

CITY OF CHARLES TOWN, WEST VIRGINIA

CHARLES WASHINGTON HALL RENOVATION

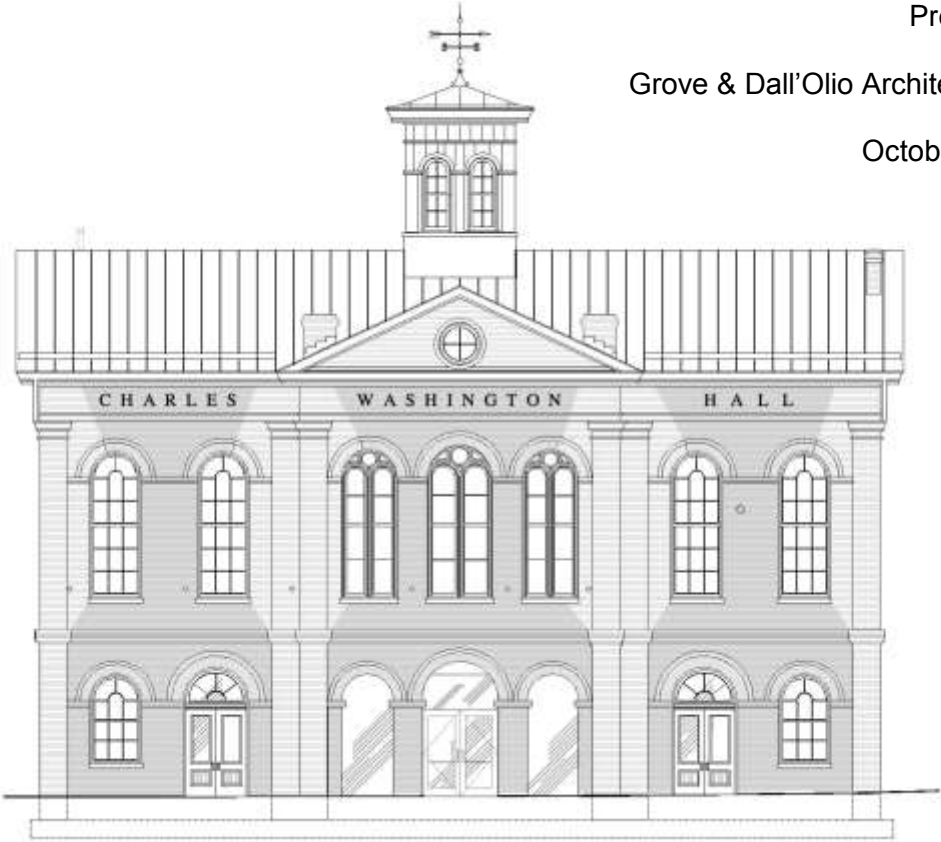
Project No. 11935

PROJECT MANUAL

Prepared By

Grove & Dall'Olio Architects PLLC

October 28, 2014



PROJECT TEAM

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CITY OF CHARLES TOWN, WV
Charles Washington Hall RENOVATION - 11935
Charles Town, West Virginia

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INVITATION TO BID

The City of Charles Town, WV invites proposals to provide all work, including, but not limited to, labor, material, equipment, supplies and transportation for:

The Renovation of Charles Washington Hall

All Bids must be submitted in accordance with the Bidding Documents issued by Grove & Dall'Olio Architects PLLC. Bidding Documents may be obtained ELECTRONICALLY by calling the Architect's office.

Grove & Dall'Olio Architects PLLC
220 West King Street
Martinsburg, WV 25401
304 267-2120

A pre-bid meeting is scheduled for:

TIME: 9:00 AM
DATE: Wednesday November 12, 2014
PLACE: Charles Town City Hall (see address below)

Attendance is **Mandatory**. All Bidders must attend the Pre-bid Meeting to familiarize themselves with the project location, site conditions and other relevant information. Should any Bidder wish to revisit the site or arrange for subcontractors to visit the site, contact Todd Wilt at 304 724-3260 for access to the site.

Questions will be received by the Project Architect, Matthew Grove, via email up until 72 hours prior to the Bid Opening time. All Bids must be submitted in accordance with the Bidding Documents issued by the Architect by 4:00 PM, on Thursday, December 4, 2014.

Sealed bids will be received by the **OWNER** at the following location:

Attn: David Mills, City Manager
City of Charles Town
101 East Washington Street
Charles Town, WV 25414

The public bid opening will take place at **4:01 PM, on Thursday, December 4, 2014** .

END OF INVITATION TO BID



AIA[®] Document A701[™] – 1997

Instructions to Bidders

for the following PROJECT:
(Name and location or address):

THE OWNER:
(Name and address):

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

THE ARCHITECT:
(Name and address):

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ARTICLE 1 DEFINITIONS

§ 1.1 Bidding Documents include the Bidding Requirements and the proposed Contract Documents. The Bidding Requirements consist of the Advertisement or Invitation to Bid, Instructions to Bidders, Supplementary Instructions to Bidders, the bid form, and other sample bidding and contract forms. The proposed Contract Documents consist of the form of Agreement between the Owner and Contractor, Conditions of the Contract (General, Supplementary and other Conditions), Drawings, Specifications and all Addenda issued prior to execution of the Contract.

§ 1.2 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.

§ 1.3 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 additions, deletions, clarifications or corrections.

§ 1.4 A Bid is a complete and properly executed proposal to do the Work for the sums stipulated therein, submitted in accordance with the Bidding Documents.

§ 1.5 The Base Bid is the sum stated in the Bid for which the Bidder offers to perform the Work described in the Bidding Documents as the base, to which Work may be added or from which Work may be deleted for sums stated in Alternate Bids.

§ 1.6 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 the Work, as described in the Bidding Documents, is accepted.

§ 1.7 A Unit Price is an amount stated in the Bid as a price per unit of measurement for materials, equipment or services or a portion of the Work as described in the Bidding Documents.

§ 1.8 A Bidder is a person or entity who submits a Bid and who meets the requirements set forth in the Bidding Documents.

§ 1.9 A Sub-bidder is a person or entity who submits a bid to a Bidder for materials, equipment or labor for a portion of the Work.

ARTICLE 2 BIDDER'S REPRESENTATIONS

§ 2.1 The Bidder by making a Bid represents that:

§ 2.1.1 The Bidder has read and understands the Bidding Documents or Contract Documents, to the extent that such documentation relates to the Work for which the Bid is submitted, and for other portions of the Project, if any, being bid concurrently or presently under construction.

§ 2.1.2 The Bid is made in compliance with the Bidding Documents.

§ 2.1.3 The Bidder has visited the site, become familiar with local conditions under which the Work is to be performed and has correlated the Bidder's personal observations with the requirements of the proposed Contract Documents.

§ 2.1.4 The Bid is based upon the materials, equipment and systems required by the Bidding Documents without exception.

ARTICLE 3 BIDDING DOCUMENTS

§ 3.1 COPIES

§ 3.1.1 Bidders may obtain complete sets of the Bidding Documents from the issuing office designated in the Advertisement or Invitation to Bid in the number and for the deposit sum, if any, stated therein. The deposit will be refunded to Bidders who submit a bona fide Bid and return the Bidding Documents in good condition within ten days after receipt of Bids. The cost of replacement of missing or damaged documents will be deducted from the deposit. A Bidder receiving a Contract award may retain the Bidding Documents and the Bidder's deposit will be refunded.

§ 3.1.2 Bidding Documents will not be issued directly to Sub-bidders unless specifically offered in the Advertisement or Invitation to Bid, or in supplementary instructions to bidders.

§ 3.1.3 Bidders shall use complete sets of Bidding Documents in preparing Bids; neither the Owner nor Architect assumes responsibility for errors or misinterpretations resulting from the use of incomplete sets of Bidding Documents.

