locked.
- I. Blade Axles:
 - 1. Material: Nonferrous metal.
 - 2. Diameter: 0.20 inch.
- J. Tie Bars and Brackets: Aluminum or Galvanized steel.
- 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: Insect.
 - 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:
 - 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.
 - 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. Jackshaft:
 - 1. Size: 1-inch diameter.
 - 2. Material: Galvanized-steel pipe rotating within pipe-bearing assembly mounted on supports at each mullion and at each end of multiple-damper assemblies.
 - 3. Length and Number of Mountings: As required to connect linkage of each damper in multiple-damper assembly.
- 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 FLANGE CONNECTORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Ductmate Industries, Inc.
 - 2. Nexus PDQ; Division of Shilco Holdings Inc.
 - 3. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
- B. Description: Add-on or roll-formed, factory-fabricated, slide-on transverse flange connectors, gaskets, and components.
- C. Material: Galvanized steel.
- D. Gage and Shape: Match connecting ductwork.

2.5 TURNING VANES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Ductmate Industries, Inc.
 - 2. Duro Dyne Inc.
 - 3. METALAIRE, Inc.
 - 4. SEMCO Incorporated.
 - 5. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
- B. Manufactured Turning Vanes for Metal Ducts: Curved blades of galvanized sheet steel; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.
 - 1. Acoustic Turning Vanes: Fabricate airfoil-shaped aluminum extrusions with perforated faces and fibrous-glass fill.
- C. Manufactured Turning Vanes for Nonmetal Ducts: Fabricate curved blades of resin-bonded fiberglass with acrylic polymer coating; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.
- D. General Requirements: Comply with SMACNA's "HVAC Duct Construction Standards Metal and Flexible"; Figures 4-3, "Vanes and Vane Runners," and 4-4, "Vane Support in Elbows."
- E. Vane Construction: Single wall.
- F. Vane Construction: Single wall for ducts up to 48 inches wide and double wall for larger dimensions.

2.6 DUCT-MOUNTED ACCESS DOORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. American Warming and Ventilating; a division of Mestek, Inc.
 - 2. Cesco Products; a division of Mestek, Inc.
 - 3. Ductmate Industries, Inc.
 - 4. Flexmaster U.S.A., Inc.
 - 5. Greenheck Fan Corporation.
 - 6. McGill AirFlow LLC.
 - 7. Nailor Industries Inc.
 - 8. Pottorff; a division of PCI Industries, Inc.
 - 9. Ventfabrics, Inc.
 - 10. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
- B. Duct-Mounted Access Doors: Fabricate access panels according to SMACNA's "HVAC Duct Construction Standards Metal and Flexible"; Figures 7-2, "Duct Access Doors and Panels," and 7-3, "Access Doors Round Duct."
 - 1. Door:

- a. Double wall, rectangular.
- b. Galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class.
- c. Vision panel.
- d. Hinges and Latches: 1-by-1-inch butt or piano hinge and cam latches.
- e. Fabricate doors airtight and suitable for duct pressure class.
- 2. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.
- 3. Number of Hinges and Locks:
 - a. Access Doors Less Than 12 Inches Square: No hinges and two sash locks.
 - b. Access Doors up to 18 Inches Square: Two hinges and two sash locks.
 - c. Access Doors up to 24 by 48 Inches: Three hinges and two compression latches.
 - d. Access Doors Larger Than 24 by 48 Inches: Four hinges and two compression latches with outside and inside handles.

2.7 FLEXIBLE CONNECTORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of 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. 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 movement at start and stop.

2.8 FLEXIBLE DUCTS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Flexmaster U.S.A., Inc.
 - 2. McGill AirFlow LLC.
 - 3. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
- B. Insulated, Flexible Duct: UL 181, Class 1, 2-ply vinyl film supported by helically wound, spring-steel wire; fibrous-glass insulation; polyethylene 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.
 - 4. Insulation R-value: Comply with ASHRAE/IESNA 90.1.
- C. Insulated, Flexible Duct: UL 181, Class 1, black polymer film supported by helically wound, spring-steel wire; fibrous-glass insulation; polyethylene 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.
 - 4. Insulation R-Value: Comply with ASHRAE/IESNA 90.1.
- D. 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: Liquid adhesive plus tape.

2.9 DUCT ACCESSORY HARDWARE

A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct-insulation thickness.

B. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

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.
- 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 backdraft dampers at inlet of exhaust fans or exhaust ducts as close as possible to exhaust fan unless otherwise indicated.
- D. 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.
- E. Set dampers to fully open position before testing, adjusting, and balancing.
- F. Install test holes at fan inlets and outlets and elsewhere as indicated.
- G. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:
 - 1. Downstream from manual volume dampers, control dampers, backdraft dampers, and equipment.
 - 2. At each change in direction and at maximum 50-foot spacing.
 - 3. Upstream from turning vanes.
 - 4. Elsewhere as indicated.
- H. Install access doors with swing against duct static pressure.
- I. 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.
- J. Label access doors according to Division 23 Section "Identification for HVAC Piping and Equipment" to indicate the purpose of access door.
- K. Install flexible connectors to connect ducts to equipment.
- L. Connect diffusers to ducts directly or with maximum 60-inch lengths of flexible duct clamped or strapped in place.

- M. Connect flexible ducts to metal ducts with liquid adhesive plus tape.
- N. Install duct test holes where required for testing and balancing purposes.
- O. 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 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.

END OF SECTION 233300

SECTION 233713 - DIFFUSERS, REGISTERS, AND GRILLES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Rectangular and square ceiling diffusers.
 - 2. Adjustable bar grilles.
 - 3. Fixed face bar grilles.
 - 4. Eggcrate grilles.

1.2 ACTION 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 each exposed product and for each color and texture specified.

PART 2 - PRODUCTS

2.1 CEILING DIFFUSERS

- A. Rectangular and Square Ceiling Diffusers:
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - a. A-J Manufacturing Co., Inc.
 - b. Anemostat Products; a Mestek company.
 - c. Carnes.
 - d. Hart & Cooley Inc.
 - e. Krueger.
 - f. METALAIRE, Inc.
 - g. Nailor Industries Inc.
 - h. Price Industries.
 - i. Titus.
 - j. Tuttle & Bailey.
 - 2. Material: Steel.
 - 3. Finish: Baked enamel, color selected by Architect.
 - 4. Face Size: 24 by 24 inches.

- 5. Face Style: Three cone.
- 6. Mounting: T-bar.
- 7. Pattern: Adjustable.

2.2 REGISTERS AND GRILLES

- A. Adjustable Bar Grille:
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - a. A-J Manufacturing Co., Inc.
 - b. Anemostat Products; a Mestek company.
 - c. Carnes.
 - d. Dayus Register & Grille Inc.
 - e. Hart & Cooley Inc.
 - f. Krueger.
 - g. METALAIRE, Inc.
 - h. Nailor Industries Inc.
 - i. Price Industries.
 - j. Titus.
 - k. Tuttle & Bailey.
 - 2. Material: Steel.
 - 3. Finish: Baked enamel, color selected by Architect.
 - 4. Face Blade Arrangement: Horizontal spaced 3/4 inch apart.
 - 5. Core Construction: Integral.
 - 6. Rear-Blade Arrangement: Vertical spaced 3/4 inch apart.
 - 7. Frame: 1 inch wide.
 - 8. Mounting: Countersunk screw for sidewall and concealed for duct mounted.
- B. Fixed Face Grille:
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - a. A-J Manufacturing Co., Inc.
 - b. Anemostat Products; a Mestek company.
 - c. Carnes.
 - d. Dayus Register & Grille Inc.
 - e. Hart & Cooley Inc.
 - f. Krueger.
 - g. Nailor Industries Inc.
 - h. Price Industries.
 - i. Titus.
 - j. Tuttle & Bailey.
 - 2. Material: Steel.
 - 3. Finish: Baked enamel, color selected by Architect.
 - 4. Face Arrangement: 1/2-by-1/2-by-1/2-inch grid core.
 - 5. Core Construction: Integral.
- 6. Frame: 1 inch wide provide with larger frame in lay-in applications of required to fit in ceiling grid.
- 7. Mounting: Countersunk screw for sidewall and concealed for duct mounted or Lay in where indicated on drawings.
- C. Eggcrate Grille:
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - a. A-J Manufacturing Co., Inc.
 - b. Anemostat Products; a Mestek company.
 - c. Carnes.
 - d. Dayus Register & Grille Inc.
 - e. Hart & Cooley Inc.
 - f. Krueger.
 - g. Nailor Industries Inc.
 - h. Price Industries.
 - i. Titus.
 - j. Tuttle & Bailey.
 - 2. Material: Steel or aluminum.
 - 3. Finish: Baked enamel, color selected by Architect.
 - 4. Face Arrangement: eggcrate core at a 45° deflection angle.
 - 5. Core Construction: Integral.
 - 6. Frame: 1 inch wide.
 - 7. Mounting: Lay in.

2.3 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 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.

3.2 ADJUSTING

A. After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION 233713

SECTION 236200 - PACKAGED COMPRESSOR AND CONDENSER UNITS

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 packaged, refrigerant compressor and condenser units.

1.3 ACTION SUBMITTALS

- A. Product Data: For each compressor and condenser unit. Include rated capacities, operating characteristics, and furnished specialties and accessories. Include equipment dimensions, weights and structural loads, required clearances, method of field assembly, components, and location and size of each field connection.
- B. Shop Drawings: For compressor and condenser units. Include plans, elevations, sections, details, and attachments to other work.
 - 1. Wiring Diagrams: For power, signal, and control wiring.
- C. Delegated-Design Submittal: For compressor and condenser units 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. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.

1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:
 - 1. Structural members to which compressor and condenser units will be attached.
 - 2. Liquid and vapor pipe sizes.
 - 3. Refrigerant specialties.
 - 4. Piping including connections, oil traps, and double risers.
 - 5. Compressors.
 - 6. Evaporators.

- B. Seismic Qualification Certification: For compressor and condenser units, accessories, and components, from manufacturer.
 - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 - 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- C. Field quality-control reports.
- D. Warranty: Sample of special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For compressor and condenser units to include in emergency, operation, and maintenance manuals.

1.6 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Fabricate and label refrigeration system according to ASHRAE 15, "Safety Standard for Refrigeration Systems."
- C. ASHRAE/IESNA 90.1 Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6, "Heating, Ventilating, and Air-Conditioning."
- D. ASME Compliance: Fabricate and label water-cooled compressor and condenser units to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.

1.7 COORDINATION

- A. Coordinate sizes and locations of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Section 033000 "Cast-In-Place Concrete" and Section 033053 "Miscellaneous Cast-In-Place Concrete."
- B. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Section 077200 "Roof Accessories."
- C. Coordinate location of piping and electrical rough-ins.

1.8 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of compressor and condenser units that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Compressor failure.
 - b. Condenser coil leak.
 - 2. Warranty Period: One year from date of Substantial Completion.
 - 3. Warranty Period (Compressor and Electric Heater): Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 COMPRESSOR AND CONDENSER UNITS, AIR COOLED, 1 TO 5 TONS (3.5 TO 17.6 kW)

- A. <u>Basis-of-Design Product</u>: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - 1. Carrier Corporation; Commercial HVAC Systems.
 - 2. <u>Lennox International Inc</u>.
 - 3. <u>Rheem Air Conditioning Division</u>.
 - 4. <u>Ruud Air Conditioning Division</u>.
 - 5. <u>Trane; a business of American Standard Companies</u>.
 - 6. <u>YORK; a Johnson Controls company</u>.
- B. Description: Factory assembled and tested; consisting of compressor, condenser coil, fan, motors, refrigerant reservoir, and operating controls.
- C. Compressor: Scroll, hermetically sealed, with rubber vibration isolators.
 - 1. Motor: Single speed, and includes thermal- and current-sensitive overload devices, start capacitor, relay, and contactor.
 - 2. Two-Speed Compressor: Include manual-reset, high-pressure switch and automatic-reset, low-pressure switch.
 - 3. Accumulator: Suction tube.
- D. Refrigerant: R-410A.
- E. Condenser Coil: Seamless copper-tube, aluminum-fin coil; circuited for integral liquid subcooler, with removable drain pan and brass service valves with service ports.
- F. Condenser Fan: Direct-drive, aluminum propeller fan; with permanently lubricated, totally enclosed fan motor with thermal-overload protection[**and ball bearings**].
- G. Accessories:

- 1. Crankcase heater.
- 2. Cycle Protector: Automatic-reset timer to prevent rapid compressor cycling.
- 3. Electronic programmable thermostat to control compressor and condenser unit and evaporator fan.
- 4. Evaporator Freeze Thermostat: Temperature-actuated switch that stops unit when evaporator reaches freezing temperature.
- 5. Filter-dryer.
- 6. High-Pressure Switch: Automatic-reset switch cycles compressor off on high refrigerant pressure.
- 7. Liquid-line solenoid.
- 8. Low-Ambient Controller: Cycles condenser fan to permit operation down to 30 deg F (minus 1 deg C).
- 9. Low-Pressure Switch: Automatic-reset switch cycles compressor off on low refrigerant pressure.
- 10. PE mounting base.
- 11. Precharged and insulated suction and liquid tubing.
- 12. Sound Hood: Wraps around sound attenuation cover for compressor.
- 13. Thermostatic expansion valve.
- 14. Time-Delay Relay: Continues operation of evaporator fan after compressor shuts off.
- 15. Reversing valve.
- 16. **<Insert accessories>**.
- H. Unit Casing: Galvanized steel, finished with baked enamel; with removable panels for access to controls, weep holes for water drainage, and mounting holes in base. Mount service valves, fittings, and gage ports on exterior of casing.

2.2 MOTORS

- A. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section 230513 "Common Motor Requirements for HVAC Equipment."
 - 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.

2.3 SOURCE QUALITY CONTROL

- A. Verification of Performance: Rate compressor and condenser units according to ARI 206/110.
- B. Energy Efficiency: Equal to or greater than prescribed by ASHRAE/IESNA 90.1, "Energy Efficient Design of New Buildings except Low-Rise Residential Buildings," Section 6, "Heating, Ventilating, and Air-Conditioning."
- C. Test and inspect shell and tube condensers according to ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.

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 compressor and condenser units.
- B. Examine roughing-in for refrigerant piping systems to verify actual locations of piping connections before equipment installation.
- C. Examine walls, floors, and roofs for suitable conditions where compressor and condenser units will be installed.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install units level and plumb, firmly anchored in locations indicated.
- B. Install roof-mounting units on equipment supports specified in Section 077200 "Roof Accessories."
- C. Equipment Mounting:
 - 1. Comply with requirements for vibration isolation and seismic control devices specified in Section 230548 "Vibration and Seismic Controls for HVAC."
 - 2. Comply with requirements for vibration isolation devices specified in Section 230548.13 "Vibration Controls for HVAC."
- D. Maintain manufacturer's recommended clearances for service and maintenance.
- E. Loose Components: Install electrical components, devices, and accessories that are not factory mounted.

3.3 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
 - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections, and to assist in testing.
- B. Tests and Inspections:
 - 1. Perform each visual and mechanical inspection and electrical test. Certify compliance with test parameters.
 - 2. Leak Test: After installation, charge system with refrigerant and oil and test for leaks. Repair leaks, replace lost refrigerant and oil, and retest until no leaks exist.

- 3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor operation and unit operation, product capability, and compliance with requirements.
- 4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- 5. Verify proper airflow over coils.
- C. Verify that vibration isolation and flexible connections properly dampen vibration transmission to structure.
- D. Compressor and condenser units will be considered defective if they do not pass tests and inspections.
- E. Prepare test and inspection reports.

3.4 STARTUP SERVICE

- A. Engage a factory-authorized service representative to perform startup service.
 - 1. Complete installation and startup checks according to manufacturer's written instructions and perform the following:
 - a. Inspect for physical damage to unit casing.
 - b. Verify that access doors move freely and are weathertight.
 - c. Clean units and inspect for construction debris.
 - d. Verify that all bolts and screws are tight.
 - e. Adjust vibration isolation and flexible connections.
 - f. Verify that controls are connected and operational.
- B. Lubricate bearings on fan motors.
- C. Verify that fan wheel is rotating in the correct direction and is not vibrating or binding.
- D. Adjust fan belts to proper alignment and tension.
- E. Start unit according to manufacturer's written instructions and complete manufacturer's startup checklist.
- F. Measure and record airflow and air temperature rise over coils.
- G. Verify proper operation of condenser capacity control device.
- H. Verify that vibration isolation and flexible connections properly dampen vibration transmission to structure.
- I. After startup and performance test, lubricate bearings.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain compressor and condenser units.

END OF SECTION 236200

SECTION 260010 - BASIC ELECTRICAL REQUIREMENTS

PART 1 - GENERAL

1.01 GENERAL

- A. Basic Requirements: The Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.
- B. General Provisions: Provide all labor, materials, equipment, and incidentals required to make ready for use complete electrical systems as specified herein and shown on the drawings.
- C. Provide and Install: The word "provide" where used on the Drawings or in the Specifications shall mean "furnish, install, mount, connect, test, complete, and make ready for operation". The word "install" where used on the Drawings or in the Specifications shall mean "mount, connect, test, complete, and make ready for operation". Perform work required by, and in accordance with, the Contract Documents.
- D. Installation: Provide and place in satisfactory condition, ready for proper operation, raceways, wires, cables, and other material needed for all complete electrical systems required by the Contract Documents. Additional raceways and wiring shall be provided to complete the installation of the specific equipment provided. Include auxiliaries and accessories for complete and properly operating systems. Provide electrical systems and accessories to comply with the NEC, state and local codes and ordinances. It is the intent of these Specifications that the electrical systems be suitable in every way for the use intended. Material and work which is incidental to the work of this Contract shall be provided at no additional cost to the Contract.
- E. Field Connections: Provide field connections to remote equipment and control panels provided under other Divisions of these Specifications. Provide raceway, wire, and interconnections between equipment, transmitters, local indicators, and receivers. Install field connections to "packaged" equipment provided under other Divisions of these Specifications.

1.02 SCOPE OF WORK

- A. General: Provide labor, materials, permits, inspections and re-inspection fees, tools, equipment, transportation, insurance, temporary protection, temporary power and lighting, supervision and incidental items essential for proper installation and operation of the Electrical systems indicated in the Contract Documents. Provide materials not specifically mentioned or indicated but which are usually provided or are essential for proper installation and operation of the Electrical systems indicated in the contract documents.
- B. Notices: Give notices, file Plans, pay fees, and obtain permits and approvals from authorities having jurisdiction. Include all fees in the Bid Price.