§ 3.1.4 The Owner and Architect may make copies of the Bidding Documents available on the above terms for the purpose of obtaining Bids on the Work. No license or grant of use is conferred by issuance of copies of the Bidding Documents.

§ 3.2 INTERPRETATION OR CORRECTION OF BIDDING DOCUMENTS

§ 3.2.1 The Bidder shall carefully study and compare the Bidding Documents with each other, and with other work being bid concurrently or presently under construction to the extent that it relates to the Work for which the Bid is submitted, shall examine the site and local conditions, and shall at once report to the Architect errors, inconsistencies or ambiguities discovered.

§ 3.2.2 Bidders and Sub-bidders requiring clarification or interpretation of the Bidding Documents shall make a written request which shall reach the Architect at least seven days prior to the date for receipt of Bids.

§ 3.2.3 Interpretations, corrections and changes of the Bidding Documents will be made by Addendum. Interpretations, corrections and changes of the Bidding Documents made in any other manner will not be binding, and Bidders shall not rely upon them.

§ 3.3 SUBSTITUTIONS

§ 3.3.1 The materials, 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.

§ 3.3.2 No substitution will be considered prior to receipt of Bids unless written request for approval has been received by the Architect at least ten days prior to the date for receipt of Bids. Such requests shall include the name of the material or equipment for which it is to be substituted and a complete description of the proposed substitution including drawings, performance and test data, and other information necessary for an evaluation. A statement setting forth changes in other materials, equipment or other portions of the Work, including changes in the work of other contracts that incorporation of the proposed substitution would require, shall be included. The burden of proof of the merit of the proposed substitution is upon the proposer. The Architect's decision of approval or disapproval of a proposed substitution shall be final.

§ 3.3.3 If the Architect approves a proposed substitution prior to receipt of Bids, such approval will be set forth in an Addendum. Bidders shall not rely upon approvals made in any other manner.

§ 3.3.4 No substitutions will be considered after the Contract award unless specifically provided for in the Contract Documents.

§ 3.4 ADDENDA

§ 3.4.1 Addenda will be transmitted to all who are known by the issuing office to have received a complete set of Bidding Documents.

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

§ 3.4.3 Addenda will be issued no later than four days prior to the date for receipt of Bids except an Addendum withdrawing the request for Bids or one which includes postponement of the date for receipt of Bids.

§ 3.4.4 Each Bidder shall ascertain prior to submitting a Bid that the Bidder has received all Addenda issued, and the Bidder shall acknowledge their receipt in the Bid.

ARTICLE 4 BIDDING PROCEDURES

§ 4.1 PREPARATION OF BIDS

§ 4.1.1 Bids shall be submitted on the forms included with the Bidding Documents.

§ 4.1.2 All blanks on the bid form shall be legibly executed in a non-erasable medium.

§ 4.1.3 Sums shall be expressed in both words and figures. In case of discrepancy, the amount written in words shall govern.

§ 4.1.4 Interlineations, alterations and erasures must be initialed by the signer of the Bid.

§ 4.1.5 All requested Alternates shall be bid. If no change in the Base Bid is required, enter "No Change."

§ 4.1.6 Where two or more Bids for designated portions of the Work have been requested, the Bidder may, without forfeiture of the bid security, state the Bidder's refusal to accept award of less than the combination of Bids stipulated by the Bidder. The Bidder shall make no additional stipulations on the bid form nor qualify the Bid in any other manner.

§ 4.1.7 Each copy of the Bid shall state the legal name of the Bidder and the nature of legal form of the Bidder. The Bidder shall provide evidence of legal authority to perform within the jurisdiction of the Work. 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 the agent's authority to bind the Bidder.

§ 4.2 BID SECURITY

§ 4.2.1 Each Bid shall be accompanied by a bid security in the form and amount required if so stipulated in the Instructions to Bidders. The Bidder pledges to enter into a Contract with the Owner on the terms stated in the Bid and will, if required, furnish bonds covering the faithful performance of the Contract and 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 a penalty. The amount of the bid security shall not be forfeited to the Owner in the event the Owner fails to comply with Section 6.2.

§ 4.2.2 If a surety bond is required, it shall be written on AIA Document A310, Bid Bond, unless otherwise provided in the Bidding Documents, and the attorney-in-fact who executes the bond on behalf of the surety shall affix to the bond a certified and current copy of the power of attorney.

§ 4.2.3 The Owner will have the right to retain the bid security of Bidders to whom an award is being considered until either (a) the Contract has been executed and bonds, if required, have been furnished, or (b) the specified time has elapsed so that Bids may be withdrawn or (c) all Bids have been rejected.

§ 4.3 SUBMISSION OF BIDS

§ 4.3.1 All copies of the Bid, the bid security, if any, and any other documents required to be submitted with the Bid shall be enclosed in a sealed opaque envelope. 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, if applicable, the designated portion of the Work for which the Bid is submitted. If the Bid is sent by mail, the sealed envelope shall be enclosed in a separate mailing envelope with the notation "SEALED BID ENCLOSED" on the face thereof.

§ 4.3.2 Bids shall be deposited at the designated location prior to the time and date for receipt of Bids. Bids received after the time and date for receipt of Bids will be returned unopened.

§ 4.3.3 The Bidder shall assume full responsibility for timely delivery at the location designated for receipt of Bids.

§ 4.3.4 Oral, telephonic, telegraphic, facsimile or other electronically transmitted bids will not be considered.

§ 4.4 MODIFICATION OR WITHDRAWAL OF BID

§ 4.4.1 A Bid may not be modified, withdrawn or canceled by the Bidder during the stipulated time period following the time and date designated for the receipt of Bids, and each Bidder so agrees in submitting a Bid.

§ 4.4.2 Prior to the time and date designated for receipt of Bids, a Bid submitted may be modified or withdrawn by notice to the party receiving Bids at the place designated for receipt of Bids. Such notice shall be in writing over the signature of the Bidder. Written confirmation over the signature of the Bidder shall be received, and date- and time-stamped by the receiving party on or before the date and time set for receipt of Bids. A change shall be so worded as not to reveal the amount of the original Bid.

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

§ 4.4.4 Bid security, if required, shall be in an amount sufficient for the Bid as resubmitted.

ARTICLE 5 CONSIDERATION OF BIDS

§ 5.1 OPENING OF BIDS

At the discretion of the Owner, if stipulated in the Advertisement or Invitation to Bid, the properly identified Bids received on time will be publicly opened and will be read aloud. An abstract of the Bids may be made available to Bidders.

§ 5.2 REJECTION OF BIDS

The Owner shall have the right to reject any or all Bids. A Bid not accompanied by a required bid security or by other data required by the Bidding Documents, or a Bid which is in any way incomplete or irregular is subject to rejection.

§ 5.3 ACCEPTANCE OF BID (AWARD)

§ 5.3.1 It is the intent of the Owner to award a Contract to the lowest qualified Bidder provided the Bid has been submitted in accordance with the requirements of the Bidding Documents and does not exceed the funds available. The Owner shall have the right to waive informalities and irregularities in a Bid received and to accept the Bid which, in the Owner's judgment, is in the Owner's own best interests.

§ 5.3.2 The Owner shall have the right to accept Alternates in any order or combination, unless otherwise specifically provided in the Bidding Documents, and to determine the low Bidder on the basis of the sum of the Base Bid and Alternates accepted.

ARTICLE 6 POST-BID INFORMATION

§ 6.1 CONTRACTOR'S QUALIFICATION STATEMENT

Bidders to whom award of a Contract is under consideration shall submit to the Architect, upon request, a properly executed AIA Document A305, Contractor's Qualification Statement, unless such a Statement has been previously required and submitted as a prerequisite to the issuance of Bidding Documents.

§ 6.2 OWNER'S FINANCIAL CAPABILITY

The Owner shall, at the request of the Bidder to whom award of a Contract is under consideration and no later than seven days prior to the expiration of the time for withdrawal of Bids, furnish to the Bidder reasonable evidence that financial arrangements have been made to fulfill the Owner's obligations under the Contract. Unless such reasonable evidence is furnished, the Bidder will not be required to execute the Agreement between the Owner and Contractor.

§ 6.3 SUBMITTALS

§ 6.3.1 The Bidder shall, as soon as practicable or as stipulated in the Bidding Documents, after notification of selection for the award of a Contract, furnish to the Owner through the Architect in writing:

- .1 a designation of the Work to be performed with the Bidder's own forces;
- .2 names of the manufacturers, products, and the suppliers of principal items or systems of materials and equipment proposed for the Work; and
- .3 names of persons or entities (including those who are to furnish materials or equipment fabricated to a special design) proposed for the principal portions of the Work.

§ 6.3.2 The Bidder will be required to establish to the satisfaction of the Architect and Owner the reliability and responsibility of the persons or entities proposed to furnish and perform the Work described in the Bidding Documents.

§ 6.3.3 Prior to the execution of the Contract, the Architect will notify the Bidder in writing if either the Owner or Architect, after due investigation, has reasonable objection to a person or entity proposed by the Bidder. If the Owner or Architect has reasonable objection to a proposed person or entity, the Bidder may, at the Bidder's option, (1) withdraw the Bid or (2) submit an acceptable substitute person or entity with an adjustment in the Base Bid or Alternate Bid to cover the difference in cost occasioned by such substitution. The Owner may accept the adjusted bid price or disqualify the Bidder. In the event of either withdrawal or disqualification, bid security will not be forfeited.

§ 6.3.4 Persons and entities proposed by the Bidder and to whom the Owner and Architect have made no reasonable objection must be used on the Work for which they were proposed and shall not be changed except with the written consent of the Owner and Architect.

ARTICLE 7 PERFORMANCE BOND AND PAYMENT BOND

§ 7.1 BOND REQUIREMENTS

§ 7.1.1 If stipulated in the Bidding Documents, the Bidder shall furnish bonds covering the faithful performance of the Contract and payment of all obligations arising thereunder. Bonds may be secured through the Bidder's usual sources.

§ 7.1.2 If the furnishing of such bonds is stipulated in the Bidding Documents, the cost shall be included in the Bid. If the furnishing of such bonds is required after receipt of bids and before execution of the Contract, the cost of such bonds shall be added to the Bid in determining the Contract Sum.

§ 7.1.3 If the Owner requires that bonds be secured from other than the Bidder's usual sources, changes in cost will be adjusted as provided in the Contract Documents.

§ 7.2 TIME OF DELIVERY AND FORM OF BONDS

§ 7.2.1 The Bidder shall deliver the required bonds to the Owner not later than three days following the date of execution of the Contract. If the Work is to be commenced prior thereto in response to a letter of intent, the Bidder shall, prior to commencement of the Work, submit evidence satisfactory to the Owner that such bonds will be furnished and delivered in accordance with this Section 7.2.1.

§ 7.2.2 Unless otherwise provided, the bonds shall be written on AIA Document A312, Performance Bond and Payment Bond. Both bonds shall be written in the amount of the Contract Sum.

§ 7.2.3 The bonds shall be dated on or after the date of the Contract.

§ 7.2.4 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 the power of attorney.

ARTICLE 8 FORM OF AGREEMENT BETWEEN OWNER AND CONTRACTOR

Unless otherwise required in the Bidding Documents, the Agreement for the Work will be written on AIA Document A101, Standard Form of Agreement Between Owner and Contractor Where the Basis of Payment Is a Stipulated Sum.

ATTACHMENT TO AIA DOCUMENT A701-1997, *Instructions to Bidders*

The provisions of this Attachment shall delete, modify and supplement the provisions contained in the "*Instructions to Bidders*," AIA Document A701-1997 Edition. The provisions contained in this Attachment will supersede any conflicting provisions of the AIA Document. The term "Agency," as used in this Attachment, shall mean the United States of America, acting through the United States Department of Agriculture.

ARTICLE 2, BIDDER'S REPRESENTATIONS

2.1 Add the following subparagraph to paragraph 2.1:

2.1.5 This Bid has been arrived at independently, without consultation, communication, or agreement as to any matter relating to this Bid, with any other Bidder or with any competitor.

ARTICLE 4, BIDDING PROCEDURES

4.1.1 Add the following sentence to subparagraph 4.1.1:

Only one copy of the Bid is to be submitted.

4.2.1 Delete subparagraph 4.2.1 and substitute the following:

4.2.1 Each Bid must be accompanied by a Bid Bond payable to the Owner for five percent of the total amount of the Bid.

4.2.2 Delete Subparagraph 4.2.2 and substitute the following:

4.2.2 The Bid Bond shall be written on a form identical to that included in the Bidding Documents, and the attorney-in-fact who executes the Bid Bond on behalf of the surety shall affix to the Bid Bond a certified and current copy of the power of attorney.

4.2.3 Add the words "payment and performance" before the word "bonds"; and add

the following to subparagraph 4.2.3:

As soon as the Bid prices have been compared, the Owner will return the Bid Bonds of all except the three lowest responsible Bidders. When the Agreement is executed, the Bid Bonds of the two remaining unsuccessful Bidders will be returned.

4.2 Add the following subparagraph to paragraph 4.2:

4.2.4 If a Bidder refuses to execute the Agreement or obtain the Performance and Payment Bonds within the agreed time, the Owner may consider the Bidder in default, in which case the Bid Bond accompanying the Bid shall become the property of the Owner.

4.3 Add the following subparagraphs to paragraph 4.3:

4.3.5 All applicable laws, ordinances, and the rules and regulations of all authorities having jurisdiction over construction of the Project, shall apply to the Contract throughout.

4.3.6 The Bidder agrees to abide by the requirements of Executive Order 11246, specifically including the provisions of the Equal Opportunity Clause and the Standard Federal Equal Employment Construction Contract Specifications set forth in the Supplementary Conditions.

4.3.7 The Bidder agrees to abide by the requirements of section 319 of Public Law 101-121, which pertains to lobbying activities and applies to recipients of contracts or subcontracts that exceed \$100,000 at any tier under a Federal loan that exceeds \$150,000 or a Federal grant that exceeds \$100,000. Each Bid shall be accompanied by a completed lobbying certification form identical to that included in the Bidding Documents.

4.3.8 The Bidder agrees to abide by the requirements under 7 C.F.R. part 3017, which pertains to the debarment or suspension of a person from participating in a Federal program or activity. Each Bid exceeding \$25,000 shall be accompanied by a relevant completed certification form identical to that included in the Bidding Documents.

4.4.1 Delete subparagraph 4.4.1 and substitute the following:

4.4.1 No Bidder may withdraw, modify or cancel a Bid within 60 calendar days after the actual date of the opening thereof. Should there be reasons why the Contract cannot be awarded within the specified period, the time may be extended by mutual agreement between the Owner and the Bidder, and the concurrence of the Agency.

4.4.4 Delete the words ", if required," from Subparagraph 4.4.4.

ARTICLE 5, CONSIDERATION OF BIDS

5.3.2 Delete subparagraph 5.3.2 and substitute the following:

5.3.2 The Owner shall have the right to accept Alternates in the sequence or combinations listed and to determine the low Bidder on the basis of the sum of the Base Bid and the Alternates accepted.

ARTICLE 7, PERFORMANCE BOND AND PAYMENT BOND

7.1.1 Delete subparagraph 7.1.1 and substitute the following:

7.1.1 Prior to execution of the Contract, the Bidder shall furnish Bonds covering the faithful performance of the Contract and the payment of all obligations arising thereunder. Both Bonds shall be separately written, each in the amount of the Contract Sum. The cost shall be included in the Bid.