1.03 INTERPRETATION OF DRAWINGS

- A. General: The Drawings are diagrammatic and are not intended to show exact locations of Raceway runs, outlet boxes, junction boxes, pull boxes, etc. The locations of equipment, appliances, fixtures, Raceways, outlets, boxes and similar devices shown on the Drawings are approximate only. Exact locations shall be determined and coordinated in the field. The right is reserved to change, without additional cost, the location of any outlet within the same room or general area before it is permanently installed. Obtain all information relevant to the placing of electrical work and in case of interference with other work, proceed as directed by the Architect.
- B. Discrepancies: Notify the Architect of any discrepancies found during construction of the project. The Architect will provide written instructions as to how to proceed with that portion of work. If a conflict exists between the Contract Documents and an applicable code or standard, the most stringent requirement shall apply.
- C. Wiring: Each three-phase circuit shall be run in a separate Raceway unless otherwise shown on the Drawings. Unless otherwise accepted by the Architect, Raceway shall not be installed exposed. Where circuits are shown as "home-runs" all necessary fittings, supports, and boxes shall be provided for a complete raceway installation.
- D. Layout: Circuit layouts are not intended to show the number of fittings, or other installation details. Connections to equipment shall be made as required, and in accordance with the accepted shop and manufacturer's setting drawings.
- E. Coordination: Coordinate final equipment locations with drawings or other disciplines. Layout before installation so that all trades may install equipment in available space. Provide coordination as required for installation in a neat and workmanlike manner.

1.04 EQUIPMENT SIZE AND HANDLING

- A. Coordination: Investigate each space in the structure through which equipment must pass to reach its final location. If necessary, ship the equipment in sections of specific sizes to permit the passing through the necessary areas within the structure.
- B. Handling: Equipment shall be kept upright at all times. When equipment has to be tilted for ease of passage through restricted areas during transportation, the manufacturer shall be required to brace the equipment suitably, to insure that the tilting does not impair the functional integrity of the equipment.

1.05 RECORD DRAWINGS

- A. Production: The Contractor shall provide two (2) sets of black or blue line on white drawings to maintain and submit record "As-Built Documents". Label each sheet of the Record Document set with "Project Record Documents" with company name of the installing contractor in stamped or printed letters. One set shall be maintained at the site and at all times be accurate, clear, and complete. These drawings shall be available at all times to the Architect's field representatives.
- B. Recording: Record information concurrent with construction progress. Make entries within 24 hours upon receipt of information. The "As-Built" drawings shall accurately reflect installed electrical work specified or shown on the Contract Documents.

- C. Completion: At the completion of the Work, transfer changes with a colored pencil onto the second set and submit to the Architect. The "As-Built" drawings shall be made available to the Architect to make the substantial completion punch list.
- D. Final: Upon Contractor's completion of the Engineer's final punch list, transfer all "As-Built" conditions and all requirements by the Engineer to a reproducible set of drawings and CAD files. Submit drawings and CAD disks for review and acceptance. The Contractor shall provide updated disks which include final As-Built conditions.

1.06 ABBREVIATIONS

A. Abbreviations: The following abbreviations or initials may be used:

A/C	Air Conditioning
AC	Alternating Current
ABV CLG	Above Ceiling
ADA	Americans with Disabilities Act
AF	Ampere Frame
AFF	Above Finished Floor
AFG	Above Finished Grade
AHU	Air Handler Unit
AIC	Amps Interrupting Capacity
AL	Aluminum
AMP	Ampere
ANSI	American National Standards Institute
ASA	American Standards Association
AT	Ampere Trip
ATS	Automatic Transfer Switch
AUX	Auxiliary
AWG	American Wire Gauge
BC	Bare Copper
BIL	Basic Impulse Level
BMS	Building Management System
BRKR or BKR	Breaker
CAB	Cabinet
С	Conduit or Raceway
CB	Circuit Breaker
CBM	Certified Ballast Manufacturers
CCTV	Closed Circuit Television
CKT	Circuit
CLEC	Clock Equipment Cabinet
CLG	Ceiling
CO	Conduit or Raceway Only
COAX	Coaxial Cable
COND	Conductor
CONN	Connection
CPU	Central Processing Unit
СТ	Current Transformer
CU	Copper

CW	Cold Water
DC	Direct Current
DDC	Direct Digital Control
DEG	Degree
DISC	Disconnect
DO	Draw Out
DN	Down
DPST	Double Pole Single Throw
EMT	Electrical Metallic Tubing
EO	Electrically Operated
EOL	End of Line Resistor
FWC	Electric Water Cooler
FAAP	Fire Alarm Annunciator Panel
FACP	Fire Alarm Control Panel
FCU	Fan Coil Unit
FLA	Full Load Amperes
FM	Factory Mutual
CE CE	Ground Fault
GECI	Ground Fault Circuits Interrupter
CND	Ground Fault Circuits Interrupter
UND	Used Off Automatic
	Hand-Off-Automatic
HUKIZ	
HP IC	Horsepower
IC	Intercom
ICU	Intensive Care Unit
IEEE	Institute of Electrical and Electronic Engineers
IES	Illuminating Engineering Society
IMC	Intermediate Metallic Raceway
IN	Inches
IT	Instantaneous Trip
IPCEA	Insulated Power Cable Engineers Association
JB	Junction Box
KCMIL	Thousand Circular Mills
KV	Kilovolt
KVA	Kilo-Volt-Amps
KW	Kilowatts
LBS	Pounds
LED	Light Emitting Diode
LT	Light
LTD	Long Time Delay
LTT	Long Time Trip
LTG	Lighting
MAX	Maximum
MCB	Main Circuit Breaker
MCC	Motor Control Center
MCP	Motor Circuit Protector
MIC	Microphone
MIN	Minimum
MLO	Main Lugs Only
MTD	Mounted

Multiplex (Transponder) Panel Mega Volt Amps Neutral Normally Closed National Electrical Code National Electrical Contractors Association National Electrical Manufacturers Association National Fire Protection Association Not in Contract Non Fused Non Linear Number or Normally Open Number Phase Overload Occupational Safety and Health Administration Pole
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Occupational Safety and Health Administration Pole
Pole Pullbox
Dullhow
PILLINN
Post Indicator Valve
Ponel
Pair
Power
Power Faster
Power Factor
Pillial y Dotontial Transformer
Potential Transformer
Polyvinyichionde
Refrigerator
Rigid Galvanized Raceway
Root-Mean-Square
Revolutions Per Minute
Receptacle
Short Circuit Amps
Smoke Detector
Secondary
Solid Neutral
Speaker
Single Pole Single Throw
Solid State Trip
Short Time Trip
Short Time Delay
Switch
Switchgear
Switchboard
Telephone
Telephone Terminal Board
Telephone Terminal Cabinet
Television Equipment Cabinet
Television Equipment Cabinet Typical

UON	Unless Otherwise Noted
V	Volt
VFD	Variable Frequency Drive
VSD	Variable Speed Drive
W	Wire
WP	Weatherproof
XFMR	Transformer

1.07 CODES, FEES, AND STANDARDS

- A. Application: The codes, standards and practices listed herein generally apply to the entire project and specification sections. Other codes, standards or practices that are more specific will be referenced within a particular specification.
- B. Requirements: All materials and types of construction covered in the specifications will be required to meet or exceed applicable standards of manufacturer, testing, performance, and installation according to the requirements of UL, ANSI, NEMA, IEEE, and NEC referenced documents where indicated and the manufacturer's recommended practices. Requirements indicated on the contract documents that exceed but are not contrary to governing codes shall be followed.
- C. Compliance and Certification: The installation shall comply with the governing state and local codes or ordinances. The completed electrical installation shall be inspected and certified by applicable agencies that it is in compliance with codes.
- D. Applicability: The codes and standards and practices listed herein, and their respective dates are furnished as the minimum latest requirements.
 - 1. State of Florida.
 - 2. Suwannee County.
 - 3. City of Live Oak.
- E. Utility Company: Comply with latest utility company regulations.
- F. Building Code: Florida Building Code (2010 w/addendums).
- G. Standards: American Society of Mechanical Engineers
 - 1. ASME-A17.1 (2004) Elevator Code, plus Interpretations to Date.
- H. Labels: Materials and equipment shall be new and free of defects, and shall be U.L. listed, bear the U.L. label or be labeled or listed with an approved, nationally recognized Electrical Testing Agency. Where no labeling or listing service is available or desired for certain types of equipment, test data shall be submitted to validate that equipment meets or exceeds available standards.
- I. NFPA: National Fire Protection Association (NFPA) Standards

NFPA-1	(2006)Uniform Fire Code [™]
NFPA-13	(2002) Standard for the Installation of Sprinkler Systems
NFPA-70	(2005)National Electrical Code
NFPA-72	(2002)National Fire Alarm Code

NFPA-75 (2003)Standard for the Protection of Information Technology Equipment
 NFPA-90A (2002)Standard for the Installation of Air Conditioning And Ventilating Systems
 NFPA-101A (2004)Guide on Alternative Approaches to Life Safety
 NFPA-101B (2002) Standard on Means of Egress for Buildings and Structures
 NFPA-780 (2004)Installation of Lightning Protection Systems

J. AIA Guidelines, 2006 Edition

1.08 INVESTIGATION OF SITE

- A. General: Before commencing work, verify existing conditions at the premises including, but not limited to, existing structural frame, existing openings; existing wall and partition locations, existing mechanical and electrical work, equipment type, and examine adjoining work on which work is in anyway dependent.
- B. Responsibility: No waiver of responsibility for defective and inadequate work or additional cost as a result of existing conditions which should have been verified shall be considered unless notice of same has been filed by the Contractor and agreed to in writing by the Architect before the bid date.
- C. Site Renovation: Verify and coordinate existing site raceways and pipes at any excavation on site. Provide hand-digging and required rerouting in areas of existing Raceways and pipes within bid price.
- D. Renovation: Investigate site thoroughly and reroute raceway and wiring in area of new construction in order to maintain continuity of existing circuitry. Existing Raceways shown on plans show approximate locations only.
- E. Special Considerations: Special attention is called to the fact that there will be piping, fixtures or other items in the existing building which must be removed or relocated in order to perform the alteration work. Include removal and relocation required for completion of the alterations and the new construction. All existing wiring that is to remain in renovated areas shall be made code compliant.
- F. Power Outage: Special attention is called to the fact that work involved is in connection with existing buildings which shall remain in operation while work is being performed. Work must be done in accordance with the priority schedule. Schedule work for a minimum outage to Owner. Request written permission and receive written acceptance from the Owner no later than 72 hours in advance of power and communication shut-downs. Perform work required at other than standard working hours where outages cannot be accepted by Owner during regular working hours. Protect existing buildings and equipment during construction.

1.09 SUPERVISION OF THE WORK

A. Supervision: Provide one field superintendent who has had a minimum of four (4) years previous successful experience on projects of comparable sizes, type and complexity. The Superintendent shall be present at all times when work is being performed. At least one member of the Electrical Contracting Firm shall hold a State Master Certificate of Competency.

1.10 COORDINATION

- A. General: Compare drawings and specifications with those of other trades and report any discrepancies between them to the Architect. Obtain from the Architect written instructions to make the necessary changes in any of the affected work. Work shall be installed in cooperation with other Trades installing interrelated work. Before installation, Trades shall make proper provisions to avoid interferences in a manner approved by the Architect.
- B. Provide all required coordination and supervision where work connects to or is affected by work of others, and comply with all requirements affecting this Division. Work required under other divisions, specifications or drawings to be performed by this Division shall be coordinated with the Contractor and such work performed at no additional cost to Owner including but not limited to electrical work required for:
 - 1. Door hardware
 - 2. Roll-up doors
 - 3. Roll-up grilles
 - 4. Signage
 - 5. Fire shutters
 - 6. Elevators
 - 7. Sliding or automatic doors
 - 8. Mechanical Division of the Specifications
 - 9. Interior design drawings
 - 10. Millwork design drawings and shop drawings
- C. Obtain set of Contract Documents from Owner's Authorized Representative or Contractor for all areas of work noted above and include all electrical work in bid whether included in Division 26Contract Documents or not.
- D. Secure approved shop drawings from all required disciplines and verify final electrical characteristics before roughing power feeds to any equipment. When electrical data on approved shop drawings differs from that shown or called for in Construction Documents, make adjustments to the wiring, disconnects, and branch circuit protection to match that required for the equipment installed.
- E. Damage from interference caused by inadequate coordination shall be corrected at no additional cost to the Owner.
- F. Adjustments: Locations of raceway and equipment shall be adjusted to accommodate the work with interferences anticipated and encountered. Determine the exact routing and location of systems prior to fabrication or installation.
- G. Priorities: Lines which pitch shall have the right of way over those which do not pitch. For example, plumbing drains shall normally have the right of way. Lines whose elevations cannot be changed shall have the right of way over lines whose elevations can be changed.
- H. Modifications: Offsets and changes of direction in raceway systems shall be made to maintain proper headroom and pitch of sloping lines whether or not indicated on the drawings. Provide elbows, boxes, etc., as required to allow offsets and changes to suit job conditions.

- Replacement: Work shall be installed in a way to permit removal (without damage to other parts) of other system components provided under this Contract requiring periodic replacement or maintenance. Raceway shall be arranged in a manner to clear the openings of swinging overhead access doors as well as ceiling tiles.
- J. Layout: The Contract Drawings are diagrammatic only intending to show general runs and locations of raceway and equipment, and not necessarily showing required offsets, details and accessories and equipment to be connected. Work shall be accurately laid out with other Trades to avoid conflicts and to obtain a neat and workmanlike installation, which will afford maximum accessibility for operation, maintenance and headroom.
- K. Contract Conflicts: Where discrepancies exist in the Scope of Work as to what Trade provides items such as starters, disconnects, flow switches, etc. such conflicts shall be coordinated between the divisions involved. It is the intent of the Contract Documents that all work shall be provided complete as one bid price.
- L. Drawing Conflicts: Where drawing details, plans or specification requirements are in conflict and where sizes of the same item run are shown to be different within the contract documents, the most stringent requirement shall be included in the Contract. Systems and equipment called for in the specification or as shown on the drawings shall be provided as if it was required by both the drawings and specifications. Prior to ordering or installation of any portion of work, which appears to be in conflict, such work shall be brought to Architect's attention for direction as to what is to be provided.
- M. It is the responsibility of this Contractor to coordinate the exact required location of floor outlets, floor ducts, floor stub-ups, etc. with Owner's Authorized Representative and Designer (and receive their approval) prior to rough-in. Locations indicated in Contract Documents are only approximate locations.
- N. The Contract Documents describe specific sizes of switches, breakers, fuses, Raceways, conductors, motor starters and other items of wiring equipment. These sizes are based on specific items of power consuming equipment (heaters, lights, motors for fans, compressors, pumps, etc.). Coordinate the requirements of each load with each load's respective circuitry shown and with each load's requirements as noted on its nameplate data and manufacturer's published electrical criteria. Adjust circuit breaker, fuse, Raceway, and conductor sizes to meet the actual requirements of the equipment being provided and installed and change from single point to multiple points of connection (or vice versa) to meet equipment requirements. Changes shall be made at no additional cost to the Owner.
- O. Working Clearances: Minimum working clearances about electrical equipment shall be as referenced in the applicable edition NEC Article 110, and shall include equipment installed in ceiling spaces.

1.11 DEMOLITION

- A. General: Relocate existing equipment and reroute existing raceways in areas being renovated as required to facilitate the installation of the new systems. The Owner shall require continuous operation of the existing systems, while demolition, relocation work or new tie-ins are performed.
- B. Coordination: Prior to any deactivation, relocation or demolition work, arrange a conference with the Architect and the Owner's representative in the field to inspect each of the items to be deactivated, removed or relocated. Care shall be taken to protect equipment designated as being relocated and reused or equipment remaining in operation and integrated with the new systems.

- C. Provisions: Deactivation, relocation, and temporary tie-ins shall be provided by the Contractor. Demolition, removal and the legal disposal of demolished materials shall be provided by the Contractor.
- D. Owner's Salvage: The Owner reserves the right to inspect the material scheduled for removal and salvage any items he deems usable as spare parts.
- E. Phasing: The Contractor shall perform work in phases as directed by the Architect to suit the project progress schedule, as well as the completion date of the project.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Specified Method: Where several brand names, make or manufacturers are listed as acceptable each shall be regarded as equally acceptable, based on the design selection but each must meet all specification requirements. Where a manufacturer's model number is listed, this model shall set the standard of quality and performance required. Where no brand name is specified, the source and quality shall be subject to Engineer's review and acceptance. Where manufacturers are listed, one of the listed manufacturers shall be submitted for acceptance. No substitutions are permitted.
- B. Certification: When a product is specified to be in accordance with a trade association or government standard requested by the Engineer, Contractor shall provide a certificate that the product complies with the referenced standard. Upon request of Engineer, Contractor shall submit supporting test data to substantiate compliance.
- C. Basis of Bid: Each bidder represents that his bid is based upon the manufacturer's, materials, and equipment described in the Contract Documents.
- D. Space Requirements: Equipment or optional equipment shall conform to established space requirements within the project. Equipment which does not meet space requirements, shall be replaced at no additional expense to the Contract. Modifications of related systems shall be made at no additional expense to the Contract. Submit modifications to the Architect/Engineer for acceptance.

2.02 SHOP DRAWINGS

- A. General: Shop drawings shall be submitted for every item listed within the Submittals section each individual specification section. One copy shall be submitted to the engineer prior to ordering equipment. Refer to Basis of approval paragraph.
- B. Responsibility: It is the Contractors responsibility to provide material in accordance with the plans and specifications. Material not provided in accordance with the plans and specifications shall be removed and replaced at the Contractors expense.
- C. Official Record: The shop drawing submittal shall become the official record of the materials to be installed. If materials are installed which do not correspond to the record submittal they shall be removed from the project without any additional cost or delays in construction completion.

- D. Information: The shop drawing record submittal shall include the following information to the extent applicable to the particular item;
 - 1. Manufacturer's name and product designation or catalog number.
 - 2. Standards or specifications of ANSI, ASTM, ICEA, IEEE, ISA, NEMA, NFPA, OSHA, UL, or other organizations, including the type, size, or other designation.
 - 3. Dimensioned plan, sections, and elevations showing means for mounting, raceway connections, and grounding, and showing layout of components.
 - 4. Materials and finish specifications, including paints.
 - 5. List of components including manufacturer's names and catalog numbers.
 - 6. Internal wiring diagram indicating connections to components and the terminals for external connections.
 - 7. Manufacturer's instructions and recommendations for installation, operation, and maintenance.
 - 8. Manufacturer's recommended list of spare parts.
 - 9. Provide 1/2" = 1'-0" enlarged electrical room layout drawings for all electrical rooms. All equipment shall be indicated at actual size of equipment being provided. All dimensions and required working clearances shall be shown.
- E. Preparation: Prior to submittal, shop drawings shall be checked for accuracy and contract requirements. Shop drawings shall bear the date checked and shall be accompanied by a statement that the shop drawings have been examined for conformity to Specifications and Drawings. This statement shall also list discrepancies with the Specifications and Drawings. Shop drawings not so checked and noted shall be returned to Contractor unreviewed.
- F. Basis of Review: Approval is only for general conformance with the design concept of the project and general compliance with the information given in the contract documents. Contractor is responsible for quantities, dimensions, fabrication processes, and construction techniques.
- G. Responsibility: The responsibility that dimensions are confirmed and correlated with proper coordination of other trades shall be included as part of the Contract Documents. The responsibility and the necessity of providing materials and workmanship required by the Specifications and Drawings which may not be indicated on the shop drawings shall be included as part of the Contract Documents. The Contractor is responsible for any delays in job progress occurring directly or indirectly from late submissions or re-submissions of shop drawings, product data, or samples.
- H. Ordering Equipment: No material shall be ordered or shop work started until the Engineer has officially received the shop drawings record submittal and has formally released the Contractor for submittal requirements.
- I. Brochure Requirements: Submit Technical Information Brochures at the start of construction or no later than 30 days after Award of the Contract. Each brochure shall consist of an adequately sized, hardcover, 3-ring binder for 8-1/2" X 11" sheets. Provide correct designation on outside cover and on end of brochure. When one binder is not enough to adequately catalog all data, an additional binder shall be submitted.
- J. Brochure Contents: First sheet in the brochure shall be a photocopy of the Electrical Index pages in these specifications. Second sheet shall be a list of Project Addresses for this project. Third sheet shall list Project Information. Provide reinforced separation sheets tabbed with the appropriate specification reference number and typed index for each section in the Electrical Schedule.

- K. Technical Information consisting of marked catalog sheets or shop drawings shall be inserted in the brochure in proper order on all items specified and shown on drawings. At the end of the brochure, provide and insert a copy of the specifications for this Division and all addenda applicable to this Division.
- L. Contractor's Review: Review the brochures before submitting to the Engineer. No request for payment shall be considered until the brochure has been reviewed, stamped and submitted for review.
- M. Cost: Submit cost breakdown on work in the Technical Information Brochures. The cost of material and labor for each item shall be indicated. The cost of fittings and incidentals are not required.
- N. Title Drawings: Title drawings to include identification of project and names of Architect-Engineer, Engineer, Contractors, and/or supplier, data, number sequentially and indicate in general;
 - 1. Fabrication and Erection dimensions.
 - 2. Arrangements and sectional views.
 - 3. Necessary details, including complete information for making connections with other work.
 - 4. Kinds of materials and finishes.
 - 5. Descriptive names of equipment.
 - 6. Modifications and options to standard equipment required by the contract.
 - 7. Leave blank area, size approximately 4 by 2-1/2 inches, near title block (for Engineer's stamp imprint).
 - 8. In order to facilitate review of shop drawings, they shall be noted, indicating by cross-reference the contract drawings, notes, and specification paragraph numbers where items occur in the contract documents.
 - 9. See specific sections of specifications for further requirements.
- O. Technical Data: Submit technical data verifying that the item submitted complies with the requirements of the specifications. Technical data shall include manufacturer's name and model number, dimensions, weights, electrical characteristics, and clearances required. Indicate optional equipment and changes from the standard item as called for in the specifications. Provide drawings, or diagrams, dimensioned and in correct scale, covering equipment, showing arrangement of components and overall coordination.
- P. Same Manufacturer: In general, relays, contactors, starters, motor control centers, switchboards, panelboards, dry type transformers, disconnect switches, circuit breakers, manual motor starter switches, etc., shall be supplied and manufactured by the same manufacturer. This requirement shall apply to same type of electrical components specified in other Divisions.

2.03 EQUIPMENT, MATERIALS, AND SUPPORTS

- A. General: Each item of equipment or material shall be manufactured by a company regularly engaged in the manufacturer of the type and size of equipment, shall be suitable for the environment in which it is to be installed, shall be approved for its purpose, environment, and application, and shall bear the UL label.
- B. Installation Requirements: Each item of equipment or material shall be installed in accordance with instructions and recommendations of the manufacturer, however, the methods shall not be less stringent than specified herein.

- C. Required Accessories: Provide all devices and materials, such as expansion bolts, foundation bolts, screws, channels, angles, and other attaching means, required to fasten enclosures, raceways, and other electrical equipment and materials to be mounted on structures which are existing or new.
- D. Protection: Electrical equipment shall at all times during construction be adequately protected against mechanical injury or damage by the elements. Equipment shall be stored in dry permanent shelters. If apparatus has been damaged, such damage shall be repaired at no additional cost or time extension to the Contract. If apparatus has been subject to possible injury, it shall be thoroughly cleaned, dried out and put through tests as directed by the Manufacturer and Engineer, or shall be replaced, if directed by the Engineer, at no additional cost to the Contract.

2.04 IDENTIFICATION OF EQUIPMENT

A. General: Electrical items shall be identified as specified in the Contract Documents. Such identification shall be in addition to the manufacturer's nameplates and shall serve to identify the item's function and the equipment or system, which it serves or controls. Refer to Identification Section of the specifications for additional information.

2.05 CONCRETE PADS

A. General: Provide reinforced concrete pads for floor mounted electrical equipment. Unless otherwise noted, pads shall be nominal four (4) inches high and shall exceed dimensions of equipment being set on them, including future sections, by six (6) inches on all sides, except when equipment is flush against a wall, then the side or sides against the wall shall be flush with the equipment. Chamfer top edges 1/2". Trowel surfaces smooth. Reinforce pads with #5 reinforcing bars at 24" centers each way, unless specifically detailed on drawings.

2.06 SURFACE MOUNTED EQUIPMENT

A. General: Surface mounted fixtures, outlets, cabinets, panels, etc. shall have a factory-applied finish or shall be painted as accepted by Engineer. Raceways and fittings, where allowed to be installed surface mounted, shall be painted to match the finish on which it was installed. Paint shall be in accordance with other applicable sections of these specifications.

2.07 CUTTING AND PATCHING

- A. Core Drilling: The Contractor shall be responsible for core drilling as required for work under this section, but in no case shall the Contractor cut into or weld onto any structural element of the project without the written approval of the Architect.
- B. Cutting and Patching: Cutting, rough patching and finish patching shall be provided as specified in the contract documents. Cutting and patching shall be performed in a neat and workmanlike manner. Upon completion, the patched area shall match adjacent surfaces.
- C. Openings and Sleeves: Locate openings required for work performed under this section. Provide sleeves, guards or other accepted methods to allow passage of items installed under this section.

D. Roof Penetration: Provide roofer with pitch pans, fittings, etc., required for electrical items which penetrate the roof. Roof penetrations are to be waterproofed in such a manner that roofing guarantees are fully in force. Roof penetrations shall be coordinated with other Trades to ensure that roof warranty is not invalidated.

2.08 SLEEVES AND FORMS FOR OPENINGS

- A. Sleeves: Provide sleeves for Raceways penetrating floors, walls, partitions, etc. Locate necessary slots for electrical work and form before concrete is poured. Watertight sleeves shall be line seal type WS. Fire rated partition sleeves shall be mild steel. Sleeves shall be Schedule 40 PVC or galvanized rigid steel unless specifically noted otherwise. Size shall be one standard diameter larger than pipe being installed or of a larger diameter to below 1/4" minimum clearance.
- B. Forms: Provide boxed out forms for Raceway penetrations only where allowed by the Architect. Fill opening after Raceway installation, with equivalent material.

2.09 OPERATING AND MAINTENANCE INSTRUCTIONS

- A. General: Thoroughly instruct the Owner's Representative, to the complete satisfaction of the Architect and Engineer, in the proper operation of all systems and equipment provided. The Contractor shall make all arrangements, via the Architect, as to whom the instructions are to be given in the operation of the systems and the period of time in which they are to be given. The Architect shall be completely satisfied that the Owner's Representative has been thoroughly and completely instructed in the proper operation of all systems and equipment before final payment is made. If the Architect determines that complete and thorough instructions have not been given by the Contractor to the Owner's Representative, then the Contractor shall be directed by the Architect to provide whatever instructions are necessary until the intent of this paragraph of the Specification has been complied with.
- B. Submittals: Submit to the Architect for approval five (5) typed sets, bound neatly in loose-leaf binders, of instructions for the installation, operation, care and maintenance of equipment and systems, including instructions for the ordering and stocking of spare parts for equipment installed under this contract. The lists shall include part number and suggested suppliers. Each set shall also include an itemized list of component parts that should be kept on hand and where such parts can be purchased.
- C. Information Requirements: Information shall indicate possible problems with equipment and suggested corrective action. The manuals shall be indexed for each type of equipment. Each section shall be clearly divided from the other sections. A sub index for each section shall also be provided.
- D. Instructions: The instructions shall contain information deemed necessary by the Architect and include but not limited to the following:
 - 1. Introduction:
 - a. Explanation of Manual and its use.
 - b. Summary description of the Electrical Systems.
 - c. Purpose of systems.
 - 2. System:
 - a. Detailed description of all systems.
 - b. Illustrations, schematics, block diagrams, catalog cuts and other exhibits.

- 3. Operations:
 - a. Complete detailed, step by step, sequential description of all phases of operation for all portions of the systems, including start up, shutdown and balancing. Include posted instruction charts.
- 4. Maintenance:
 - a. Parts list and part numbers.
 - b. Maintenance and replacement charts and the Manufacturer's recommendations for preventive maintenance.
 - c. Trouble shooting charts for systems and components.
 - d. Instructions for testing each type of part.
 - e. Recommended list of on-hand spare parts.
 - f. Complete calibration instructions for all parts and entire systems.
 - g. General and miscellaneous maintenance notes.
- 5. Manufacturer's Literature:
 - a. Complete listing for all parts.
 - b. Names, addresses and telephone numbers.
 - c. Care and operation.
 - d. All pertinent brochures, illustrations, drawings, cuts, bulletins, technical data, certified performance charts and other literature with the model actually furnished to be clearly and conspicuously identified.
 - e. Internal wiring diagrams and Engineering data sheets for all items and/or equipment furnished under each Contract.
 - f. Guarantee and warranty data.

2.10 SERVICE AND METERING

- A. Company: The utility company serving this project is Lakeland Electric which will be referred to as the Utility Company herein.
- B. Service: Make arrangements with the power company for obtaining a complete service. Pay charges and provide labor and material for the service. Service shall be obtained at 120/208 volts from the Utility Company. Provide Utility Company approved meter socket and empty 1-1/2" Raceway from transformer secondary bushings to meter location.
- C. Fees: Contact the Utility Company to determine if any fees, charges or costs will be due the Company, as required for temporary power, permanent power, installations, hook-ups, etc. This fee, charge or cost shall be included in the bid price.
- D. Payment: Pay for required licenses, fees and inspections. Include costs in the proposed construction cost submission. These costs shall include but not be limited to applicable taxes, permits, necessary notices, certificates and costs required to obtain same.
- E. Codes: Install a complete system in accordance with the latest edition of the National Electrical Code and the latest regulations of governing local, State, County and other applicable codes, including the Utility Company requirements.
- F. Provide transformer pad per Utility Company requirements.

2.11 TEMPORARY LIGHT AND POWER

- A. Capacity: Provide capacity for new temporary service. Make arrangements with the Owner for temporary service and pay all related expenses. Temporary light and power shall be provided constantly during the project dependent upon Owner's safety requirements.
- B. Lighting: Temporary light shall be based on one 200 watt lamp covering each 1,000 square foot of floor area in the building. Each room 100 square foot and over shall have a minimum of one 100-watt lamp with guards. Provide power for motors up to 3/4 horsepower only. Provisions are to be made for electric welders, if required.
- C. Outlets: Provide outlets located at convenient points so that extension cords of not over fifty (50) feet will reach work requiring artificial light or power.
- D. Other Connections: Contractors of other trades shall furnish their own cords and sockets, as may be required for their work and shall also pay for cost of temporary wiring of construction offices and shanties used by them.
- E. New Fixtures: Permanently installed lighting fixtures may be used for temporary lighting at the Contractor's option with the provision that cool white lamps for fluorescent, clear lamps for incandescent and marked temporary for other types shall be installed. At job completion, lamps shall be replaced with permanent lamps specified.
- F. Wiring: Temporary electrical work shall be furnished and installed in conformity with the National Electrical Code and in accordance with the requirements of the local ordinances and shall be maintained in a workmanlike manner throughout their entire construction period and shall be removed after installation of the permanent electrical systems. Extension cords shall be GFCI protected or shall be fed from GFCI circuit breakers.
- H. Payment: The Contractor will pay for the cost of energy consumed by all trades. Any temporary wiring of a special nature for light and power required other than mentioned above shall be paid for by the Contractor using same.

2.12 EXISTING CONDITIONS

- A. Support: Existing Raceway and cables within the area of renovation shall be provided with proper supports as specified for new work in other sections of this specification.
- B. Installation: Existing electrical which is designated for reworking or requires relocation, repair or adjustment shall conform to applicable codes and shall be treated as new work complying to all sections of this specification.
- C. Violations: Where existing conditions are discovered which are not in compliance with the codes and standards, the Contractor shall submit proper documentation to the Architect for clarification and corrective work direction. Existing conditions shall not remain which will create a disapproval of the renovated area.
- D. Patching: Existing Raceway and cable penetrations shall be properly fire treated per code and specification requirements. The Contractor shall thoroughly inspect existing locations and include the cost of patching and repair in his proposed construction cost.

PART 3 - EXECUTION

3.01 WORKMANSHIP

- A. General: The installation of materials and equipment shall be performed in a neat, workmanlike and timely manner by an adequate number of craftsmen knowledgeable of the requirements of the Contract Documents. They shall be skilled in the methods and craftsmanship needed to produce a quality level of workmanship. Personnel who install materials and equipment shall be qualified by training and experience to perform their assigned tasks.
- B. Acceptable Workmanship: Acceptable workmanship is characterized by first-quality appearance and function, conforming to applicable standards of building system construction, and exhibiting a high degree of quality and proficiency which is judged by the Architect as equivalent or better than that ordinarily produced by qualified industry tradesmen.
- C. Performance: Personnel shall not be used in the performance of the installation of material and equipment who, in the opinion of the Architect, are deemed to be careless or unqualified to perform the assigned tasks. Material and equipment installations not in compliance with the Contract Documents, or installed with substandard workmanship and not acceptable to the Architect, shall be removed and reinstalled by qualified craftsmen, at no change in the contract price.

3.02 PROTECTION AND CLEAN UP

- A. Protection and Restoration: Suitably protect equipment provided under this Division during construction. Restore damaged surfaces and items to "like new" condition before a request for substantial completion inspection.
- B. Handling: Materials shall be properly protected and Raceway openings shall be temporarily closed by the Contractor to prevent obstruction and damage. Post notice prohibiting the use of systems provided under this Contract, prior to completion of work and acceptance of systems by the Owner's representative. The Contractor shall take precautions to protect his materials from damage and theft.
- C. Safeguards: The Contractor shall furnish, place and maintain proper safety guards for the prevention of accidents that might be caused by the workmanship, materials, equipment or systems provided under this contract.
- D. Cleanup: Keep the job site free from debris and rubbish. Remove debris and rubbish from the site and leave premises in clean condition on a daily basis.

3.03 SYSTEMS GUARANTEE

A. General: Provide a one-year guarantee. This guarantee shall be by the Contractor to the Owner for any defective workmanship or material, which has been provided under this Contract at no cost to the Owner for a period of one year from the date of substantial completion of the System. The guarantee shall include lamps, for ninety days after date of Substantial Completion of the System. Explain the provisions of guarantee to the Owner at the "Demonstration of Completed System".

3.04 FINAL OBSERVATION

A. General: Work shall be completed, and forms and other information shall be submitted for acceptance one week prior to the request for final observation of the installation.

3.05 SPECIAL CONSIDERATIONS

A. Comply with special requirements imposed at site by Owner. This may include badging of employees, prohibition of smoking, special working hours, or special working conditions.

END OF SECTION 260010

CERTIFICATE OF COMPLETED DEMONSTRATION MEMO

<u>Note to Contractor</u>: Do not submit this form at the time Technical Information Brochure is submitted. Submit five copies of information listed below for checking at least one week before scheduled completion of the building. After information has been accepted and inserted in each brochure, give the Owner a Demonstration of the Completed Electrical Systems and have the Owner sign five copies of this form. Provide one signed copy for each brochure. After this has been done, a written request for a final inspection of the System shall be made.

Re:

(Name of Project)

(Division Number and Name)

This memo is for the information of all concerned that the Owner has been given a Demonstration of the Completed Electrical Systems on the work covered under this Division. This conference consisted of the system operation, a tour on which all major items of equipment were pointed out, and the following items were given to the Owner;

- (a) Owner's copy of Technical Information Brochure containing approved submittal sheets on all items, including the following; (To be inserted in the Technical Information Brochure after the correct tab).
 - (1) Maintenance Information published by manufacturer on equipment items.
 - (2) Printed Warranties by manufacturers on equipment items.
 - (3) Performance verification information as recorded by the Contractor.
 - (4) Check-out Memo on equipment by manufacturer's representative.
 - (5) Written operating instructions on any specialized items.
 - (6) Explanation of the one-year guarantee on the system.
- (b) "As-Built" conditions as described in the record drawing specifications.
- (c) A demonstration of the System in Operation and of the maintenance procedures which shall be required.

(Name of General Contractor)

By:

(Authorized Signature, Title & Date)

(Name of SubContractor)

By:

(Authorized Signature, Title & Date)

Brochure, Instruction, Prints, Demonstration & Instruction in Operation Received:

(Name of Owner)

By:

(Authorized Signature, Title, Date)

cc: Owner, Architect, Engineer, Contractor, Sub Contractor and General Contractor (List names as stated in cc: above)

SECTION 260519 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

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 wires and cables rated 600 V and less.
 - 2. Connectors, splices, and terminations rated 600 V and less.

1.3 DEFINITIONS

- A. EPDM: Ethylene-propylene-diene terpolymer rubber.
- B. NBR: Acrylonitrile-butadiene rubber.

1.4 ACTION SUBMITTALS

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

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For testing agency.
- B. Field quality-control test reports.

1.6 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.
 - 1. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association or the National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.

- 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. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 CONDUCTORS

- 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. American Insulated Wire Corp.; a Leviton Company.
 - 2. Southwire Company.
- B. Copper Conductors: Comply with NEMA WC 70.
- C. Conductor Insulation: Comply with NEMA WC 70 for Types THHN-THWN.
- D. Multiconductor Cable: Not permitted.