7.1.2 Delete subparagraph 7.1.2 and substitute the following:

7.1.2 Surety companies executing Bonds must hold a certificate of authority as a acceptable surety on Federal Bonds as listed in Treasury Circular 570, as amended, and be authorized to transact business in the State where the Project is located.

7.1.3 Delete subparagraph 7.1.3.

7.2.1 Delete subparagraph 7.2.1 and substitute the following:

7.2.1 The Bidder to whom the Contract is awarded will be required to execute the Agreement and obtain Performance and Payment Bonds within ten (10) calendar days from the date when the Notice of Award is delivered to the Bidder. The Notice shall be accompanied by the necessary Agreement and Bond forms.

7.2.2 Delete subparagraph 7.2.2 and substitute the following:

7.2.2 The Bonds shall be written on forms identical to those included in the Bidding Documents.

(Note: Any additional provisions that are necessary to remain effective after execution of the Contract for Construction will be inserted here and continue in the same format.)

o0o

FORM OF PROPOSAL

To Owner: **CITY OF CHARLES TOWN**

Project: **Charles Washington Hall Renovation**
100 West Washington Street
Charles Town, WV

The undersigned, hereinafter called the Bidder, being familiar with and understanding the Bidding Documents and also having examined the site and being familiar with all local conditions affecting the Project hereby proposes to furnish all labor, material, equipment, supplies and transportation, and to perform all Work in accordance with the Bidding Documents shall achieve Substantial Completion within _____ days, for the sum of:

BASE BID: _____ \$ _____

(Amount to be shown in both words and numbers. In the event of a difference between the written amount and the number amount, the written amount shall prevail. Complete bid breakdown for the various parts of the project.)

Provide new standing seam metal roof as indicated on the drawings and specifications

Add #1: _____ \$ _____

Provide new foundation walls and footings on the South Façade as indicated on drawings

Add #2: _____ \$ _____

I agree to honor the above bid figures for sixty (60) days past the bid due date:

Signature: _____ Date: _____
(Signature in ink)

Name: _____
(Please Type or Print) (Title)

Contractor Co. Name: _____

Contractor Co. Address: _____

Telephone Number: _____ Email Address: _____

Contractor's West Virginia License No.: _____

Charles Town Business License No.: _____

West Virginia State Code 21-11-2 requires that all persons desiring to perform contractual work in this State must be duly licensed. The West Virginia Contractors Licensing Board is empowered to issue the Contractors license. Application for a contractor's license may be made by contacting The West Virginia Department of Labor, 1800 Washington Street, E., Charleston, WV 25305. Telephone (304)-558-7890. West Virginia Code 21-11 requires a Bidder to include its contractor's license number on its bid. The successful Bidder will be required to furnish a copy of its contractor's license prior to issuance of a Purchase Order/Contract.

CHARLES WASHINGTON HALL BID BREAKDOWN

The following figures provided by the Contractor shall include labor, materials, overhead, profit and taxes necessary to perform the full extent of the work as described in the enclosed Drawings and Bidding Documents.

| Description of Work | \$ Amount |
|---|-------------|
| 1 General Conditions | |
| 2 Demolition & Site Work (utilities)..... | |
| 3 Concrete & Gravel | |
| 4 Masonry | |
| 5 Metal Work | |
| 6 Wood..... | |
| 7 Thermal & Moisture Protection | |
| 8 Openings..... | |
| 9 Finishes | |
| 10 Specialties..... | |
| 11 Equipment..... | |
| 12 Furnishings | |
| 14 Conveying Equipment..... | |
| 22 Plumbing | |
| 22 Sprinkler System..... | |
| 23 Mechanical | |
| 26 Power & Electrical..... | |
| | |
| Total | <hr/> <hr/> |

LIST OF SUBCONTRACTORS

| <u>TRADE</u> | <u>NAME</u> |
|--------------------|-------------|
| Demolition | _____ |
| Shoring | _____ |
| Excavating | _____ |
| Concrete | _____ |
| Masonry | _____ |
| Metalwork | _____ |
| Rough Carpentry | _____ |
| Finish Carpentry | _____ |
| Window Restoration | _____ |
| Glazing | _____ |
| Drywall Finishing | _____ |
| Painting | _____ |
| Plaster | _____ |
| Tile Work | _____ |
| Mechanical | _____ |
| Plumbing | _____ |
| Fire Suppression | _____ |
| Electrical | _____ |
| Superintendent | _____ |

- END OF FORM OF PROPOSAL -

AIA[®] Document A310[™] – 2010

Bid Bond

CONTRACTOR:

(Name, legal status and address)

TBD
TBD

SURETY:

(Name, legal status and principal place of business)

TBD
TBD

OWNER:

(Name, legal status and address)

TBD
TBD

BOND AMOUNT:

PROJECT:

(Name, location or address, and Project number, if any)

TBD
TBD

Project Number, if any:

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

Any singular reference to Contractor, Surety, Owner or other party shall be considered plural where applicable.

The Contractor and Surety are bound to the Owner in the amount set forth above, for the payment of which the Contractor and Surety bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally, as provided herein. The conditions of this Bond are such that if the Owner accepts the bid of the Contractor within the time specified in the bid documents, or within such time period as may be agreed to by the Owner and Contractor, and the Contractor either (1) enters into a contract with the Owner in accordance with the terms of such bid, and gives such bond or bonds as may be specified in the bidding or Contract Documents, with a surety admitted in the jurisdiction of the Project and otherwise acceptable to the Owner, for the faithful performance of such Contract and for the prompt payment of labor and material furnished in the prosecution thereof; or (2) pays to the Owner the difference, not to exceed the amount of this Bond, between the amount specified in said bid and such larger amount for which the Owner may in good faith contract with another party to perform the work covered by said bid, then this obligation shall be null and void, otherwise to remain in full force and effect. The Surety hereby waives any notice of an agreement between the Owner and Contractor to extend the time in which the Owner may accept the bid. Waiver of notice by the Surety shall not apply to any extension exceeding sixty (60) days in the aggregate beyond the time for acceptance of bids specified in the bid documents, and the Owner and Contractor shall obtain the Surety's consent for an extension beyond sixty (60) days.

If this Bond is issued in connection with a subcontractor's bid to a Contractor, the term Contractor in this Bond shall be deemed to be Subcontractor and the term Owner shall be deemed to be Contractor.

When this Bond has been furnished to comply with a statutory or other legal requirement in the location of the Project, any provision in this Bond conflicting with said statutory or legal requirement shall be deemed deleted herefrom and provisions conforming to such statutory or other legal requirement shall be deemed incorporated herein. When so furnished, the intent is that this Bond shall be construed as a statutory bond and not as a common law bond.

Signed and sealed this _____ day of _____

| | | |
|-----------|-------------|---------|
| _____ | (Principal) | (Seal) |
| (Witness) | _____ | (Title) |
| _____ | (Surety) | (Seal) |
| (Witness) | _____ | (Title) |



PERFORMANCE BOND

KNOW ALL MEN BY THESE PRESENTS:

That _____
(Contractor name, complete address including ZIP Code and legal title)

as Principal, hereinafter called Contractor, and _____
(Surety name and complete address including ZIP Code)

_____ a corporation organized and existing under
the laws of the State of _____, with its principal office in the City of _____

as Surety, hereinafter called Surety, are held firmly bound unto _____
(Owner name, complete address including ZIP Code and legal title)

as Obligee, hereinafter called Owner, in the amount of _____

Dollars (_____), for the payment whereof Contractor and Surety bind themselves, their heirs, executors,
administrators, successors, and assigns, jointly and severally, firmly by these presents.