2.2 CONNECTORS AND SPLICES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Hubbell Power Systems, Inc.
 - 2. O-Z/Gedney; EGS Electrical Group LLC.
 - 3. 3M; Electrical Products Division.
 - 4. Tyco Electronics Corp.
- B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

- A. Feeders: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.
- B. Branch Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

- A. Service Entrance: Type THHN-THWN, single conductors in raceway.
- B. Exposed Feeders: Type THHN-THWN, single conductors in raceway.
- C. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspaces: Type THHN-THWN, single conductors in raceway.
- D. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-THWN, single conductors in raceway.
- E. Exposed Branch Circuits, Including in Crawlspaces: Type THHN-THWN, single conductors in raceway.
- F. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN-THWN, single conductors in raceway.
- G. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainlesssteel, wire-mesh, strain relief device at terminations to suit application.
- H. Class 1 Control Circuits: Type THHN-THWN, in raceway.
- I. Class 2 Control Circuits: Type THHN-THWN, in raceway.
- J. Metal-clad and armored cable, Types MC and AC, are not permitted.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

- A. Conceal cables in finished walls, ceilings, and floors, unless otherwise indicated.
- B. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
- C. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.
- D. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.
- E. Support cables according to Division 26 Section "Hangers and Supports for Electrical Systems."
- F. Identify and color-code conductors and cables according to Division 26 Section "Identification for Electrical Systems."

3.4 CONNECTIONS

- A. Tighten electrical connectors and terminals according to manufacturer's published torquetightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.
- B. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.
- C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches of slack.

3.5 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Division 26 Section "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.6 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to Division 07 Section "Penetration Firestopping."

3.7 FIELD QUALITY CONTROL

- A. Perform tests and inspections and prepare test reports.
- B. Tests and Inspections:
 - 1. After installing conductors and cables and before electrical circuitry has been energized, test service entrance and feeder conductors, and conductors feeding the following critical equipment and services for compliance with requirements.
 - a. One (1) branch receptacle circuit in each exam room.
 - 2. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
 - 3. Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each splice in cables and conductors No. 3 AWG and larger. Remove box and equipment covers so splices are accessible to portable scanner.
 - a. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each splice 11 months after date of Substantial Completion.
 - b. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

- c. Record of Infrared Scanning: Prepare a certified report that identifies splices checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.
- C. Test Reports: Prepare a written report to record the following:
 - 1. Test procedures used.
 - 2. Test results that comply with requirements.
 - 3. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements. Should the sampled receptacle branch circuit fail, test all receptacle branch circuits in affected exam room.
- D. Remove and replace malfunctioning units and retest as specified above.

END OF SECTION 260519

SECTION 260526 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes: Grounding systems and equipment.
- B. Section includes grounding systems and equipment, plus the following special applications:
 - 1. Ground bonding common with lightning protection system.

1.3 ACTION SUBMITTALS

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

1.4 INFORMATIONAL SUBMITTALS

- A. Informational Submittals: Plans showing dimensioned as-built locations of grounding features specified in "Field Quality Control" Article, including the following:
 - 1. Ground rods.
 - 2. Grounding for sensitive electronic equipment.
- B. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For grounding to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:
 - 1. Instructions for periodic testing and inspection of grounding features at test wells ground rings grounding connections for separately derived systems based on NETA MTS.
 - a. Tests shall determine if ground-resistance or impedance values remain within specified maximums, and instructions shall recommend corrective action if values do not.
 - b. Include recommended testing intervals.

PART 2 - PRODUCTS

2.1 CONDUCTORS

- A. Insulated Conductors: Copper or tinned-copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.
- B. Bare Copper Conductors:
 - 1. Solid Conductors: ASTM B 3.
 - 2. Stranded Conductors: ASTM B 8.
 - 3. Tinned Conductors: ASTM B 33.
 - 4. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch (6 mm) in diameter.
 - 5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
 - 6. Bonding Jumper: Copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.
 - 7. Tinned Bonding Jumper: Tinned-copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.
- C. Grounding Bus: Predrilled rectangular bars of annealed copper, 1/4 by 4 inches (6.3 by 100 mm) in cross section, with 9/32-inch (7.14-mm) holes spaced 1-1/8 inches (28 mm) apart. Stand-off insulators for mounting shall comply with UL 891 for use in switchboards, 600 V. Lexan or PVC, impulse tested at 5000 V.

2.2 CONNECTORS

- A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.
- B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy, pressure type with at least two bolts.
 - 1. Pipe Connectors: Clamp type, sized for pipe.
- C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.
- D. Bus-bar Connectors: Mechanical type, cast silicon bronze, solderless compression-type wire terminals, and long-barrel, two-bolt connection to ground bus bar.

2.3 BONDING AND EQUIPMENT GROUNDING

A. Description of System: In general, all electrical equipment (metallic conduit, motor frames, panelboards, etc.) shall be bonded together with a green insulated copper system grounding conductor in accordance with specific rules of Article 250 of the NEC equipment grounding conductors through the raceway system shall be continuous from main switch ground bus to

panel ground bar of each panbelboard, and from panel grounding bar of each panelboard to branch circuit equipment and devices.

- B. Equipment Grounding Conductors: All raceways shall have an insulated copper system ground conductor run throughout the entire length of circuit installed within conduit in strict accordance with NEC. Grounding conductor shall be included in total conduit fill when determining conduit sizes, even though not included or shown on drawings.
- C. Redundant Grounding: In general, all branch circuits shall be provided with a redundant grounding system through the use of grounding conductors and metallic conduit.
- D. Bonding: In addition to connections to grounding electrodes, the main service ground shall be bonded to the lightning protection system and other underground metal piping.
- E. Light Poles: All exterior light poles shall have their enclosures grounded directly to a separate driven ground at the light pole in addition to the building ground connection, via the circuit equipment ground conductor.
- F. Bushings: Provide insulated grounding bushings on all metallic feeder conduits terminated within panelboards, switchboards or enclosed overcurrent devices. Provide insulated grounding bushings on all branch circuit conduits where concentric knockouts are used.

PART 3 - EXECUTION

3.1 APPLICATIONS

- A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger unless otherwise indicated.
- B. Isolated Grounding Conductors: Green-colored insulation with continuous yellow stripe. On feeders with isolated ground, identify grounding conductor where visible to normal inspection, with alternating bands of green and yellow tape, with at least three bands of green and two bands of yellow.
- C. Grounding Bus: Install in electrical and telephone equipment rooms, in rooms housing service equipment, and elsewhere as indicated.
 - 1. Install bus on insulated spacers 2 inches (50 mm) minimum from wall, 6 inches (150 mm) above finished floor unless otherwise indicated.
 - 2. Where indicated on both sides of doorways, route bus up to top of door frame, across top of doorway, and down to specified height above floor; connect to horizontal bus.
- D. Conductor Terminations and Connections:
 - 1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
 - 2. Underground Connections: Welded connectors except at test wells and as otherwise indicated.
 - 3. Connections to Ground Rods at Test Wells: Bolted connectors.
 - 4. Connections to Structural Steel: Welded connectors.
3.2 EQUIPMENT GROUNDING

- A. Install insulated equipment grounding conductors with all feeders and branch circuits.
- B. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:
 - 1. Feeders and branch circuits.
 - 2. Lighting circuits.
 - 3. Receptacle circuits.
 - 4. Single-phase motor and appliance branch circuits.
 - 5. Three-phase motor and appliance branch circuits.
 - 6. Flexible raceway runs.
 - 7. Busway Supply Circuits: Install insulated equipment grounding conductor from grounding bus in the switchgear, switchboard, or distribution panel to equipment grounding bar terminal on busway.
 - 8. Computer and Rack-Mounted Electronic Equipment Circuits: Install insulated equipment grounding conductor in branch-circuit runs from equipment-area power panels and power-distribution units.
- C. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to ductmounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.
- D. Water Heater, Heat-Tracing, and Antifrost Heating Cables: Install a separate insulated equipment grounding conductor to each electric water heater and heat-tracing cable. Bond conductor to heater units, piping, connected equipment, and components.
- E. Isolated Grounding Receptacle Circuits: Install an insulated equipment grounding conductor connected to the receptacle grounding terminal. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service unless otherwise indicated.
- F. Isolated Equipment Enclosure Circuits: For designated equipment supplied by a branch circuit or feeder, isolate equipment enclosure from supply circuit raceway with a nonmetallic raceway fitting listed for the purpose. Install fitting where raceway enters enclosure, and install a separate insulated equipment grounding conductor. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service unless otherwise indicated.
- G. Signal and Communication Equipment: In addition to grounding and bonding required by NFPA 70, provide a separate grounding system complying with requirements in TIA/ATIS J-STD-607-A.
 - 1. For telephone, alarm, voice and data, and other communication equipment, provide No. 4 AWG minimum insulated grounding conductor in raceway from grounding electrode system to each service location, terminal cabinet, wiring closet, and central equipment location.
 - 2. Service and Central Equipment Locations and Wiring Closets: Terminate grounding conductor on a 1/4-by-4-by-12-inch (6.3-by-100-by-300-mm) grounding bus.

3. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.

3.3 INSTALLATION

- A. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
- B. Ground Bonding Common with Lightning Protection System: Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system. Bond electrical power system ground directly to lightning protection system grounding conductor at closest point to electrical service grounding electrode. Use bonding conductor sized same as system grounding electrode conductor, and install in conduit.
- C. Ground Rods: Drive rods until tops are 2 inches (50 mm) below finished floor or final grade unless otherwise indicated.
 - 1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating if any.
 - 2. For grounding electrode system, install at least three rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes, and connect to the service grounding electrode conductor.
- D. Test Wells: Ground rod driven through drilled hole in bottom of handhole. Handholes are specified in Division 26 Section "Raceways and Boxes," and shall be at least 12 inches (300 mm) deep, with cover.
 - 1. Test Wells: Install at least one test well for each service unless otherwise indicated. Install at the ground rod electrically closest to service entrance. Set top of test well flush with finished grade or floor.
- E. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.
 - 1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
 - 2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.
 - 3. Use exothermic-welded connectors for outdoor locations; if a disconnect-type connection is required, use a bolted clamp.
- F. Grounding and Bonding for Piping:
 - 1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes; use a bolted clamp connector or bolt a lug-type connector to a pipe flange by using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect

grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.

- 2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
- 3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.
- G. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install tinned bonding jumper to bond across flexible duct connections to achieve continuity.
- H. Grounding for Steel Building Structure: Install a driven ground rod at base of each corner column and at intermediate exterior columns at distances not more than 60 feet (18 m) apart.

3.4 LABELING

- A. Comply with requirements in Division 26 Section "Identification for Electrical Systems" Article for instruction signs. The label or its text shall be green.
- B. Install labels at the telecommunications bonding conductor and grounding equalizer and at the grounding electrode conductor where exposed.
 - 1. Label Text: "If this connector or cable is loose or if it must be removed for any reason, notify the facility manager."

3.5 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
 - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- B. Tests and Inspections:
 - 1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
 - 2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
 - 3. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, at ground test wells, and at individual ground rods. Make tests at ground rods before any conductors are connected.
 - a. Measure ground resistance no fewer than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.

- b. Perform tests by fall-of-potential method according to IEEE 81.
- 4. Prepare dimensioned Drawings locating each test well, ground rod and ground-rod assembly, and other grounding electrodes. Identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth at each location, and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.
- C. Grounding system will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.
- E. Report measured ground resistances that exceed the following values:
 - 1. Power and Lighting Equipment or System with Capacity of 500 kVA and Less: 10 ohms.
 - 2. Power and Lighting Equipment or System with Capacity of 500 to 1000 kVA: 5 ohms.
 - 3. Power and Lighting Equipment or System with Capacity More Than 1000 kVA: 3 ohms.
 - 4. Power Distribution Units or Panelboards Serving Electronic Equipment: 1 ohm(s).
 - 5. Substations and Pad-Mounted Equipment: 5 ohms.
 - 6. Manhole Grounds: 10 ohms.
- F. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

EQUIPOTENTIAL GROUND TEST REPORT

FACILITY NAME: _____ PROJECT NAME: _____

DATE: _____TESTED BY:_____

MAXIMUM TEST INTERVALS: GENERAL CARE - 12 MOS. CRITICAL CARE - 6 MOS. WET LOCATIONS - 12 MOS. NAME:_____

COMPANY:_____

TYPE METER USED AND EXTERNAL NETWORK IF USED:

NOTE: MAXIMUM READINGS PERMITTED - 20 MV NEW - CONSTRUCTION / RENOVATION 0.1 OHM NEW - CONSTRUCTION / RENOVATION

Room No.	AREA TYPE Description (C) = CRITICAL CARE (G) = GENERAL CARE	VOLTAGE MEASUREMENT			IMPEDANCE MEASUREMENT		REMARKS - IF VOLTAGE READINGS MORE THAN 20MV IN EXISTING CONST. NOTE TESTS & INVESTIGATION REQUIRED.
		NO. OF RECEPTS.	NO. OF OTHER	MAX. READING IN MILIVOLTS	NO. OF RECEPTS	MAX READING IN OHMS	

END OF SECTION 260526

GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

SECTION 260529 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Hangers and supports for electrical equipment and systems.
 - 2. Construction requirements for concrete bases.

1.3 DEFINITIONS

- A. EMT: Electrical metallic tubing.
- B. IMC: Intermediate metal conduit.
- C. RMC: Rigid metal conduit.

1.4 PERFORMANCE REQUIREMENTS

- A. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.
- B. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

1.5 ACTION SUBMITTALS

- A. Product Data: For the following:
 - 1. Steel slotted support systems.
 - 2. Nonmetallic slotted support systems.
- B. Shop Drawings: Show fabrication and installation details and include calculations for the following:
 - 1. Trapeze hangers. Include Product Data for components.
 - 2. Steel slotted channel systems. Include Product Data for components.
 - 3. Nonmetallic slotted channel systems. Include Product Data for components.

4. Equipment supports.

1.6 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.7 QUALITY ASSURANCE

- A. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code Steel."
- B. Comply with NFPA 70.

1.8 COORDINATION

- A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.
- B. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Division 07 Section "Roof Accessories."

PART 2 - PRODUCTS

2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

- A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Allied Tube & Conduit.
 - b. Cooper B-Line, Inc.; a division of Cooper Industries.
 - c. ERICO International Corporation.
 - d. GS Metals Corp.
 - e. Thomas & Betts Corporation.
 - f. Unistrut; Tyco International, Ltd.
 - g. Wesanco, Inc.
 - 2. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
 - 3. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.
 - 4. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
 - 5. Channel Dimensions: Selected for applicable load criteria.

- B. Nonmetallic Slotted Support Systems: Structural-grade, factory-formed, glass-fiber-resin channels and angles with 9/16-inch- diameter holes at a maximum of 8 inches o.c., in at least 1 surface.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Allied Tube & Conduit.
 - b. Cooper B-Line, Inc.; a division of Cooper Industries.
 - c. Fabco Plastics Wholesale Limited.
 - d. Seasafe, Inc.
 - 2. Fittings and Accessories: Products of channel and angle manufacturer and designed for use with those items.
 - 3. Fitting and Accessory Materials: Same as channels and angles, except metal items may be stainless steel.
 - 4. Rated Strength: Selected to suit applicable load criteria.
- C. Raceway and Cable Supports: As described in NECA 1 and NECA 101.
- D. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.
- E. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.
- F. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
- G. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:
 - 1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) Hilti Inc.
 - 2) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
 - 3) MKT Fastening, LLC.
 - 4) Simpson Strong-Tie Co., Inc.; Masterset Fastening Systems Unit.
 - 2. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.

- a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) Cooper B-Line, Inc.; a division of Cooper Industries.
 - 2) Empire Tool and Manufacturing Co., Inc.
 - 3) Hilti Inc.
 - 4) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
 - 5) MKT Fastening, LLC.
- 3. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.
- 4. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
- 5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
- 6. Toggle Bolts: All-steel springhead type.
- 7. Hanger Rods: Threaded steel.

2.2 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

- A. Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.
- B. Materials: Comply with requirements in Division 05 Section "Metal Fabrications" for steel shapes and plates.

PART 3 - EXECUTION

3.1 APPLICATION

- A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.
- B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and RMC as required by NFPA 70. Minimum rod size shall be 1/4 inch in diameter.
- C. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted or other support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.
 - 1. Secure raceways and cables to these supports with two-bolt conduit clamps.
- D. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

3.2 SUPPORT INSTALLATION

- A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.
- B. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.
- C. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:
 - 1. To Wood: Fasten with lag screws or through bolts.
 - 2. To New Concrete: Bolt to concrete inserts.
 - 3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
 - 4. To Existing Concrete: Expansion anchor fasteners.
 - 5. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches thick.
 - 6. To Steel: Welded threaded studs complying with AWS D1.1/D1.1M, with lock washers and nuts and beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69.
 - 7. To Light Steel: Sheet metal screws.
 - 8. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate per manufacturer's installation instructions.
- D. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

- A. Comply with installation requirements in Division 05 Section "Metal Fabrications" for site-fabricated metal supports.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.
- C. Field Welding: Comply with AWS D1.1/D1.1M.

3.4 CONCRETE BASES

A. Construct concrete bases of dimensions indicated but not less than 4 inches larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.

- B. Use 3000-psi, 28-day compressive-strength concrete. Concrete materials, reinforcement, and placement requirements are specified in Division 03 Section "Cast-in-Place Concrete."
- C. Anchor equipment to concrete base.
 - 1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 2. Install anchor bolts to elevations required for proper attachment to supported equipment.
 - 3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

3.5 PAINTING

- A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
 - 1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.
- B. Touchup: Comply with requirements in Division 09 painting Sections for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.
- C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 260529

SECTION 260533 - RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Metal conduits, tubing, and fittings.
 - 2. Nonmetal conduits, tubing, and fittings.
 - 3. Metal wireways and auxiliary gutters.
 - 4. Nonmetal wireways and auxiliary gutters.
 - 5. Surface raceways.
 - 6. Boxes, enclosures, and cabinets.

1.3 DEFINITIONS

- A. ARC: Aluminum rigid conduit.
- B. GRC: Galvanized rigid steel conduit.
- C. IMC: Intermediate metal conduit.

1.4 ACTION SUBMITTALS

- A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.
- B. Shop Drawings: For custom enclosures and cabinets. Include plans, elevations, sections, and attachment details.

1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Conduit routing plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of items involved:
 - 1. Structural members in paths of conduit groups with common supports.
 - 2. HVAC and plumbing items and architectural features in paths of conduit groups with common supports.

PART 2 - PRODUCTS

2.1 METAL CONDUITS, TUBING, AND FITTINGS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. AFC Cable Systems, Inc.
 - 2. Allied Tube & Conduit; a Tyco International Ltd. Co.
 - 3. O-Z/Gedney; a brand of EGS Electrical Group.
 - 4. Picoma Industries, a subsidiary of Mueller Water Products, Inc.
 - 5. Republic Conduit.
 - 6. Southwire Company.
 - 7. Thomas & Betts Corporation.
 - 8. Western Tube and Conduit Corporation.
 - 9. Wheatland Tube Company; a division of John Maneely Company.
- B. Listing and Labeling: Metal conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. GRC: Comply with ANSI C80.1 and UL 6.
- D. ARC: Comply with ANSI C80.5 and UL 6A.
- E. IMC: Comply with ANSI C80.6 and UL 1242.
- F. PVC-Coated Steel Conduit: PVC-coated rigid steel conduit.
 - 1. Comply with NEMA RN 1.
 - 2. Coating Thickness: 0.040 inch, minimum.
- G. EMT: Comply with ANSI C80.3 and UL 797.
- H. FMC: Comply with UL 1; zinc-coated steel or aluminum.
- I. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.
- J. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.
 - 1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886 and NFPA 70.
 - 2. Fittings for EMT:
 - a. Material: Steel or die cast.
 - b. Type: Setscrew or compression.
 - 3. Expansion Fittings: PVC or steel to match conduit type, complying with UL 651, rated for environmental conditions where installed, and including flexible external bonding jumper.
 - 4. Coating for Fittings for PVC-Coated Conduit: Minimum thickness of 0.040 inch, with overlapping sleeves protecting threaded joints.

K. Joint Compound for IMC, GRC, or ARC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

2.2 NONMETALLIC CONDUITS, TUBING, AND FITTINGS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. CANTEX Inc.
 - 2. CertainTeed Corp.
 - 3. Kraloy.
 - 4. Lamson & Sessions; Carlon Electrical Products.
 - 5. Niedax-Kleinhuis USA, Inc.
 - 6. RACO; a Hubbell company.
 - 7. Thomas & Betts Corporation.
- B. Listing and Labeling: Nonmetallic conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. RNC: Type EPC-40-PVC, complying with NEMA TC 2 and UL 651 unless otherwise indicated.
- D. LFNC: Comply with UL 1660.
- E. Rigid HDPE: Comply with UL 651A.
- F. RTRC: Comply with UL 1684A and NEMA TC 14.
- G. Fittings for ENT and RNC: Comply with NEMA TC 3; match to conduit or tubing type and material.
- H. Fittings for LFNC: Comply with UL 514B.

2.3 METAL WIREWAYS AND AUXILIARY GUTTERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Cooper B-Line, Inc.
 - 2. Hoffman; a Pentair company.
 - 3. Mono-Systems, Inc.
 - 4. Square D; a brand of Schneider Electric.
- B. Description: Sheet metal, complying with UL 870 and NEMA 250, Type 1 or Type 3R as shown, unless otherwise indicated, and sized according to NFPA 70.
 - 1. Metal wireways installed outdoors shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

- C. Fittings and Accessories: Include covers, couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.
- D. Wireway Covers: Screw-cover type unless otherwise indicated.
- E. Finish: Manufacturer's standard enamel finish.

2.4 NONMETALLIC WIREWAYS AND AUXILIARY GUTTERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Allied Moulded Products, Inc.
 - 2. Hoffman; a Pentair company.
 - 3. Lamson & Sessions; Carlon Electrical Products.
 - 4. Niedax-Kleinhuis USA, Inc.
- B. Listing and Labeling: Nonmetallic wireways and auxiliary gutters shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. Description: Fiberglass polyester, extruded and fabricated to required size and shape, without holes or knockouts. Cover shall be gasketed with oil-resistant gasket material and fastened with captive screws treated for corrosion resistance. Connections shall be flanged and have stainless-steel screws and oil-resistant gaskets.
- D. Fittings and Accessories: Couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings shall match and mate with wireways as required for complete system.

2.5 BOXES, ENCLOSURES, AND CABINETS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Adalet.
 - 2. Cooper Technologies Company; Cooper Crouse-Hinds.
 - 3. EGS/Appleton Electric.
 - 4. Erickson Electrical Equipment Company.
 - 5. FSR Inc.
 - 6. Hoffman; a Pentair company.
 - 7. Hubbell Incorporated; Killark Division.
 - 8. Kraloy.
 - 9. Milbank Manufacturing Co.
 - 10. Mono-Systems, Inc.
 - 11. O-Z/Gedney; a brand of EGS Electrical Group.
 - 12. RACO; a Hubbell Company.
 - 13. Stahlin Non-Metallic Enclosures; a division of Robroy Industries.

- 14. Thomas & Betts Corporation.
- 15. Wiremold / Legrand.
- B. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.
- C. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.
- D. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, aluminum, Type FD, with gasketed cover.
- E. Nonmetallic Outlet and Device Boxes: Comply with NEMA OS 2 and UL 514C.
- F. Luminaire Outlet Boxes: Nonadjustable, designed for attachment of luminaire weighing 50 lb. Outlet boxes designed for attachment of luminaires weighing more than 50 lb shall be listed and marked for the maximum allowable weight.
- G. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
- H. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, cast aluminum with gasketed cover.
- I. Box extensions used to accommodate new building finishes shall be of same material as recessed box.
- J. Device Box Dimensions: 4 inches square by 2-1/8 inches deep.
- K. Gangable boxes are allowed.
- L. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250, Type 1 with continuous-hinge cover with flush latch unless otherwise indicated.
 - 1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
 - 2. Nonmetallic Enclosures: Fiberglass.
 - 3. Interior Panels: Steel; all sides finished with manufacturer's standard enamel.
- M. Cabinets:
 - 1. NEMA 250, Type 1 galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
 - 2. Hinged door in front cover with flush latch and concealed hinge.
 - 3. Key latch to match panelboards.
 - 4. Metal barriers to separate wiring of different systems and voltage.
 - 5. Accessory feet where required for freestanding equipment.
 - 6. Nonmetallic cabinets shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

- A. Outdoors: Apply raceway products as specified below unless otherwise indicated:
 - 1. Exposed Conduit: IMC.
 - 2. Concealed Conduit, Aboveground: IMC.
 - 3. Underground Conduit: RNC, Type EPC-40-PVC.
 - 4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFNC.
 - 5. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.
- B. Indoors: Apply raceway products as specified below unless otherwise indicated:
 - 1. Exposed, Not Subject to Physical Damage: EMT.
 - 2. Exposed, Not Subject to Severe Physical Damage: EMT.
 - 3. Exposed and Subject to Severe Physical Damage: GRC. Raceway locations include the following:
 - a. Loading dock.
 - b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
 - c. Mechanical rooms.
 - 4. Concealed in Ceilings and Interior Walls and Partitions: EMT.
 - 5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
 - 6. Damp or Wet Locations: GRC.
 - 7. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4 stainless steel in institutional and commercial kitchens and damp or wet locations.
- C. Minimum Raceway Size: 1/2-inch trade size.
- D. Raceway Fittings: Compatible with raceways and suitable for use and location.
 - 1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
 - 2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with this type of conduit. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer and apply in thickness and number of coats recommended by manufacturer.
 - 3. EMT: Use setscrew or compression, steel or cast-metal fittings. Comply with NEMA FB 2.10.
 - 4. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.
- E. Do not install aluminum conduits, boxes, or fittings in contact with concrete or earth.
- F. Install surface raceways only where indicated on Drawings.

G. Do not install nonmetallic conduit where ambient temperature exceeds 120 deg F.

3.2 INSTALLATION

- A. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum conduits. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.
- B. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.
- C. Complete raceway installation before starting conductor installation.
- D. Comply with requirements in Division 26 Section "Hangers and Supports for Electrical Systems" for hangers and supports.
- E. Arrange stub-ups so curved portions of bends are not visible above finished slab.
- F. Install no more than the equivalent of three 90-degree bends in any conduit run except for control wiring conduits, for which fewer bends are allowed. Support within 12 inches of changes in direction.
- G. Conceal conduit and EMT within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.
- H. Support conduit within 12 inches of enclosures to which attached.
- I. Stub-ups to Above Recessed Ceilings:
 - 1. Use EMT for raceways.
 - 2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.
- J. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.
- K. Coat field-cut threads on PVC-coated raceway with a corrosion-preventing conductive compound prior to assembly.
- L. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors including conductors smaller than No. 4 AWG.
- M. Install raceways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.
- N. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to assure a continuous ground path.

- O. Cut conduit perpendicular to the length. For conduits 2-inch trade size and larger, use roll cutter or a guide to make cut straight and perpendicular to the length.
- P. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.
- Q. Surface Raceways:
 - 1. Install surface raceway with a minimum 2-inch radius control at bend points.
 - 2. Secure surface raceway with screws or other anchor-type devices at intervals not exceeding 48 inches and with no less than two supports per straight raceway section. Support surface raceway according to manufacturer's written instructions. Tape and glue are not acceptable support methods.
- R. Install raceway sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings according to NFPA 70.
- S. Install devices to seal raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all raceways at the following points:
 - 1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
 - 2. Where an underground service raceway enters a building or structure.
 - 3. Where otherwise required by NFPA 70.
- T. Comply with manufacturer's written instructions for solvent welding RNC and fittings.
- U. Expansion-Joint Fittings:
 - 1. Install in each run of aboveground RNC that is located where environmental temperature change may exceed 30 deg F and that has straight-run length that exceeds 25 feet. Install in each run of aboveground RMC and EMT conduit that is located where environmental temperature change may exceed 100 deg F and that has straight-run length that exceeds 100 feet.
 - 2. Install type and quantity of fittings that accommodate temperature change listed for each of the following locations:
 - a. Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F temperature change.
 - b. Outdoor Locations Exposed to Direct Sunlight: 155 deg F temperature change.
 - c. Indoor Spaces Connected with Outdoors without Physical Separation: 125 deg F temperature change.
 - 3. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F of temperature change for PVC conduits. Install fitting(s) that provide expansion and contraction for at least 0.000078 inch per foot of length of straight run per deg F of temperature change for metal conduits.

- 4. Install expansion fittings at all locations where conduits cross building or structure expansion joints.
- 5. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.
- V. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of 72 inches of flexible conduit for recessed and semirecessed luminaires, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.
 - 1. Use LFMC in damp or wet locations subject to severe physical damage.
 - 2. Use LFMC or LFNC in damp or wet locations not subject to severe physical damage.
- W. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to center of box unless otherwise indicated.
- X. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surfaces to provide a flat surface for a raintight connection between box and cover plate or supported equipment and box.
- Y. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.
- Z. Locate boxes so that cover or plate will not span different building finishes.
- AA. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.
- BB. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.
- CC. Set metal floor boxes level and flush with finished floor surface.
- DD. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.

3.3 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Division 26 Section "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.4 FIRESTOPPING

A. Install firestopping at penetrations of fire-rated floor and wall assemblies. Comply with requirements in Division 07 Section "Penetration Firestopping."

3.5 **PROTECTION**

- A. Protect coatings, finishes, and cabinets from damage and deterioration.
 - 1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
 - 2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION 260533

SECTION 260544 - SLEEVES AND SLEEVE SEALS FOR ELECTRICAL RACEWAYS AND CABLING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Sleeves for raceway and cable penetration of non-fire-rated construction walls and floors.
 - 2. Sleeve-seal systems.
 - 3. Sleeve-seal fittings.
 - 4. Grout.
 - 5. Silicone sealants.
- B. Related Requirements:
 - 1. Division 07 Section "Penetration Firestopping" for penetration firestopping installed in fire-resistance-rated walls, horizontal assemblies, and smoke barriers, with and without penetrating items.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 SLEEVES

- A. Wall Sleeves:
 - 1. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, plain ends.
- B. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies: Galvanized-steel sheet; 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint, with tabs for screw-fastening the sleeve to the board.
- C. Molded-PE or -PP Sleeves: Removable, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.

- D. Sleeves for Rectangular Openings:
 - 1. Material: Galvanized sheet steel.
 - 2. Minimum Metal Thickness:
 - a. For sleeve cross-section rectangle perimeter less than 50 inches and with no side larger than 16 inches, thickness shall be 0.052 inch.
 - b. For sleeve cross-section rectangle perimeter 50 inches or more and one or more sides larger than 16 inches, thickness shall be 0.138 inch.

2.2 SLEEVE-SEAL SYSTEMS

- A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.
 - 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.
 - e. Proco Products, Inc.
 - 2. Sealing Elements: EPDM rubber 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.
 - 4. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, of length required to secure pressure plates to sealing elements.

2.3 SLEEVE-SEAL FITTINGS

- A. Description: Manufactured plastic, sleeve-type, waterstop assembly made for embedding in concrete slab or wall. Unit shall have plastic or rubber waterstop collar with center opening to match piping OD.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Presealed Systems.

2.4 GROUT

- A. Description: Nonshrink; recommended for interior and exterior sealing openings in non-firerated walls or floors.
- B. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

- C. Design Mix: 5000-psi, 28-day compressive strength.
- D. Packaging: Premixed and factory packaged.

2.5 SILICONE SEALANTS

- A. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below.
 - 1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces that are not fire rated.
- B. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION FOR NON-FIRE-RATED ELECTRICAL PENETRATIONS

- A. Comply with NECA 1.
- B. Comply with NEMA VE 2 for cable tray and cable penetrations.
- C. Sleeves for Conduits Penetrating Above-Grade Non-Fire-Rated Concrete and Masonry-Unit Floors and Walls:
 - 1. Interior Penetrations of Non-Fire-Rated Walls and Floors:
 - a. Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Division 07 Section "Joint Sealants."
 - b. Seal space outside of sleeves with mortar or grout. Pack sealing material solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect material while curing.
 - 2. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
 - 3. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway or cable unless sleeve seal is to be installed.
 - 4. Install sleeves for wall penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of walls. Cut sleeves to length for mounting flush with both surfaces of walls. Deburr after cutting.
 - 5. Install sleeves for floor penetrations. Extend sleeves installed in floors 2 inches above finished floor level. Install sleeves during erection of floors.
- D. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies:
 - 1. Use circular metal sleeves unless penetration arrangement requires rectangular sleeved opening.

- 2. Seal space outside of sleeves with approved joint compound for gypsum board assemblies.
- E. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.
- F. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel pipe 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.
- G. Underground, Exterior-Wall and Floor Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch annular clear space between raceway or cable and sleeve for installing sleeve-seal system.

3.2 SLEEVE-SEAL-SYSTEM INSTALLATION

- A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at raceway entries into building.
- B. Install type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.3 SLEEVE-SEAL-FITTING INSTALLATION

- A. Install sleeve-seal fittings in new walls and slabs as they are constructed.
- B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.
- C. Secure nailing flanges to concrete forms.
- D. Using grout, seal the space around outside of sleeve-seal fittings.

END OF SECTION 260544

SECTION 260553 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Identification for raceways.
 - 2. Identification of control cables.
 - 3. Identification for conductors.
 - 4. Underground-line warning tape.
 - 5. Warning labels and signs.
 - 6. Instruction signs.
 - 7. Equipment identification labels.
 - 8. Miscellaneous identification products.

1.3 ACTION SUBMITTALS

- A. Product Data: For each electrical identification product indicated.
- B. Identification Schedule: An index of nomenclature of electrical equipment and system components used in identification signs and labels.

1.4 QUALITY ASSURANCE

- A. Comply with ANSI A13.1.
- B. Comply with NFPA 70.
- C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.
- D. Comply with ANSI Z535.4 for safety signs and labels.
- E. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

1.5 COORDINATION

- A. Coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual; and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.
- B. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- C. Coordinate installation of identifying devices with location of access panels and doors.
- D. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 POWER RACEWAY IDENTIFICATION MATERIALS

- A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway size.
- B. Colors for Raceways Carrying Circuits at 600 V or Less:
 - 1. Black letters on an orange field.
 - 2. Legend: Indicate voltage and system or service type.
- C. Self-Adhesive Vinyl Labels for Raceways Carrying Circuits at 600 V or Less: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

2.2 CONTROL CABLE IDENTIFICATION MATERIALS

- A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.
- B. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

2.3 CONDUCTOR IDENTIFICATION MATERIALS

A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils thick by 1 to 2 inches wide.

2.4 FLOOR MARKING TAPE

A. 2-inch-wide, 5-mil pressure-sensitive vinyl tape, with black and white stripes and clear vinyl overlay.

2.5 WARNING LABELS AND SIGNS

- A. Comply with NFPA 70 and 29 CFR 1910.145.
- B. Self-Adhesive Warning Labels: Factory-printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment unless otherwise indicated.
- C. Warning label and sign shall include, but are not limited to, the following legends:
 - 1. Workspace Clearance Warning: "WARNING OSHA REGULATION AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES."
 - 2. Arc Flash: Provide permanent warning labels on all electrical panels to warn personnel of potential electric arc flash hazards per NEC 110.16. The Owner shall determine the potential for arc flash hazard level in accordance with NFPA 70E and OSHA.

2.6 INSTRUCTION SIGNS

- A. Engraved, laminated acrylic or melamine plastic, minimum 1/16 inch thick for signs up to 20 sq. inches and 1/8 inch thick for larger sizes.
 - 1. Engraved legend with black letters on white face.
 - 2. Punched or drilled for mechanical fasteners.
 - 3. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.
- B. Adhesive Film Label: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch.
- C. Adhesive Film Label with Clear Protective Overlay: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch. Overlay shall provide a weatherproof and UV-resistant seal for label.

2.7 EQUIPMENT IDENTIFICATION LABELS

- A. Engraved Plastic Laminate Nameplates:
 - 1. Provide engraving phenolic plastic laminate, in sizes and thicknesses indicated, engraved with 1/16 inch thick lines with square standard pica lettering and wording as specified herein.
 - a. black face with white core plies (letter color) for normal systems
 - b. red with white letters for fire alarm

- 2. Punch for mechanical fastening, except where adhesive mounting is necessary because of substrate.
- 3. Material thickness shall be 1/16 inch. Titles shall be 1/2 inch high and all other lettering shall be 1/4 inch high.
- 4. Provide beveled edge in order to eliminate sharp corners.
- 5. Provide self-tapping stainless steel round head screws. Provide contact type permanent adhesive where screws cannot or shall not penetrate the substrate. Adhesive nameplate shall be permanently installed.

2.8 CABLE TIES

- A. General-Purpose Cable Ties: Fungus inert, self extinguishing, one piece, self locking, Type 6/6 nylon.
 - 1. Minimum Width: 3/16 inch.
 - 2. Tensile Strength at 73 deg F, According to ASTM D 638: 12,000 psi.
 - 3. Temperature Range: Minus 40 to plus 185 deg F.
 - 4. Color: Black except where used for color-coding.
- B. UV-Stabilized Cable Ties: Fungus inert, designed for continuous exposure to exterior sunlight, self extinguishing, one piece, self locking, Type 6/6 nylon.
 - 1. Minimum Width: 3/16 inch.
 - 2. Tensile Strength at 73 deg F, According to ASTM D 638: 12,000 psi.
 - 3. Temperature Range: Minus 40 to plus 185 deg F.
 - 4. Color: Black.
- C. Plenum-Rated Cable Ties: Self extinguishing, UV stabilized, one piece, self locking.
 - 1. Minimum Width: 3/16 inch.
 - 2. Tensile Strength at 73 deg F, According to ASTM D 638: 7000 psi.
 - 3. UL 94 Flame Rating: 94V-0.
 - 4. Temperature Range: Minus 50 to plus 284 deg F.
 - 5. Color: Black.