WHEREAS, Contractor has by written agreement dated _____
_____ entered into a contract with Owner for _____

_____ in accordance with drawings and specifications prepared by _____

_____ which contract is by reference made a part hereof, and is hereinafter referred to as the CONTRACT.

NOW, THEREFORE, THE CONDITION OF THIS OBLIGATION is such that if Contractor shall, promptly and faithfully Perform and CONTRACT,
then this obligation shall be null and void, otherwise it shall remain in full force and effect.

The Surety hereby waives notice of any alteration or extension of time made by the Owner.

Whenever Contractor shall be, and declared by Owner to be in default under the CONTRACT, the Owner having performed Owner's obligations
thereunder, the Surety may promptly remedy the default, or shall promptly:

1. Complete the CONTRACT in accordance with its terms and conditions, and
2. Shall save the Owner harmless from any claims, judgments, or liens arising from the Surety's failure to either remedy the default or to
complete the CONTRACT in accordance with its terms and conditions in a timely manner.

No right of action shall accrue on this bond to or for the use of any person or corporation other than the Owner named herein or the successors of
Owner.

Signed and sealed this * _____ day of _____ 20 _____ .

Principal Raised Corporate Seal (MUST BE AFFIXED)

(Contractor Name) (Seal)

BY: _____ (Seal)
(Must be President, Vice President, Owner, Partner, Manager or Member)

(Title)

Surety Raised Corporate Seal (MUST BE AFFIXED)

(Surety)

BY: _____ (Seal)

NOTE: Raised Corporate Seals are mandatory.
Please attach Power of Attorney.

NOTE: Applicable sections of attached acknowledgments must be
completed and returned as part of the bond.

*Power of Attorney must be certified on this date or later.

APPROVED AG 08-20-09

ACKNOWLEDGMENTS

Acknowledgment by Principal if Individual or Partnership

1. STATE OF _____
2. County of _____ to-wit:
3. I, _____, a Notary Public in and for the
4. county and state aforesaid, do hereby certify that _____
whose name is signed to the foregoing writing, has this day acknowledged the same before me in my said county.
5. Given under my hand this _____ day of _____ 20 _____
6. Notary Seal 7. _____
(Notary Public)
8. My commission expires on the _____ day of _____ 20 _____

Acknowledgment by Principal if Corporation

9. STATE OF _____
10. County of _____ to-wit:
11. I, _____, a Notary Public in and for the
12. county and state aforesaid, do hereby certify that _____
13. who as, _____ signed the foregoing writing for
14. _____ a corporation,
has this day, in my said county, before me, acknowledged the said writing to be the act and deed of the said corporation.
15. Given under my hand this _____ day of _____ 20 _____
16. Notary Seal 17. _____
(Notary Public)
18. My commission expires on the _____ day of _____ 20 _____

Acknowledgment by Surety

19. STATE OF _____
20. County of _____ to-wit:
21. I, _____, a Notary Public in and for the
22. county and state aforesaid, do hereby certify that _____
23. who as, _____ signed the foregoing writing for
24. _____ a corporation,
has this day, in my said county, before me, acknowledged the said writing to be the act and deed of the said corporation.
25. Given under my hand this _____ day of _____ 20 _____
26. Notary Seal 27. _____
(Notary Public)
28. My commission expires on the _____ day of _____ 20 _____

Sufficiency in Form and Manner of Execution Approved

This _____ day of _____ 20 _____.

Attorney General
By: _____
(Deputy Attorney General)

ACKNOWLEDGMENT PREPARATION INSTRUCTIONS

1. IF PRINCIPAL IS AN INDIVIDUAL OR PARTNERSHIP, HAVE NOTARY COMPLETE LINES (1) THROUGH (8).
2. IF PRINCIPAL IS A CORPORATION, HAVE NOTARY COMPLETE LINES (9) through (18).
3. SURETY MUST HAVE NOTARY COMPLETE LINES (19) through (28).
4. **Notaries must:**

ACKNOWLEDGMENT BY PRINCIPAL, IF INDIVIDUAL OR PARTNERSHIP

1. Enter name of State.
2. Enter name of County.
3. Enter name of Notary Public witnessing transactions.
4. Enter name of principal covered by bond if individual or partnership. (Must be Owner or General Partner of Sole Proprietorship or Partnership)
5. Notary enters date bond was witnessed. Must be the same as or later than signature date.
6. Affix Notary Seal.
7. Notary affixes his/her signature.
8. Notary enters commission expiration date.

ACKNOWLEDGMENT BY PRINCIPAL IF CORPORATION

9. Enter name of State.
10. Enter name of County.
11. Enter name of Notary Public witnessing transactions.
12. Enter name of Corporate Officer signing bond.
13. Enter Title of Corporate Officer signing bond. (Must be President or Vice President of Corporation; Manager or Managing Member of Limited Liability Company)
14. Enter name of Company or Corporation.
15. Notary enters date bond was witnessed. Must be the same as or later than signature date.
16. Affix notary Seal.
17. Notary affixes his/her signature.
18. Notary enters commission expiration date.

ACKNOWLEDGMENT BY SURETY

19. Enter name of State.
20. Enter name of County.
21. Enter name of Notary Public witnessing transactions.
22. Enter name of person having power of attorney to bind Surety Company.
23. Enter Title of person binding Surety Company.
24. Enter name of Insurance Company (Surety).
25. Notary enters date bond was witnessed. Must be the same as or later than signature date.
26. Affix Notary Seal.
27. Notary affixes his/her signature.
28. Notary enters commission expiration date.

POWER OF ATTORNEY INSTRUCTIONS

Power of attorney for surety must be attached showing that it was in full force and effect on signature date indicated on the face of the bond. A raised corporate seal must also be affixed to the Power of Attorney form.

- a. Name of attorney in fact must be listed.
- b. Power of Attorney may not exceed imposed limitations.
- c. Certificate date, the signature date of bond must be entered.
- d. Signature of authorizing official must be affixed. (Signature may be facsimile).
- e. **Raised seal must be affixed.**



LABOR AND MATERIAL PAYMENT BOND

KNOW ALL MEN BY THESE PRESENTS:

That _____
(Contractor name, complete address including ZIP Code and legal title)
as Principal, hereinafter called Contractor, and _____
(Surety name and complete address including ZIP Code)
_____ a corporation organized and existing under
the laws of the State of _____, with its principal office in the City of _____
as Surety, hereinafter called Surety, are held firmly bound unto _____
(Owner name, complete address including ZIP Code and legal title)

_____ as Obligee, hereinafter called Owner, for the use and benefit of claimants as herein below defined in the amount of _____ Dollars (_____),
for the payment whereof Principal and Surety bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally,
firmly by these presents.

WHEREAS, Contractor has by written agreement dated _____
_____ entered into a contract with Owner for
_____ in accordance with drawings and specifications prepared by _____

which contract is by reference made a part hereof, and is hereinafter referred to as the CONTRACT.
NOW, THEREFORE, THE CONDITION OF THIS OBLIGATION is such that if Contractor shall, well and truly perform the contract, and shall pay off,
satisfy and discharge all claims of subcontractors, labors, materialmen and all persons furnishing material or doing work pursuant to the
CONTRACT and shall save Owner and its property harmless from any and all liability over and above the contract price thereof, between the Owner
and the Contractor, for all of such labor and material, and shall fully pay off and discharge and secure the release of any and all mechanics liens
which may be placed upon said property by any such subcontractor, laborer or materialmen, then this obligation shall be null and void. Otherwise, it
shall remain in full force and effect.

Signed and sealed this * _____ day of _____ 20 _____ .

Principal Raised Corporate Seal (MUST BE AFFIXED)

(Contractor Name) (Seal)

BY: _____ (Seal)
(Must be President, Vice President, Owner, Partner, Manager or Member)

(Title)

Surety Raised Corporate Seal (MUST BE AFFIXED)

(Surety)

BY: _____ (Seal)

NOTE: Raised Corporate Seals are mandatory.
Please attach Power of Attorney.