2.9 MISCELLANEOUS IDENTIFICATION PRODUCTS

- A. Paint: Comply with requirements in Division 09 painting Sections for paint materials and application requirements. Select paint system applicable for surface material and location (exterior or interior).
- B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Verify identity of each item before installing identification products.
- B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.
- C. Apply identification devices to surfaces that require finish after completing finish work.
- D. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.
- E. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
- F. System Identification Color-Coding Bands for Raceways and Cables: Each color-coding band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.
- G. Cable Ties: For attaching tags. Use general-purpose type, except as listed below:
 - 1. Outdoors: UV-stabilized nylon.
 - 2. In Spaces Handling Environmental Air: Plenum rated.
- H. Painted Identification: Comply with requirements in Division 09 painting Sections for surface preparation and paint application.

3.2 IDENTIFICATION SCHEDULE

- A. Accessible Raceways, 600 V or Less, for Service, Feeder, and Branch Circuits More Than 30 A, and 120 V to ground: Identify with self-adhesive vinyl tape applied in bands. Install labels at 10-foot maximum intervals.
- B. Accessible Raceways and Cables within Buildings: Identify the covers of each junction and pull box with colors indicated in the wiring system legend and system voltage.
- C. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use color-coding conductor tape to identify the phase.
 - 1. Color-Coding for Phase and Voltage Level Identification, 600 V or Less: Use colors listed below for ungrounded service feeder and branch-circuit conductors.
 - a. Color shall be factory applied or field applied for sizes larger than No. 8 AWG, if authorities having jurisdiction permit.
 - b. Colors for 208/120-V Circuits:

- 1) Phase A: Black.
- 2) Phase B: Red.
- 3) Phase C: Blue.
- c. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.
- D. Install instructional sign including the color-code for grounded and ungrounded conductors using adhesive-film-type labels.
- E. Conductors to Be Extended in the Future: Attach write-on tags to conductors and list source.
- F. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.
 - 1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
 - 2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
 - 3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual.
- G. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Selfadhesive warning labels.
 - 1. Comply with 29 CFR 1910.145.
 - 2. Identify system voltage with black letters on an orange background.
 - 3. Apply to exterior of door, cover, or other access.
- H. Operating Instruction Signs: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.
- I. Emergency Operating Instruction Signs: Install instruction signs with white legend on a red background with minimum 3/8-inch-high letters for emergency instructions at equipment used for emergency operations.
- J. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and the Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.
 - 1. Labeling Instructions:
 - a. Indoor Equipment: Engraved, laminated acrylic or melamine label. Unless otherwise indicated, provide a single line of text with 1/2-inch-high letters on 1-1/2-inch-high label; where two lines of text are required, use labels 2 inches high.

- b. Outdoor Equipment: Engraved, laminated acrylic or melamine label.
- c. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.
- d. Unless provided with self-adhesive means of attachment, fasten labels with appropriate mechanical fasteners that do not change the NEMA or NRTL rating of the enclosure.
- 2. Equipment to Be Labeled:
 - a. Panelboards: Typewritten directory of circuits in the location provided by panelboard manufacturer. Panelboard identification shall be engraved, laminated acrylic or melamine label.
 - b. Enclosures and electrical cabinets.
 - c. Access doors and panels for concealed electrical items.
 - d. Enclosed switches.
 - e. Enclosed circuit breakers.
 - f. Enclosed controllers.
 - g. Variable-speed controllers.
 - h. Push-button stations.
 - i. Contactors.
 - j. Remote-controlled switches, dimmer modules, and control devices.
 - k. Battery-inverter units.
 - 1. Battery racks.
 - m. Power-generating units.
 - n. Monitoring and control equipment.

END OF SECTION 260553

SECTION 260923 - LIGHTING CONTROL DEVICES

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. Indoor occupancy sensors.
 - 2. Lighting contactors.
- B. Related Requirements:
 - 1. Division 26 Section "Wiring Devices" for wall-box dimmers, wall-switch occupancy sensors, and manual light switches.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: Show installation details for occupancy and light-level sensors.
 - 1. Interconnection diagrams showing field-installed wiring.
 - 2. Include diagrams for power, signal, and control wiring.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For each type of lighting control device to include in emergency, operation, and maintenance manuals.

PART 2 - PRODUCTS

- 2.1 INDOOR OCCUPANCY SENSORS
 - A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Intelligent Lighting Controls (ILC)
 - 2. Watt Stopper.

- 3. Crestron Control
- 4. Douglas Lighting Controls
- 5. Cooper Industries, Inc.
- 6. Hubbell Building Automation, Inc.
- 7. Leviton Mfg. Company Inc.
- 8. Lithonia Lighting; Acuity Lighting Group, Inc.
- 9. Lutron Electronics Co., Inc.
- 10. Sensor Switch, Inc.
- B. General Requirements for Sensors: Wall- or ceiling-mounted, solid-state indoor occupancy sensors with a separate power pack.
 - 1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 - 2. Operation: Unless otherwise indicated, turn lights on when coverage area is occupied, and turn them off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 30 minutes.
 - 3. Sensor Output: Contacts rated to operate the connected relay, complying with UL 773A. Sensor is powered from the power pack.
 - 4. Power Pack: Dry contacts rated for 20-A ballast load at 120- and 277-V ac, for 13-A tungsten at 120-V ac, and for 1 hp at 120-V ac. Sensor has 24-V dc, 150-mA, Class 2 power source, as defined by NFPA 70.
 - 5. Mounting:
 - a. Sensor: Suitable for mounting in any position on a standard outlet box.
 - b. Relay: Externally mounted through a 1/2-inch knockout in a standard electrical enclosure.
 - c. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.
 - 6. Indicator: Digital display, to show when motion is detected during testing and normal operation of sensor.
 - 7. Bypass Switch: Override the "on" function in case of sensor failure.
- C. Dual-Technology Type: Ceiling mounted; detect occupants in coverage area using PIR and ultrasonic detection methods. The particular technology or combination of technologies that control on-off functions is selectable in the field by operating controls on unit.
 - 1. Sensitivity Adjustment: Separate for each sensing technology.
 - 2. Detector Sensitivity: Detect occurrences of 6-inch-minimum movement of any portion of a human body that presents a target of not less than 36 sq. in., and detect a person of average size and weight moving not less than 12 inches in either a horizontal or a vertical manner at an approximate speed of 12 inches/s.
 - 3. Detection Coverage (Standard Room): Detect occupancy anywhere within a circular area of 1000 sq. ft. when mounted on a 96-inch-high ceiling.

2.2 PHOTOELECTRIC SWITCHES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- B. Basis-of-Design Product: Subject to compliance with requirements, provide [product indicated on Drawings] <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - 1. Hubbell Building Automation, Inc.
 - 2. Cooper Industries, Inc.
 - 3. Intermatic, Inc.
 - 4. NSi Industries LLC; TORK Products.
 - 5. Tyco Electronics; ALR Brand.
- C. Description: Solid state, with DPST dry contacts rated for 1800 VA, to operate connected load, complying with UL 773.
 - 1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 - 2. Light-Level Monitoring Range: 1.5 to 10 fc (16.14 to 108 lux), with an adjustment for turn-on and turn-off levels within that range.
 - 3. Time Delay: Thirty-second minimum, to prevent false operation.
 - 4. Lightning Arrester: Air-gap type.
 - 5. Mounting: Twist lock complying with NEMA C136.10, with base.

2.3 CONDUCTORS AND CABLES

- A. Power Wiring to Supply Side of Remote-Control Power Sources: Not smaller than No. 12 AWG. Comply with requirements in Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."
- B. Classes 2 and 3 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 18 AWG. Comply with requirements in Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."
- C. Class 1 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 14 AWG. Comply with requirements in Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

PART 3 - EXECUTION

3.1 SENSOR INSTALLATION

- A. Coordinate layout and installation of ceiling-mounted devices with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, smoke detectors, fire-suppression systems, and partition assemblies.
- B. Install and aim sensors in locations to achieve not less than 90 percent coverage of areas indicated. Do not exceed coverage limits specified in manufacturer's written instructions.

3.2 WIRING INSTALLATION

- A. Wiring Method: Comply with Division 26 Section "Low-Voltage Electrical Power Conductors and Cables." Minimum conduit size is 1/2 inch.
- B. Wiring within Enclosures: Comply with NECA 1. Separate power-limited and nonpower-limited conductors according to conductor manufacturer's written instructions.
- C. Size conductors according to lighting control device manufacturer's written instructions unless otherwise indicated.
- D. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

3.3 IDENTIFICATION

- A. Identify components and power and control wiring according to Division 26 Section "Identification for Electrical Systems."
 - 1. Identify controlled circuits in lighting contactors.
 - 2. Identify circuits or luminaires controlled by photoelectric and occupancy sensors at each sensor.
- B. Label time switches and contactors with a unique designation.

3.4 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
 - 1. Operational Test: After installing time switches and sensors, and after electrical circuitry has been energized, start units to confirm proper unit operation.
 - 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- B. Lighting control devices will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports.

3.5 ADJUSTING

- A. Occupancy Adjustments: When requested within 2 months from date of Substantial Completion, provide on-site assistance in adjusting sensors to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.
 - 1. For occupancy and motion sensors, verify operation at outer limits of detector range. Set time delay to suit Owner's operations.
 - 2. For daylighting controls, adjust set points and deadband controls to suit Owner's operations.
3. Align high-bay occupancy sensors using manufacturer's laser aiming tool.

3.6 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain lighting control devices.

END OF SECTION 260923

SECTION 262726 - WIRING DEVICES

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. Receptacles, receptacles with integral GFCI, and associated device plates.
 - 2. Snap switches and wall-box dimmers.
 - 3. Floor service outlets, poke-through assemblies, service poles, and multioutlet assemblies.

1.3 DEFINITIONS

- A. EMI: Electromagnetic interference.
- B. GFCI: Ground-fault circuit interrupter.
- C. Pigtail: Short lead used to connect a device to a branch-circuit conductor.
- D. RFI: Radio-frequency interference.
- E. TVSS: Transient voltage surge suppressor.
- F. UTP: Unshielded twisted pair.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: List of legends and description of materials and process used for premarking wall plates.

1.5 INFORMATIONAL SUBMITTALS

A. Field quality-control test reports.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing label warnings and instruction manuals that include labeling conditions.

1.7 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials described in subparagraphs below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Floor Service Outlet Assemblies: One for every 10, but no fewer than one.

1.8 QUALITY ASSURANCE

- A. Source Limitations: Obtain each type of wiring device and associated wall plate through one source from a single manufacturer. Insofar as they are available, obtain all wiring devices and associated wall plates from a single manufacturer and one source.
- 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. Comply with NFPA 70.

1.9 COORDINATION

A. Receptacles for Owner-Furnished Equipment: Match plug configurations.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers' Names: Shortened versions (shown in parentheses) of the following manufacturers' names are used in other Part 2 articles:
 - 1. Cooper Wiring Devices; a division of Cooper Industries, Inc. (Cooper).
 - 2. Hubbell Incorporated; Wiring Device-Kellems (Hubbell).
 - 3. Leviton Mfg. Company Inc. (Leviton).
 - 4. Pass & Seymour/Legrand; Wiring Devices & Accessories (Pass & Seymour).

2.2 STRAIGHT BLADE RECEPTACLES

- A. Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498.
 - 1. Products: Subject to compliance with requirements, provide one of the following:

- a. Cooper.
- b. Hubbell.
- c. Leviton.
- d. Pass & Seymour.

2.3 GFCI RECEPTACLES

- A. General Description: Straight blade, non-feed-through type. Comply with NEMA WD 1, NEMA WD 6, UL 498, and UL 943, Class A, and include indicator light that is lighted when device is tripped.
- B. Duplex GFCI Convenience Receptacles, 125 V, 20 A:
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Cooper.
 - b. Pass & Seymour.

2.4 SNAP SWITCHES

- A. Comply with NEMA WD 1 and UL 20.
- B. Key-Operated Switches, 120/277 V, 20 A:
 - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - 2. Products: Subject to compliance with requirements, provide one of the following:
 - a. Cooper; 2221L.
 - b. Hubbell; HBL1221L.
 - c. Leviton; 1221-2L.
 - d. Pass & Seymour; PS20AC1-L.
 - 3. Description: Single pole, with factory-supplied key in lieu of switch handle.

2.5 WALL PLATES

- A. Single and combination types to match corresponding wiring devices.
 - 1. Plate-Securing Screws: Metal with head color to match plate finish.
 - 2. Material for Finished Spaces: Smooth, high-impact thermoplastic.
 - 3. Material for Unfinished Spaces: Galvanized steel.
 - 4. Material for Damp Locations: Thermoplastic with spring-loaded lift cover, and listed and labeled for use in "wet locations."
- B. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with type 3R weatherresistant thermoplastic with lockable cover.

2.6 FINISHES

- A. Color: Wiring device catalog numbers in Section Text do not designate device color.
 - 1. Wiring Devices: As selected by Architect, unless otherwise indicated or required by NFPA 70 or device listing.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with NECA 1, including the mounting heights listed in that standard, unless otherwise noted.
- B. Coordination with Other Trades:
 - 1. Take steps to insure that devices and their boxes are protected. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of the boxes.
 - 2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
 - 3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
 - 4. Install wiring devices after all wall preparation, including painting, is complete.
- C. Conductors:
 - 1. Do not strip insulation from conductors until just before they are spliced or terminated on devices.
 - 2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
 - 3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
- D. Device Installation:
 - 1. Replace all devices that have been in temporary use during construction or that show signs that they were installed before building finishing operations were complete.
 - 2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
 - 3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
 - 4. Connect devices to branch circuits using pigtails that are not less than 6 inches in length.
 - 5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, 2/3 to 3/4 of the way around terminal screw.
 - 6. Use a torque screwdriver when a torque is recommended or required by the manufacturer.
 - 7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.

- 8. Tighten unused terminal screws on the device.
- 9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device mounting screws in yokes, allowing metal-to-metal contact.
- E. Receptacle Orientation:
 - 1. Install ground pin of vertically mounted receptacles down, and on horizontally mounted receptacles to the left.
- F. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.
- G. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical. Group adjacent switches under single, multigang wall plates.

3.2 IDENTIFICATION

- A. Comply with Division 26 Section "Identification for Electrical Systems."
 - 1. Receptacles: Identify panelboard and circuit number from which served. Use hot, stamped or engraved machine printing with black-filled lettering on face of plate, and durable wire markers or tags inside outlet boxes.

3.3 FIELD QUALITY CONTROL

- A. Perform tests and inspections and prepare test reports.
 - 1. Test Instruments: Use instruments that comply with UL 1436.
 - 2. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated LED indicators of measurement.
- B. Tests for Convenience Receptacles:
 - 1. Line Voltage: Acceptable range is 105 to 132 V.
 - 2. Percent Voltage Drop under 15-A Load: A value of 5 percent or higher is not acceptable.
 - 3. Ground Impedance: Values of up to 2 ohms are acceptable.
 - 4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
 - 5. Using the test plug, verify that the device and its outlet box are securely mounted.
 - 6. The tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.

END OF SECTION 262726

SECTION 262813 - FUSES

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. Cartridge fuses rated 600-V ac and less for use in control circuits, enclosed switches enclosed controllers and motor-control centers.
 - 2. Spare-fuse cabinets.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material, dimensions, descriptions of individual components, and finishes for spare-fuse cabinets. Include the following for each fuse type indicated:
 - 1. Ambient Temperature Adjustment Information: If ratings of fuses have been adjusted to accommodate ambient temperatures, provide list of fuses with adjusted ratings.
 - a. For each fuse having adjusted ratings, include location of fuse, original fuse rating, local ambient temperature, and adjusted fuse rating.
 - b. Provide manufacturer's technical data on which ambient temperature adjustment calculations are based.
 - 2. Dimensions and manufacturer's technical data on features, performance, electrical characteristics, and ratings.
 - 3. Current-limitation curves for fuses with current-limiting characteristics.
 - 4. Time-current coordination curves (average melt) and current-limitation curves (instantaneous peak let-through current) for each type and rating of fuse.
 - 5. Coordination charts and tables and related data.
 - 6. Fuse sizes for elevator feeders and elevator disconnect switches.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For fuses to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:
 - 1. Ambient temperature adjustment information.

- 2. Current-limitation curves for fuses with current-limiting characteristics.
- 3. Time-current coordination curves (average melt) and current-limitation curves (instantaneous peak let-through current) for each type and rating of fuse.
- 4. Coordination charts and tables and related data.

1.5 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than two of each size and type.

1.6 QUALITY ASSURANCE

- A. Source Limitations: Obtain fuses, for use within a specific product or circuit, from single source from single manufacturer.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. Comply with NEMA FU 1 for cartridge fuses.
- D. Comply with NFPA 70.

1.7 PROJECT CONDITIONS

A. Where ambient temperature to which fuses are directly exposed is less than 40 deg F or more than 100 deg F, apply manufacturer's ambient temperature adjustment factors to fuse ratings.

1.8 COORDINATION

A. Coordinate fuse ratings with utilization equipment nameplate limitations of maximum fuse size and with system short-circuit current levels.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Cooper Bussmann, Inc.
 - 2. Edison Fuse, Inc.
 - 3. Ferraz Shawmut, Inc.
 - 4. Littelfuse, Inc.

2.2 CARTRIDGE FUSES

A. Characteristics: NEMA FU 1, nonrenewable cartridge fuses with voltage ratings consistent with circuit voltages.

2.3 SPARE-FUSE CABINET

- A. Characteristics: Wall-mounted steel unit with full-length, recessed piano-hinged door and keycoded cam lock and pull.
 - 1. Size: Adequate for storage of spare fuses specified with 15 percent spare capacity minimum.
 - 2. Finish: Gray, baked enamel.
 - 3. Identification: "SPARE FUSES" in 1-1/2-inch-high letters on exterior of door.
 - 4. Fuse Pullers: For each size of fuse, where applicable and available, from fuse manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine fuses before installation. Reject fuses that are moisture damaged or physically damaged.
- B. Examine holders to receive fuses for compliance with installation tolerances and other conditions affecting performance, such as rejection features.
- C. Examine utilization equipment nameplates and installation instructions. Install fuses of sizes and with characteristics appropriate for each piece of equipment.
- D. Evaluate ambient temperatures to determine if fuse rating adjustment factors must be applied to fuse ratings.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 FUSE APPLICATIONS

- A. Cartridge Fuses:
 - 1. Service Entrance: Class J, time delay, dual element.
 - 2. Feeders: Class J, time delay.
 - 3. Motor Branch Circuits: Class RK5, time delay.
 - 4. Other Branch Circuits: Class J, time delay.
 - 5. Control Circuits: Class CC, time delay.

3.3 INSTALLATION

- A. Install fuses in fusible devices. Arrange fuses so rating information is readable without removing fuse.
- B. Install spare-fuse cabinet(s).

3.4 IDENTIFICATION

A. Install labels complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems" and indicating fuse replacement information on inside door of each fused switch and adjacent to each fuse block, socket, and holder.

END OF SECTION 262813

SECTION 262816 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Fusible switches.
 - 2. Nonfusible switches.
 - 3. Molded-case circuit breakers (MCCBs).
 - 4. Molded-case switches.
 - 5. Enclosures.

1.3 DEFINITIONS

- A. NC: Normally closed.
- B. NO: Normally open.
- C. SPDT: Single pole, double throw.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.
 - 1. Enclosure types and details for types other than NEMA 250, Type 1.
 - 2. Current and voltage ratings.
 - 3. Short-circuit current ratings (interrupting and withstand, as appropriate).
 - 4. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices, accessories, and auxiliary components.
 - 5. Include time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device.
- B. Shop Drawings: For enclosed switches and circuit breakers. Include plans, elevations, sections, details, and attachments to other work.
 - 1. Wiring Diagrams: For power, signal, and control wiring.

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1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified testing agency.
- B. Field quality-control reports.
 - 1. Test procedures used.
 - 2. Test results that comply with requirements.
 - 3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.
- C. Manufacturer's field service report.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For enclosed switches and circuit breakers to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:
 - 1. Manufacturer's written instructions for testing and adjusting enclosed switches and circuit breakers.
 - 2. Time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device.

1.7 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.
 - 2. Fuse Pullers: Two for each size and type.

1.8 QUALITY ASSURANCE

- A. Source Limitations: Obtain enclosed switches and circuit breakers, overcurrent protective devices, components, and accessories, within same product category, from single source from single manufacturer.
- B. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed switches and circuit breakers, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- D. Comply with NFPA 70.

1.9 PROJECT CONDITIONS

- A. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:
 - 1. Ambient Temperature: Not less than minus 22 deg F and not exceeding 104 deg F.
 - 2. Altitude: Not exceeding 6600 feet.

1.10 COORDINATION

A. Coordinate layout and installation of switches, circuit breakers, and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

PART 2 - PRODUCTS

2.1 FUSIBLE SWITCHES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
 - 2. General Electric Company; GE Consumer & Industrial Electrical Distribution.
 - 3. Square D; a brand of Schneider Electric.
- B. Type GD, General Duty, Single Throw, 600-V ac, 800 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with cartridge fuse interiors to accommodate indicated fuses, lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.
- C. Accessories:
 - 1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
 - 2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
 - 3. Auxiliary Contact Kit: One NO/NC (Form "C") auxiliary contact(s), arranged to activate before switch blades open.
 - 4. Hookstick Handle: Allows use of a hookstick to operate the handle.
 - 5. Lugs: Mechanical type, suitable for number, size, and conductor material.
 - 6. Service-Rated Switches: Labeled for use as service equipment.

2.2 ENCLOSURES

- A. Enclosed Switches and Circuit Breakers: NEMA AB 1, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.
 - 1. Indoor, Dry and Clean Locations: NEMA 250, Type 1.

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- 2. Outdoor Locations: NEMA 250, Type 3R.
- 3. Other Wet or Damp, Indoor Locations: NEMA 250, Type 4.
- 4. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: NEMA 250, Type 12.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.
- B. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.
- C. Install fuses in fusible devices.
- D. Comply with NECA 1.

3.3 IDENTIFICATION

- A. Comply with requirements in Division 26 Section "Identification for Electrical Systems."
 - 1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
 - 2. Label each enclosure with engraved metal or laminated-plastic nameplate.

3.4 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
 - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- B. Acceptance Testing Preparation:
 - 1. Test insulation resistance for each enclosed switch and circuit breaker, component, connecting supply, feeder, and control circuit.
 - 2. Test continuity of each circuit.

- C. Tests and Inspections:
 - 1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
 - 2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
 - 3. Perform the following infrared scan tests and inspections and prepare reports:
 - a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each enclosed switch and circuit breaker. Remove front panels so joints and connections are accessible to portable scanner.
 - b. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each enclosed switch and circuit breaker 11 months after date of Substantial Completion.
 - c. Instruments and Equipment: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
 - 4. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.
- D. Enclosed switches and circuit breakers will be considered defective if they do not pass tests and inspections.
- E. Prepare test and inspection reports, including a certified report that identifies enclosed switches and circuit breakers and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.5 ADJUSTING

A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.

END OF SECTION 262816

SECTION 265100 - INTERIOR LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Interior lighting fixtures, lamps, and ballasts.
 - 2. Emergency lighting units.
 - 3. Exit signs.
 - 4. Lighting fixture supports.
- B. Related Sections:
 - 1. Division 26 Section "Lighting Control Devices" for automatic control of lighting, including time switches, photoelectric relays, occupancy sensors, and multipole lighting relays and contactors.
 - 2. Division 26 Section "Wiring Devices" for manual wall-box dimmers for incandescent lamps.

1.3 DEFINITIONS

- A. BF: Ballast factor.
- B. CCT: Correlated color temperature.
- C. CRI: Color-rendering index.
- D. HID: High-intensity discharge.
- E. LER: Luminaire efficacy rating.
- F. Lumen: Measured output of lamp and luminaire, or both.
- G. Luminaire: Complete lighting fixture, including ballast housing if provided.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of lighting fixture, arranged in order of fixture designation. Include data on features, accessories, finishes, and the following:

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- 1. Physical description of lighting fixture including dimensions.
- 2. Emergency lighting units including battery and charger.
- 3. Ballast, including BF.
- 4. Energy-efficiency data.
- 5. Life, output (lumens, CCT, and CRI), and energy-efficiency data for lamps.
- 6. Photometric data and adjustment factors based on laboratory tests, complying with IESNA Lighting Measurements Testing & Calculation Guides, of each lighting fixture type. The adjustment factors shall be for lamps, ballasts, and accessories identical to those indicated for the lighting fixture as applied in this Project.
 - a. Manufacturer Certified Data: Photometric data shall be certified by a manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
 - 1. Wiring Diagrams: For power, signal, and control wiring.
- C. Installation instructions.

1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Reflected ceiling plan(s) and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
 - 1. Lighting fixtures.
 - 2. Suspended ceiling components.
 - 3. Partitions and millwork that penetrate the ceiling or extends to within 12 inches of the plane of the luminaires.
 - 4. Ceiling-mounted projectors.
 - 5. Structural members to which suspension systems for lighting fixtures will be attached.
 - 6. Other items in finished ceiling including the following:
 - a. Air outlets and inlets.
 - b. Speakers.
 - c. Sprinklers.
 - d. Smoke and fire detectors.
 - e. Occupancy sensors.
 - f. Access panels.
 - 7. Perimeter moldings.
- B. Qualification Data: For qualified agencies providing photometric data for lighting fixtures.
- C. Product Certificates: For each type of ballast for bi-level and dimmer-controlled fixtures, from manufacturer.
- D. Warranty: Sample of special warranty.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For lighting equipment and fixtures to include in emergency, operation, and maintenance manuals.
 - 1. Provide a list of all lamp types used on Project; use ANSI and manufacturers' codes.

1.7 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Lamps: 10 for every 100 of each type and rating installed. Furnish at least one of each type.
 - 2. Plastic Diffusers and Lenses: One for every 100 of each type and rating installed. Furnish at least one of each type.
 - 3. Fluorescent-fixture-mounted, emergency battery pack: One for every 20 emergency lighting unit.
 - 4. Ballasts: One for every 100 of each type and rating installed. Furnish at least one of each type.
 - 5. Globes and Guards: One for every 20 of each type and rating installed. Furnish at least one of each type.

1.8 QUALITY ASSURANCE

- A. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by manufacturers' laboratories that are accredited under the National Volunteer Laboratory Accreditation Program for Energy Efficient Lighting Products.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. Comply with NFPA 70.

1.9 COORDINATION

A. Coordinate layout and installation of lighting fixtures and suspension system with other construction that penetrates ceilings or is supported by them, including HVAC equipment, fire-suppression system, and partition assemblies.

1.10 WARRANTY

A. Special Warranty for Emergency Lighting Batteries: Manufacturer's standard form in which manufacturer of battery-powered emergency lighting unit agrees to repair or replace components of rechargeable batteries that fail in materials or workmanship within specified warranty period.

- 1. Warranty Period for Emergency Lighting Unit Batteries: 10 years from date of Substantial Completion. Full warranty shall apply for first year, and prorated warranty for the remaining nine years.
- 2. Warranty Period for Emergency Fluorescent Ballast and Self-Powered Exit Sign Batteries: Seven years from date of Substantial Completion. Full warranty shall apply for first year, and prorated warranty for the remaining six years.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide product indicated on Drawings.

2.2 GENERAL REQUIREMENTS FOR LIGHTING FIXTURES AND COMPONENTS

- A. Recessed Fixtures: Comply with NEMA LE 4 for ceiling compatibility for recessed fixtures.
- B. Incandescent Fixtures: Comply with UL 1598. Where LER is specified, test according to NEMA LE 5A.
- C. Fluorescent Fixtures: Comply with UL 1598. Where LER is specified, test according to NEMA LE 5 and NEMA LE 5A as applicable.
- D. Metal Parts: Free of burrs and sharp corners and edges.
- E. Sheet Metal Components: Steel unless otherwise indicated. Form and support to prevent warping and sagging.
- F. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.
- G. Diffusers and Globes:
 - 1. Acrylic Lighting Diffusers: 100 percent virgin acrylic plastic. High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
 - a. Lens Thickness: At least 0.125 inch minimum unless otherwise indicated.
 - b. UV stabilized.
 - 2. Glass: Annealed crystal glass unless otherwise indicated.
- H. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps and ballasts. Labels shall be located where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.
 - 1. Label shall include the following lamp and ballast characteristics:

- a. "USE ONLY" and include specific lamp type.
- b. Lamp diameter code (T-4, T-5, T-8, T-12, etc.), tube configuration (twin, quad, triple, etc.), base type, and nominal wattage for fluorescent and compact fluorescent luminaires.
- c. Lamp type, wattage, bulb type (ED17, BD56, etc.) and coating (clear or coated) for HID luminaires.
- d. Start type (preheat, rapid start, instant start, etc.) for fluorescent and compact fluorescent luminaires.
- e. ANSI ballast type (M98, M57, etc.) for HID luminaires.
- f. CCT and CRI for all luminaires.
- I. Electromagnetic-Interference Filters: Factory installed to suppress conducted electromagnetic interference as required by MIL-STD-461E. Fabricate lighting fixtures with one filter on each ballast indicated to require a filter.

2.3 BALLASTS FOR LINEAR FLUORESCENT LAMPS

- A. General Requirements for Electronic Ballasts:
 - 1. Comply with UL 935 and with ANSI C82.11.
 - 2. Designed for type and quantity of lamps served.
 - 3. Ballasts shall be designed for full light output unless another BF, dimmer, or bi-level control is indicated.
 - 4. Sound Rating: Class A.
 - 5. Total Harmonic Distortion Rating: Less than 10 percent.
 - 6. Transient Voltage Protection: IEEE C62.41.1 and IEEE C62.41.2, Category A or better.
 - 7. Operating Frequency: 42 kHz or higher.
 - 8. Lamp Current Crest Factor: 1.7 or less.
 - 9. BF: 0.88 or higher.
 - 10. Power Factor: 0.98 or higher.
 - 11. Parallel Lamp Circuits: Multiple lamp ballasts shall comply with ANSI C82.11 and shall be connected to maintain full light output on surviving lamps if one or more lamps fail.
- B. Luminaires controlled by occupancy sensors shall have programmed-start ballasts.
- C. Electronic Programmed-Start Ballasts for T5 and T8 Lamps: Comply with ANSI C82.11 and the following:
 - 1. Lamp end-of-life detection and shutdown circuit for T5 diameter lamps.
 - 2. Automatic lamp starting after lamp replacement.
- D. Ballasts for Low Electromagnetic-Interference Environments: Comply with 47 CFR 18, Ch. 1, Subpart C, for limitations on electromagnetic and radio-frequency interference for consumer equipment.
- E. Ballasts for Dimmer-Controlled Lighting Fixtures: Electronic type.
 - 1. Dimming Range: 100 to 10 percent of rated lamp lumens.
 - 2. Ballast Input Watts: Can be reduced to 20 percent of normal.

- 3. Compatibility: Certified by manufacturer for use with specific dimming control system and lamp type indicated.
- 4. Control: Coordinate wiring from ballast to control device to ensure that the ballast, controller, and connecting wiring are compatible.
- F. Ballasts for Bi-Level Controlled Lighting Fixtures: Electronic type.
 - 1. Operating Modes: Ballast circuit and leads provide for remote control of the light output of the associated lamp between high- and low-level and off.
 - a. High-Level Operation: 100 percent of rated lamp lumens.
 - b. Low-Level Operation: 40 percent of rated lamp lumens. (+/- 10%)
 - 2. Ballast shall provide equal current to each lamp in each operating mode.
 - 3. Compatibility: Certified by manufacturer for use with specific bi-level control system and lamp type indicated.

2.4 EXIT SIGNS

- A. General Requirements for Exit Signs: Comply with UL 924; for sign colors, visibility, luminance, and lettering size, comply with authorities having jurisdiction.
- B. Internally Lighted Signs:
 - 1. Self-Powered Exit Signs (Battery Type): Integral automatic charger in a self-contained power pack.
 - a. Battery: Sealed, maintenance-free, nickel-cadmium type.
 - b. Charger: Fully automatic, solid-state type with sealed transfer relay.
 - c. Operation: Relay automatically energizes lamp from battery when circuit voltage drops to 80 percent of nominal voltage or below. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
 - d. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
 - e. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.

2.5 FLUORESCENT LAMPS

- A. T8 rapid-start lamps, rated 32 W maximum, nominal length of 48 inches, 2800 initial lumens (minimum), CRI 75 (minimum), color temperature 3500 K, and average rated life 20,000 hours unless otherwise indicated.
- B. T8 rapid-start lamps, rated 17 W maximum, nominal length of 24 inches, 1300 initial lumens (minimum), CRI 75 (minimum), color temperature 3500 K, and average rated life of 20,000 hours unless otherwise indicated.

2.6 LIGHTING FIXTURE SUPPORT COMPONENTS

- A. Comply with Division 26 Section "Hangers and Supports for Electrical Systems" for channeland angle-iron supports and nonmetallic channel and angle supports.
- B. Single-Stem Hangers: 1/2-inch steel tubing with swivel ball fittings and ceiling canopy. Finish same as fixture.
- C. Twin-Stem Hangers: Two, 1/2-inch steel tubes with single canopy designed to mount a single fixture. Finish same as fixture.
- D. Wires: ASTM A 641/A 641M, Class 3, soft temper, zinc-coated steel, 12 gage.
- E. Wires for Humid Spaces: ASTM A 580/A 580M, Composition 302 or 304, annealed stainless steel, 12 gage.
- F. Rod Hangers: 3/16-inch minimum diameter, cadmium-plated, threaded steel rod.
- G. Hook Hangers: Integrated assembly matched to fixture and line voltage and equipped with threaded attachment, cord, and locking-type plug.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Lighting fixtures:
 - 1. Set level, plumb, and square with ceilings and walls unless otherwise indicated.
 - 2. Install lamps in each luminaire.
- B. Temporary Lighting: If it is necessary, and approved by Architect, to use permanent luminaires for temporary lighting, install and energize the minimum number of luminaires necessary. When construction is sufficiently complete, remove the temporary luminaires, disassemble, clean thoroughly, install new lamps, and reinstall.
- C. Lay-in Ceiling Lighting Fixtures Supports: Use grid as a support element.
 - 1. Install four ceiling support system rods or wires, independent of the ceiling suspension devices, for each 2' x 4' and 2' x 2' fixture. Locate not more than 6 inches from lighting fixture corners.
 - 2. Support Clips: Fasten to lighting fixtures and to ceiling grid members at or near each fixture corner with clips that are UL listed for the application.
 - 3. Fixtures of Sizes Less Than Ceiling Grid: Install as indicated on reflected ceiling plans or center in acoustical panel, and support fixtures independently with at least two 3/4-inch metal channels spanning and secured to ceiling tees.
 - 4. Install at least one independent support rod or wire from structure to a tab on lighting fixture. Wire or rod shall have breaking strength of the weight of fixture at a safety factor of 3.
- D. Suspended Lighting Fixture Support:

- 1. Pendants and Rods: Where longer than 48 inches, brace to limit swinging.
- 2. Stem-Mounted, Single-Unit Fixtures: Suspend with twin-stem hangers.
- 3. Continuous Rows: Use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of fixture chassis, including one at each end.
- 4. Do not use grid as support for pendant luminaires. Connect support wires or rods to building structure.
- E. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.2 IDENTIFICATION

A. Install labels with panel and circuit numbers on concealed junction and outlet boxes. Comply with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

3.3 FIELD QUALITY CONTROL

- A. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery and retransfer to normal.
- B. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

3.4 STARTUP SERVICE

A. Burn-in all lamps that require specific aging period to operate properly, prior to occupancy by Owner. Burn-in fluorescent and compact fluorescent lamps intended to be dimmed, for at least 100 hours at full voltage.

3.5 ADJUSTING

- A. Occupancy Adjustments: When requested within 2 months of date of Substantial Completion, provide on-site assistance in adjusting aimable luminaires to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose. Some of this work may be required after dark.
 - 1. Adjust aimable luminaires in the presence of Architect.

END OF SECTION 265100

SECTION 283111 - DIGITAL, ADDRESSABLE FIRE-ALARM SYSTEM

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-alarm control unit.
 - 2. Manual fire-alarm boxes.
 - 3. System smoke detectors.
 - 4. Heat detectors.
 - 5. Notification appliances.
 - 6. Magnetic door holders.
 - 7. Remote annunciator.
 - 8. Addressable interface device.
 - 9. Digital alarm communicator transmitter.

1.3 DEFINITIONS

- A. LED: Light-emitting diode.
- B. NICET: National Institute for Certification in Engineering Technologies.

1.4 SYSTEM DESCRIPTION

A. Existing noncoded, UL-certified addressable system, with multiplexed signal transmission, dedicated to fire-alarm service only, to be expanded to cover tenant fit out area or second floor.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For fire-alarm system. Include plans, elevations, sections, details, and attachments to other work.
 - 1. Comply with recommendations in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter in NFPA 72.
 - 2. Include voltage drop calculations for notification appliance circuits.
 - 3. Include battery-size calculations.