NOTE: Applicable sections of attached acknowledgments
must be completed and returned as part of the bond.

*Power of Attorney must be certified on this date or later.

APPROVED AG 08-20-09

ACKNOWLEDGMENTS

Acknowledgment by Principal if Individual or Partnership

1. STATE OF _____
2. County of _____ to-wit:
3. I, _____, a Notary Public in and for the
4. county and state aforesaid, do hereby certify that _____
whose name is signed to the foregoing writing, has this day acknowledged the same before me in my said county.
5. Given under my hand this _____ day of _____ 20 _____
6. Notary Seal 7: _____
(Notary Public)
8. My commission expires on the _____ day of _____ 20 _____

Acknowledgment by Principal if Corporation

9. STATE OF _____
10. County of _____ to-wit:
11. I, _____, a Notary Public in and for the
12. county and state aforesaid, do hereby certify that _____
13. who as, _____ signed the foregoing writing for
14. _____ a corporation,
has this day, in my said county, before me, acknowledged the said writing to be the act and deed of the said corporation.
15. Given under my hand this _____ day of _____ 20 _____
16. Notary Seal 17: _____
(Notary Public)
18. My commission expires on the _____ day of _____ 20 _____

Acknowledgment by Surety

19. STATE OF _____
20. County of _____ to-wit:
21. I, _____, a Notary Public in and for the
22. county and state aforesaid, do hereby certify that _____
23. who as, _____ signed the foregoing writing for
24. _____ a corporation,
has this day, in my said county, before me, acknowledged the said writing to be the act and deed of the said corporation.
25. Given under my hand this _____ day of _____ 20 _____
26. Notary Seal 27: _____
(Notary Public)
28. My commission expires on the _____ day of _____ 20 _____

Sufficiency in Form and Manner of Execution Approved

This _____ day of _____ 20 _____.

By: _____
(Deputy Attorney General)

Attorney General

ACKNOWLEDGMENT PREPARATION INSTRUCTIONS

1. IF PRINCIPAL IS AN INDIVIDUAL OR PARTNERSHIP, HAVE NOTARY COMPLETE LINES (1) THROUGH (8).
2. IF PRINCIPAL IS A CORPORATION, HAVE NOTARY COMPLETE LINES (9) through (18).
3. SURETY MUST HAVE NOTARY COMPLETE LINES (19) through (28).
4. **Notaries must:**

ACKNOWLEDGMENT BY PRINCIPAL, IF INDIVIDUAL OR PARTNERSHIP

1. Enter name of State.
2. Enter name of County.
3. Enter name of Notary Public witnessing transactions.
4. Enter name of principal covered by bond if individual or partnership. (Must be Owner or General Partner of Sole Proprietorship or Partnership)
5. Notary enters date bond was witnessed. Must be the same as or later than signature date.
6. Affix Notary Seal.
7. Notary affixes his/her signature.
8. Notary enters commission expiration date.

ACKNOWLEDGMENT BY PRINCIPAL IF CORPORATION

9. Enter name of State.
10. Enter name of County.
11. Enter name of Notary Public witnessing transactions.
12. Enter name of Corporate Officer signing bond.
13. Enter Title of Corporate Officer signing bond. (Must be President or Vice President of Corporation; Manager or Managing Member of Limited Liability Company)
14. Enter name of Company or Corporation.
15. Notary enters date bond was witnessed. Must be the same as or later than signature date.
16. Affix notary Seal.
17. Notary affixes his/her signature.
18. Notary enters commission expiration date.

ACKNOWLEDGMENT BY SURETY

19. Enter name of State.
20. Enter name of County.
21. Enter name of Notary Public witnessing transactions.
22. Enter name of person having power of attorney to bind Surety Company.
23. Enter Title of person binding Surety Company.
24. Enter name of Insurance Company (Surety).
25. Notary enters date bond was witnessed. Must be the same as or later than signature date.
26. Affix Notary Seal.
27. Notary affixes his/her signature.
28. Notary enters commission expiration date.

POWER OF ATTORNEY INSTRUCTIONS

Power of attorney for surety must be attached showing that it was in full force and effect on signature date indicated on the face of the bond. A raised corporate seal must also be affixed to the Power of Attorney form.

- a. Name of attorney in fact must be listed.
- b. Power of Attorney may not exceed imposed limitations.
- c. Certificate date, the signature date of bond must be entered.
- d. Signature of authorizing official must be affixed. (Signature may be facsimile).
- e. **Raised seal must be affixed.**



 **AIA**® Document A101™ – 2007

Standard Form of Agreement Between Owner and Contractor where the basis of payment is a Stipulated Sum

AGREEMENT made as of the _____ day of _____
in the year _____
(In words, indicate day, month and year.)

BETWEEN the Owner:
(Name, legal status, address and other information)

and the Contractor:
(Name, legal status, address and other information)

for the following Project:
(Name, location and detailed description)

The Architect:
(Name, legal status, address and other information)

The Owner and Contractor agree as follows.

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

AIA Document A201™–2007, General Conditions of the Contract for Construction, is adopted in this document by reference. Do not use with other general conditions unless this document is modified.

TABLE OF ARTICLES

| | |
|----|---|
| 1 | THE CONTRACT DOCUMENTS |
| 2 | THE WORK OF THIS CONTRACT |
| 3 | DATE OF COMMENCEMENT AND SUBSTANTIAL COMPLETION |
| 4 | CONTRACT SUM |
| 5 | PAYMENTS |
| 6 | DISPUTE RESOLUTION |
| 7 | TERMINATION OR SUSPENSION |
| 8 | MISCELLANEOUS PROVISIONS |
| 9 | ENUMERATION OF CONTRACT DOCUMENTS |
| 10 | INSURANCE AND BONDS |

ARTICLE 1 THE CONTRACT DOCUMENTS

The Contract Documents consist of this Agreement, Conditions of the Contract (General, Supplementary and other Conditions), Drawings, Specifications, Addenda issued prior to execution of this Agreement, other documents listed in this Agreement and Modifications issued after execution of this Agreement, all of which form the Contract, and are as fully a part of the Contract as if attached to this Agreement or repeated herein. The Contract represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations or agreements, either written or oral. An enumeration of the Contract Documents, other than a Modification, appears in Article 9.

ARTICLE 2 THE WORK OF THIS CONTRACT

The Contractor shall fully execute the Work described in the Contract Documents, except as specifically indicated in the Contract Documents to be the responsibility of others.

ARTICLE 3 DATE OF COMMENCEMENT AND SUBSTANTIAL COMPLETION

§ 3.1 The date of commencement of the Work shall be the date of this Agreement unless a different date is stated below or provision is made for the date to be fixed in a notice to proceed issued by the Owner.

(Insert the date of commencement if it differs from the date of this Agreement or, if applicable, state that the date will be fixed in a notice to proceed.)

If, prior to the commencement of the Work, the Owner requires time to file mortgages and other security interests, the Owner's time requirement shall be as follows:

§ 3.2 The Contract Time shall be measured from the date of commencement.

§ 3.3 The Contractor shall achieve Substantial Completion of the entire Work not later than () days from the date of commencement, or as follows:
(Insert number of calendar days. Alternatively, a calendar date may be used when coordinated with the date of commencement. If appropriate, insert requirements for earlier Substantial Completion of certain portions of the Work.)

Portion of Work

Substantial Completion Date

, subject to adjustments of this Contract Time as provided in the Contract Documents.
(Insert provisions, if any, for liquidated damages relating to failure to achieve Substantial Completion on time or for bonus payments for early completion of the Work.)

ARTICLE 4 CONTRACT SUM

§ 4.1 The Owner shall pay the Contractor the Contract Sum in current funds for the Contractor's performance of the Contract. The Contract Sum shall be (\$), subject to additions and deductions as provided in the Contract Documents.

§ 4.2 The Contract Sum is based upon the following alternates, if any, which are described in the Contract Documents and are hereby accepted by the Owner:
(State the numbers or other identification of accepted alternates. If the bidding or proposal documents permit the Owner to accept other alternates subsequent to the execution of this Agreement, attach a schedule of such other alternates showing the amount for each and the date when that amount expires.)

§ 4.3 Unit prices, if any:
(Identify and state the unit price; state quantity limitations, if any, to which the unit price will be applicable.)

| Item | Units and Limitations | Price per Unit (\$0.00) |
|------|-----------------------|-------------------------|
|------|-----------------------|-------------------------|

§ 4.4 Allowances included in the Contract Sum, if any:
(Identify allowance and state exclusions, if any, from the allowance price.)

| Item | Price |
|------|-------|
|------|-------|

ARTICLE 5 PAYMENTS

§ 5.1 Progress Payments

§ 5.1.1 Based upon Applications for Payment submitted to the Architect by the Contractor and Certificates for Payment issued by the Architect, the Owner shall make progress payments on account of the Contract Sum to the Contractor as provided below and elsewhere in the Contract Documents.

§ 5.1.2 The period covered by each Application for Payment shall be one calendar month ending on the last day of the month, or as follows:

§ 5.1.3 Provided that an Application for Payment is received by the Architect not later than the day of a month, the Owner shall make payment of the certified amount to the Contractor not later than the _____ day of the _____ month. If an Application for Payment is received by the Architect after the application date fixed above, payment shall be made by the Owner not later than (_____) days after the Architect receives the Application for Payment.
(Federal, state or local laws may require payment within a certain period of time.)

§ 5.1.4 Each Application for Payment shall be based on the most recent schedule of values submitted by the Contractor in accordance with the Contract Documents. The schedule of values shall allocate the entire Contract Sum among the various portions of the Work. The schedule of values shall be prepared in such form and supported by such data to substantiate its accuracy as the Architect may require. This schedule, unless objected to by the Architect, shall be used as a basis for reviewing the Contractor's Applications for Payment.

§ 5.1.5 Applications for Payment shall show the percentage of completion of each portion of the Work as of the end of the period covered by the Application for Payment.

§ 5.1.6 Subject to other provisions of the Contract Documents, the amount of each progress payment shall be computed as follows:

- .1 Take that portion of the Contract Sum properly allocable to completed Work as determined by multiplying the percentage completion of each portion of the Work by the share of the Contract Sum allocated to that portion of the Work in the schedule of values, less retainage of _____ percent (_____ %). Pending final determination of cost to the Owner of changes in the Work, amounts not in dispute shall be included as provided in Section 7.3.9 of AIA Document A201™-2007, General Conditions of the Contract for Construction;
- .2 Add that portion of the Contract Sum properly allocable to materials and equipment delivered and suitably stored at the site for subsequent incorporation in the completed construction (or, if approved in advance by the Owner, suitably stored off the site at a location agreed upon in writing), less retainage of _____ percent (_____ %);
- .3 Subtract the aggregate of previous payments made by the Owner; and
- .4 Subtract amounts, if any, for which the Architect has withheld or nullified a Certificate for Payment as provided in Section 9.5 of AIA Document A201-2007.

§ 5.1.7 The progress payment amount determined in accordance with Section 5.1.6 shall be further modified under the following circumstances:

- .1 Add, upon Substantial Completion of the Work, a sum sufficient to increase the total payments to the full amount of the Contract Sum, less such amounts as the Architect shall determine for incomplete Work, retainage applicable to such work and unsettled claims; and
(Section 9.8.5 of AIA Document A201-2007 requires release of applicable retainage upon Substantial Completion of Work with consent of surety, if any.)
- .2 Add, if final completion of the Work is thereafter materially delayed through no fault of the Contractor, any additional amounts payable in accordance with Section 9.10.3 of AIA Document A201-2007.

§ 5.1.8 Reduction or limitation of retainage, if any, shall be as follows:

(If it is intended, prior to Substantial Completion of the entire Work, to reduce or limit the retainage resulting from the percentages inserted in Sections 5.1.6.1 and 5.1.6.2 above, and this is not explained elsewhere in the Contract Documents, insert here provisions for such reduction or limitation.)

§ 5.1.9 Except with the Owner's prior approval, the Contractor shall not make advance payments to suppliers for materials or equipment which have not been delivered and stored at the site.

§ 5.2 Final Payment

§ 5.2.1 Final payment, constituting the entire unpaid balance of the Contract Sum, shall be made by the Owner to the Contractor when

- .1 the Contractor has fully performed the Contract except for the Contractor's responsibility to correct Work as provided in Section 12.2.2 of AIA Document A201-2007, and to satisfy other requirements, if any, which extend beyond final payment; and
- .2 a final Certificate for Payment has been issued by the Architect.

§ 5.2.2 The Owner's final payment to the Contractor shall be made no later than 30 days after the issuance of the Architect's final Certificate for Payment, or as follows:

ARTICLE 6 DISPUTE RESOLUTION

§ 6.1 Initial Decision Maker

The Architect will serve as Initial Decision Maker pursuant to Section 15.2 of AIA Document A201-2007, unless the parties appoint below another individual, not a party to this Agreement, to serve as Initial Decision Maker.

(If the parties mutually agree, insert the name, address and other contact information of the Initial Decision Maker, if other than the Architect.)

§ 6.2 Binding Dispute Resolution

For any Claim subject to, but not resolved by, mediation pursuant to Section 15.3 of AIA Document A201-2007, the method of binding dispute resolution shall be as follows:

(Check the appropriate box. If the Owner and Contractor do not select a method of binding dispute resolution below, or do not subsequently agree in writing to a binding dispute resolution method other than litigation, Claims will be resolved by litigation in a court of competent jurisdiction.)

- Arbitration pursuant to Section 15.4 of AIA Document A201-2007
- Litigation in a court of competent jurisdiction
- Other: *(Specify)*

ARTICLE 7 TERMINATION OR SUSPENSION

§ 7.1 The Contract may be terminated by the Owner or the Contractor as provided in Article 14 of AIA Document A201–2007.

§ 7.2 The Work may be suspended by the Owner as provided in Article 14 of AIA Document A201–2007.

ARTICLE 8 MISCELLANEOUS PROVISIONS

§ 8.1 Where reference is made in this Agreement to a provision of AIA Document A201–2007 or another Contract Document, the reference refers to that provision as amended or supplemented by other provisions of the Contract Documents.

§ 8.2 Payments due and unpaid under the Contract shall bear interest from the date payment is due at the rate stated below, or in the absence thereof, at the legal rate prevailing from time to time at the place where the Project is located. *(Insert rate of interest agreed upon, if any.)*

§ 8.3 The Owner’s representative:
(Name, address and other information)

§ 8.4 The Contractor’s representative:
(Name, address and other information)

§ 8.5 Neither the Owner’s nor the Contractor’s representative shall be changed without ten days written notice to the other party.

§ 8.6 Other provisions:

ARTICLE 9 ENUMERATION OF CONTRACT DOCUMENTS

§ 9.1 The Contract Documents, except for Modifications issued after execution of this Agreement, are enumerated in the sections below.

§ 9.1.1 The Agreement is this executed AIA Document A101–2007, Standard Form of Agreement Between Owner and Contractor.

§ 9.1.2 The General Conditions are AIA Document A201–2007, General Conditions of the Contract for Construction.