- 4. Include performance parameters and installation details for each detector, verifying that each detector is listed for complete range of air velocity, temperature, and humidity possible when air-handling system is operating.
- 5. Include plans, sections, and elevations of heating, ventilating, and air-conditioning ducts, drawn to scale and coordinating installation of duct smoke detectors and access to them. Show critical dimensions that relate to placement and support of sampling tubes, detector housing, and remote status and alarm indicators. Locate detectors according to manufacturer's written recommendations.
- 6. Include voice/alarm signaling-service equipment rack or console layout, grounding schematic, amplifier power calculation, and single-line connection diagram.
- 7. Include floor plans to indicate final outlet locations showing address of each addressable device. Show size and route of cable and conduits.
- C. General Submittal Requirements:
 - 1. Submittals shall be approved by authorities having jurisdiction prior to submitting them to Architect.
 - 2. Shop Drawings shall be prepared by persons with the following qualifications:
 - a. Trained and certified by manufacturer in fire-alarm system design.
 - b. NICET-certified fire-alarm technician, Level III minimum.
 - c. Licensed or certified by authorities having jurisdiction.
- D. Qualification Data: For qualified Installer.
- E. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For fire-alarm systems and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," deliver copies to authorities having jurisdiction and include the following:
 - 1. Comply with the "Records" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.
 - 2. Provide "Record of Completion Documents" according to NFPA 72 article "Permanent Records" in the "Records" Section of the "Inspection, Testing and Maintenance" Chapter.
 - 3. Record copy of site-specific software.
 - 4. Provide "Maintenance, Inspection and Testing Records" according to NFPA 72 article of the same name and include the following:
 - a. Frequency of testing of installed components.
 - b. Frequency of inspection of installed components.
 - c. Requirements and recommendations related to results of maintenance.
 - d. Manufacturer's user training manuals.

- 5. Manufacturer's required maintenance related to system warranty requirements.
- 6. Abbreviated operating instructions for mounting at fire-alarm control unit.
- B. Software and Firmware Operational Documentation:
 - 1. Software operating and upgrade manuals.
 - 2. Program Software Backup: On magnetic media or compact disk, complete with data files.
 - 3. Device address list.
 - 4. Printout of software application and graphic screens.

1.7 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Lamps for Remote Indicating Lamp Units: Quantity equal to 10 percent of amount installed, but no fewer than 1 unit.
 - 2. Lamps for Strobe Units: Quantity equal to 10 percent of amount installed, but no fewer than 1 unit.
 - 3. Smoke Detectors, Fire Detectors: Quantity equal to 10 percent of amount of each type installed, but no fewer than 1 unit of each type.
 - 4. Detector Bases: Quantity equal to 2 percent of amount of each type installed, but no fewer than 1 unit of each type.
 - 5. Keys and Tools: One extra set for access to locked and tamperproofed components.
 - 6. Audible and Visual Notification Appliances: One of each type installed.
 - 7. Fuses: Two of each type installed in the system.

1.8 QUALITY ASSURANCE

- A. Installer Qualifications: Personnel shall be trained and certified by manufacturer for installation of units required for this Project.
- B. Installer Qualifications: Installation shall be by personnel certified by NICET as fire-alarm Level II technician and licensed in the State of Florida.
- C. Source Limitations for Fire-Alarm System and Components: Obtain fire-alarm system from single source from single manufacturer. Components shall be compatible with, and operate as, an extension of existing system.
- D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- E. NFPA Certification: Obtain certification according to NFPA 72 by a UL-listed alarm company.

1.9 SOFTWARE SERVICE AGREEMENT

- A. Comply with UL 864.
- B. Technical Support: Beginning with Substantial Completion, provide software support for two years.
- C. Upgrade Service: Update software to latest version at Project completion. Install and program software upgrades that become available within two years from date of Substantial Completion. Upgrading software shall include operating system. Upgrade shall include new or revised licenses for use of software.
 - 1. Provide 30 days' notice to Owner to allow scheduling and access to system and to allow Owner to upgrade computer equipment if necessary.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Match existing system.

2.2 SYSTEMS OPERATIONAL DESCRIPTION

- A. Fire-alarm signal initiation shall be by one or more of the following devices and systems:
 - 1. Manual stations.
 - 2. Heat detectors.
 - 3. Smoke detectors.
 - 4. Duct smoke detectors.
 - 5. Verified automatic alarm operation of smoke detectors.
 - 6. Automatic sprinkler system water flow.
 - 7. Heat detectors in elevator shaft and pit.
 - 8. Fire standpipe system.
- B. Fire-alarm signal shall initiate the following actions:
 - 1. Continuously operate alarm notification appliances.
 - 2. Identify alarm at fire-alarm control unit and remote annunciators.
 - 3. Transmit an alarm signal to the remote alarm receiving station.
 - 4. Unlock electric door locks in designated egress paths.
 - 5. Release fire and smoke doors held open by magnetic door holders.
 - 6. Activate voice/alarm communication system.
 - 7. Switch heating, ventilating, and air-conditioning equipment controls to fire-alarm mode.
 - 8. Activate smoke-control system (smoke management) at firefighter smoke-control system panel.
 - 9. Activate stairwell and elevator-shaft pressurization systems.
 - 10. Close smoke dampers in air ducts of designated air-conditioning duct systems.
 - 11. Recall elevators to primary or alternate recall floors.

- 12. Record events in the system memory.
- C. Supervisory signal initiation shall be by one or more of the following devices and actions:
 - 1. Valve supervisory switch.
 - 2. Elevator shunt-trip supervision.
- D. System trouble signal initiation shall be by one or more of the following devices and actions:
 - 1. Open circuits, shorts, and grounds in designated circuits.
 - 2. Opening, tampering with, or removing alarm-initiating and supervisory signal-initiating devices.
 - 3. Loss of primary power at fire-alarm control unit.
 - 4. Ground or a single break in fire-alarm control unit internal circuits.
 - 5. Abnormal ac voltage at fire-alarm control unit.
 - 6. Break in standby battery circuitry.
 - 7. Failure of battery charging.
 - 8. Abnormal position of any switch at fire-alarm control unit or annunciator.
- E. System Trouble and Supervisory Signal Actions: Initiate notification appliance and annunciate at fire-alarm control unit and remote annunciators.

2.3 SYSTEM CHARACTERISTICS

- A. Circuits:
 - 1. Initiating Device, Notification Appliance, and Signaling Line Circuits: NFPA 72, Class A.
 - a. Initiating Device Circuits: Style E.
 - b. Notification Appliance Circuits: Style Z.
 - c. Signaling Line Circuits: Style 6.
 - d. Install no more than 50 addressable devices on each signaling line circuit.
 - 2. Serial Interfaces: Two RS-232 or USB ports for printers.
- B. Smoke-Alarm Verification:
 - 1. Initiate audible and visible indication of an "alarm-verification" signal at fire-alarm control unit.
 - 2. Activate an NRTL-listed and -approved "alarm-verification" sequence at fire-alarm control unit and detector.
 - 3. Sound general alarm if the alarm is verified.
 - 4. Cancel fire-alarm control unit indication and system reset if the alarm is not verified.
- C. Elevator Recall:
 - 1. Smoke detectors at the following locations shall initiate automatic elevator recall.
 - a. Elevator lobby detectors except the lobby detector on the designated floor.
 - b. Smoke detector in elevator machine room.

- c. Smoke detectors in elevator hoistway.
- 2. Elevator lobby detectors located on the designated recall floors shall be programmed to move the cars to the alternate recall floor.
- 3. Water-flow alarm connected to sprinkler in an elevator shaft and elevator machine room shall shut down elevators associated with the location without time delay.
 - a. Water-flow switch associated with the sprinkler in the elevator pit may have a delay to allow elevators to move to the designated floor.
- D. Door Controls: Door hold-open devices that are controlled by smoke detectors at doors in smoke barrier walls shall be connected to fire-alarm system.
- E. Transmission to Remote Alarm Receiving Station: Automatically transmit alarm, supervisory, and trouble signals to a remote alarm station.
- F. Log of Events: On receipt of signal, log alarm, supervisory, and trouble events. Identify zone, device, and function. Include type of signal (alarm, supervisory, or trouble) and date and time of occurrence. Differentiate alarm signals from all other logged indications. Also log system reset event, including same information for device, location, date, and time.
- G. Primary Power: 24-V dc obtained from 120-V ac service and a power-supply module. Initiating devices, notification appliances, signaling lines, trouble signals, supervisory and digital alarm communicator transmitters shall be powered by 24-V dc source.
 - 1. Alarm current draw of entire fire-alarm system shall not exceed 80 percent of the powersupply module rating.
- H. Secondary Power: 24-V dc supply system with batteries, automatic battery charger, and automatic transfer switch.
 - 1. Batteries: Sealed lead calcium, as required to existing system.
- I. Instructions: Computer printout or typewritten instruction card mounted behind a plastic or glass cover in a stainless-steel or aluminum frame. Include interpretation and describe appropriate response for displays and signals. Briefly describe the functional operation of the system under normal, alarm, and trouble conditions.

2.4 MANUAL FIRE-ALARM BOXES

- A. General Requirements for Manual Fire-Alarm Boxes: Comply with UL 38. Boxes shall be finished in red with molded, raised-letter operating instructions in contrasting color; shall show visible indication of operation; and shall be mounted on recessed outlet box. If indicated as surface mounted, provide manufacturer's surface back box.
 - 1. Double-action mechanism requiring two actions to initiate an alarm, pull-lever type; with integral addressable module arranged to communicate manual-station status (normal, alarm, or trouble) to fire-alarm control unit.
 - 2. Station Reset: Key- or wrench-operated switch.

3. Weatherproof Protective Shield: Factory-fabricated clear plastic enclosure hinged at the top to permit lifting for access to initiate an alarm.

2.5 SYSTEM SMOKE DETECTORS

- A. General Requirements for System Smoke Detectors:
 - 1. Comply with UL 268; operating at 24-V dc, nominal.
 - 2. Detectors shall be two-wire type, four where required for auxiliary operations.
 - 3. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.
 - 4. Base Mounting: Detector and associated electronic components shall be mounted in a twist-lock module that connects to a fixed base. Provide terminals in the fixed base for connection to building wiring.
 - 5. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.
 - 6. Integral Visual-Indicating Light: LED type indicating detector has operated and poweron status.
- B. Photoelectric Smoke Detectors:
 - 1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
 - 2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:
 - a. Primary status.
 - b. Device type.
 - c. Present average value.
 - d. Present sensitivity selected.
 - e. Sensor range (normal, dirty, etc.).
- C. Duct Smoke Detectors: Photoelectric type complying with UL 268A.
 - 1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
 - 2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:
 - a. Primary status.
 - b. Device type.
 - c. Present average value.
 - d. Present sensitivity selected.
 - e. Sensor range (normal, dirty, etc.).
 - 3. Weatherproof Duct Housing Enclosure: NEMA 250, Type 4X; NRTL listed for use with the supplied detector.
 - 4. Each sensor shall have multiple levels of detection sensitivity.
 - 5. Sampling Tubes: Design and dimensions as recommended by manufacturer for specific duct size, air velocity, and installation conditions where applied.

6. Relay Fan Shutdown: Rated to interrupt fan motor-control circuit.

2.6 HEAT DETECTORS

- A. General Requirements for Heat Detectors: Comply with UL 521.
- B. Heat Detector, Combination Type: Actuated by either a fixed temperature of 135 deg F or a rate of rise that exceeds 15 deg F per minute unless otherwise indicated.
 - 1. Mounting: Twist-lock base interchangeable with smoke-detector bases.
 - 2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.

2.7 NOTIFICATION APPLIANCES

- A. General Requirements for Notification Appliances: Connected to notification appliance signal circuits, zoned as indicated, equipped for mounting as indicated and with screw terminals for system connections.
 - 1. Combination Devices: Factory-integrated audible and visible devices in a singlemounting assembly, equipped for mounting as indicated and with screw terminals for system connections.
- B. Chimes, Low-Level Output: Vibrating type, 75-dBA minimum rated output.
- C. Chimes, High-Level Output: Vibrating type, 81-dBA minimum rated output.
- D. Horns: Electric-vibrating-polarized type, 24-V dc; with provision for housing the operating mechanism behind a grille. Comply with UL 464. Horns shall produce a sound-pressure level of 90 dBA, measured 10 feet from the horn, using the coded signal prescribed in UL 464 test protocol.
- E. Visible Notification Appliances: Xenon strobe lights comply with UL 1971, with clear or nominal white polycarbonate lens mounted on an aluminum faceplate. The word "FIRE" is engraved in minimum 1-inch- high letters on the lens.
 - 1. Rated Light Output:
 - a. 75 cd except where noted otherwise.
 - 2. Mounting: Wall mounted unless otherwise indicated.
 - 3. For units with guards to prevent physical damage, light output ratings shall be determined with guards in place.
 - 4. Flashing shall be in a temporal pattern, synchronized with other units.
 - 5. Strobe Leads: Factory connected to screw terminals.
 - 6. Mounting Faceplate: Factory finished, red.

2.8 MAGNETIC DOOR HOLDERS

- A. Description: Units are equipped for wall or floor mounting as indicated and are complete with matching doorplate.
 - 1. Electromagnet: Requires no more than 3 W to develop 25-lbf holding force.
 - 2. Wall-Mounted Units: Flush mounted unless otherwise indicated.
 - 3. Rating: 24-V ac or dc.
- B. Material and Finish: Match door hardware.

2.9 REMOTE ANNUNCIATOR

- A. Description: Annunciator functions shall match those of fire-alarm control unit for alarm, supervisory, and trouble indications. Manual switching functions shall match those of fire-alarm control unit, including acknowledging, silencing, resetting, and testing.
 - 1. Mounting: Flush cabinet, NEMA 250, Type 1.
- B. Display Type and Functional Performance: Alphanumeric display and LED indicating lights shall match those of fire-alarm control unit. Provide controls to acknowledge, silence, reset, and test functions for alarm, supervisory, and trouble signals.

2.10 ADDRESSABLE INTERFACE DEVICE

- A. Description: Microelectronic monitor module, NRTL listed for use in providing a system address for alarm-initiating devices for wired applications with normally open contacts.
- B. Integral Relay: Capable of providing a direct signal to elevator controller to initiate elevator recall or to circuit-breaker shunt trip for power shutdown.

PART 3 - EXECUTION

3.1 EQUIPMENT INSTALLATION

- A. Comply with NFPA 72 for installation of fire-alarm equipment.
- B. Smoke- or Heat-Detector Spacing:
 - 1. Comply with NFPA 72, "Smoke-Sensing Fire Detectors" Section in the "Initiating Devices" Chapter, for smoke-detector spacing.
 - 2. Comply with NFPA 72, "Heat-Sensing Fire Detectors" Section in the "Initiating Devices" Chapter, for heat-detector spacing.
 - 3. Smooth ceiling spacing shall not exceed 30 feet.
 - 4. Spacing of detectors for irregular areas, for irregular ceiling construction, and for high ceiling areas shall be determined according to Appendix A or Appendix B in NFPA 72.
 - 5. HVAC: Locate detectors not closer than 3 feet from air-supply diffuser or return-air opening.

- 6. Lighting Fixtures: Locate detectors not closer than 12 inches from any part of a lighting fixture.
- C. Duct Smoke Detectors: Comply with NFPA 72 and NFPA 90A. Install sampling tubes so they extend the full width of duct.
- D. Heat Detectors in Elevator Shafts: Coordinate temperature rating and location with sprinkler rating and location.
- E. Remote Status and Alarm Indicators: Install near each smoke detector and each sprinkler waterflow switch and valve-tamper switch that is not readily visible from normal viewing position.
- F. Audible Alarm-Indicating Devices: Install not less than 6 inches below the ceiling. Install bells and horns on flush-mounted back boxes with the device-operating mechanism concealed behind a grille.
- G. Visible Alarm-Indicating Devices: Install adjacent to each alarm bell or alarm horn and at least 6 inches below the ceiling.
- H. Device Location-Indicating Lights: Locate in public space near the device they monitor.
- I. Annunciator: Install with top of panel not more than 72 inches above the finished floor.
- J. All wiring shall be in conduit, $\frac{1}{2}$ inch minimum.

3.2 CONNECTIONS

- A. For fire-protection systems related to doors in fire-rated walls and partitions and to doors in smoke partitions, comply with requirements in Division 08 Section "Door Hardware." Connect hardware and devices to fire-alarm system.
 - 1. Verify that hardware and devices are NRTL listed for use with fire-alarm system in this Section before making connections.
- B. Make addressable connections with a supervised interface device to the following devices and systems. Install the interface device less than 3 feet from the device controlled. Make an addressable confirmation connection when such feedback is available at the device or system being controlled.
 - 1. Smoke dampers in air ducts of designated air-conditioning duct systems.
 - 2. Alarm-initiating connection to elevator recall system and components.
 - 3. Supervisory connections at valve supervisory switches.
 - 4. Supervisory connections at elevator shunt trip breaker.

3.3 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."
- B. Install framed instructions in a location visible from fire-alarm control unit.

3.4 GROUNDING

A. Ground fire-alarm control unit and associated circuits; comply with IEEE 1100. Install a ground wire from main service ground to fire-alarm control unit.

3.5 FIELD QUALITY CONTROL

- A. Field tests shall be witnessed by authorities having jurisdiction.
- B. Perform tests and inspections.
 - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- C. Tests and Inspections:
 - 1. Visual Inspection: Conduct visual inspection prior to testing.
 - a. Inspection shall be based on completed Record Drawings and system documentation that is required by NFPA 72 in its "Completion Documents, Preparation" Table in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter.
 - b. Comply with "Visual Inspection Frequencies" Table in the "Inspection" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72; retain the "Initial/Reacceptance" column and list only the installed components.
 - 2. System Testing: Comply with "Test Methods" Table in the "Testing" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.
 - 3. Test audible appliances for the public operating mode according to manufacturer's written instructions.
 - 4. Test audible appliances for the private operating mode according to manufacturer's written instructions.
 - 5. Test visible appliances for the public operating mode according to manufacturer's written instructions.
 - 6. Factory-authorized service representative shall prepare the "Fire Alarm System Record of Completion" in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter in NFPA 72 and the "Inspection and Testing Form" in the "Records" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.
- D. Reacceptance Testing: Perform reacceptance testing to verify the proper operation of added or replaced devices and appliances.
- E. Fire-alarm system will be considered defective if it does not pass tests and inspections.
- F. Prepare test and inspection reports, include with O&M Manual.
- G. Maintenance Test and Inspection: Perform tests and inspections listed for weekly, monthly, quarterly, and semiannual periods. Use forms developed for initial tests and inspections.

H. Annual Test and Inspection: One year after date of Substantial Completion, test fire-alarm system complying with visual and testing inspection requirements in NFPA 72. Use forms developed for initial tests and inspections.

3.6 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain fire-alarm system.

END OF SECTION 283111