§ 9.1.3 The Supplementary and other Conditions of the Contract:

| Document | Title | Date | Pages |
|----------|-------|------|-------|
|----------|-------|------|-------|

§ 9.1.4 The Specifications:

(Either list the Specifications here or refer to an exhibit attached to this Agreement.)

| Section | Title | Date | Pages |
|---------|-------|------|-------|
|---------|-------|------|-------|

§ 9.1.5 The Drawings:

(Either list the Drawings here or refer to an exhibit attached to this Agreement.)

| Number | Title | Date |
|--------|-------|------|
|--------|-------|------|

§ 9.1.6 The Addenda, if any:

| Number | Date | Pages |
|--------|------|-------|
|--------|------|-------|

Portions of Addenda relating to bidding requirements are not part of the Contract Documents unless the bidding requirements are also enumerated in this Article 9.

§ 9.1.7 Additional documents, if any, forming part of the Contract Documents:

- .1 AIA Document E201™–2007, Digital Data Protocol Exhibit, if completed by the parties, or the following:

- .2 Other documents, if any, listed below:
(List here any additional documents that are intended to form part of the Contract Documents. AIA Document A201–2007 provides that bidding requirements such as advertisement or invitation to bid, Instructions to Bidders, sample forms and the Contractor's bid are not part of the Contract Documents unless enumerated in this Agreement. They should be listed here only if intended to be part of the Contract Documents.)

ARTICLE 10 INSURANCE AND BONDS

The Contractor shall purchase and maintain insurance and provide bonds as set forth in Article 11 of AIA Document A201-2007.

(State bonding requirements, if any, and limits of liability for insurance required in Article 11 of AIA Document A201-2007.)

Type of Insurance or Bond

Limit of Liability or Bond Amount (\$0.00)

This Agreement entered into as of the day and year first written above.

OWNER (Signature)

CONTRACTOR (Signature)

(Printed name and title)

(Printed name and title)

CAUTION: You should sign an original AIA Contract Document, on which this text appears in RED. An original assures that changes will not be obscured.

Init.

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ATTACHMENT TO AIA DOCUMENT A101-2007, *Standard Form of Agreement
Between Owner and Contractor*

The provisions of this Attachment shall delete, modify and supplement the provisions contained in the "*Standard Form of Agreement Between Owner and Contractor*," AIA Document A101-2007 Edition. The provisions contained in this attachment shall supersede any conflicting provisions of the AIA Document.

ARTICLE 3, DATE OF COMMENCEMENT AND SUBSTANTIAL COMPLETION

Delete paragraph 3.1 and substitute the following:

3.1 The date of commencement shall be contained in the Notice to Proceed.

Add the following to paragraph 3.3:

If the work is not substantially complete on or before this date, or within this period of time, or extension thereof granted by the Owner, damage will be sustained by the Owner and that it is and will be impracticable and extremely difficult to fix the actual damage which the Owner will sustain in the event of and by reason of such delays. The Contractor shall pay to the Owner liquidated damages in the sum of \$ _____ for each calendar day of delay. Any sums that may be due the Owner as liquidated damages may be deducted from any monies due or to become due the Contractor under the Contract or may be collected from the Contractor's surety.

ARTICLE 5, PAYMENTS

Insert "ten" and "10" in the appropriate spaces in clauses 5.1.6.1 and subparagraph 5.1.6.2.

Delete the last sentence of clause 5.1.6.1.

Delete the following from clause 5.1.6.2:

(or, if approved in advance by the Owner, suitably stored off the site at a location agreed upon in writing)

Insert the following sentences in subparagraph 5.1.8:

The amount retained shall be 10% of the value of Work until 50% of the Work has been completed. At 50% completion, further partial payments shall be made in full to the Contractor and no additional amounts may be retained unless the Architect certifies that the Work is not proceeding satisfactorily, but amounts previously retained shall not be paid to the Contractor. At 50% completion or any time thereafter when the progress of the Work is not satisfactory, additional amounts may be retained but in no event shall the total retainage be more than 10% of the value of Work completed.

ARTICLE 8, MISCELLANEOUS PROVISIONS

Add the following subparagraph to paragraph 8.6:

8.6.1 This Agreement shall not become effective until concurred in writing by the Agency. Such concurrence shall be evidenced by the signature of a duly authorized representative of the Agency in the space provided at the end of this Attachment to the Agreement. The concurrence so evidenced by the Agency shall in no way commit the Agency to render financial assistance to the Owner and is without liability to the Agency for any payment thereunder, but in the event such assistance is provided, the concurrence shall signify the provisions of this Agreement are consistent with Agency requirements.

ARTICLE 9, ENUMERATION OF CONTRACT DOCUMENTS

The following Documents should be referenced, if applicable:

Subparagraph 9.1.3:

Attachment to the *Standard Form of Agreement Between Owner and Contractor* (RD Instruction 1942-A, Guide 27, Attachment 3)

General Conditions of the Contract for Construction, AIA A201-2007

Attachment to the *General Conditions of the Contract for Construction* (RD Instruction 1942-A, Guide 27, Attachment 4)

Special Conditions

Subparagraph 9.1.7:

Invitation for Bids (Form RD 1924-5)
Instructions to Bidders, AIA A701-1997
Attachment to the *Instructions to Bidders* (RD Instruction
1924-A, Guide 27, Attachment 2)
Bid Form
Bid Bond
Compliance Statement (Form RD 400-6)
Payment Bond
Performance Bond
Certification Regarding Debarment, Suspension,
Ineligibility and Voluntary Exclusion - Lower Tier
Covered Transactions (Form AD 1048)
Disclosure of Lobbying Activities (SF-LLL)
Certification for Contracts, Grants and Loans (RD
Instruction 1940-Q, Exhibit A-1)

Delete the signature block on page 7 of this Agreement, and substitute
the block on the following page:

IN WITNESS WHEREOF, the parties hereto have executed, or caused to be executed by their duly authorized officials, this Agreement in duplicate on the respective dates indicated below:

| | |
|--------------------------|-------------------------|
| ATTEST: _____ _____ | OWNER: By _____ |
| Type Name _____ _____ | Type Name _____ |
| Title _____ _____ | Title _____ |
| Date _____ _____ | Date _____ |
| ATTEST: _____ _____ | CONTRACTOR: By _____ |
| Type Name _____ _____ | Type Name _____ |
| Title _____ _____ | Title _____ |
| Date _____ _____ | Date _____ |

AGENCY CONCURRENCE:

By _____
Type Name _____
Title _____
Date _____

The concurrence so evidenced by the Agency shall in no way commit the Agency to render financial assistance to the Owner and is without liability to the Agency for any payment hereunder, but in the event such assistance is provided, the concurrence shall signify the provisions of this Agreement are consistent with Agency requirements.



AIA® Document G701™ – 2001

Change Order

| | | |
|--|-----------------------------|-------------------------------------|
| PROJECT: <i>(Name and address)</i> | CHANGE ORDER NUMBER: | OWNER <input type="checkbox"/> |
| | DATE: | ARCHITECT <input type="checkbox"/> |
| | ARCHITECT'S PROJECT NUMBER: | CONTRACTOR <input type="checkbox"/> |
| TO CONTRACTOR: <i>(Name and address)</i> | | FIELD <input type="checkbox"/> |
| | CONTRACT DATE: | OTHER <input type="checkbox"/> |
| | CONTRACT FOR: | |

The Contract is changed as follows:
(Include, where applicable, any undisputed amount attributable to previously executed Construction Change Directives)

The original (Contract Sum) (Guaranteed Maximum Price) was \$ _____

The net change by previously authorized Change Orders \$ _____

The (Contract Sum) (Guaranteed Maximum Price) prior to this Change Order was \$ _____

The (Contract Sum) (Guaranteed Maximum Price) will be (increased) (decreased) (unchanged) by this Change Order in the amount of \$ _____

The new (Contract Sum) (Guaranteed Maximum Price) including this Change Order will be \$ _____

The Contract Time will be (increased) (decreased) (unchanged) by () days

The date of Substantial Completion as of the date of this Change Order therefore is _____

(Note: This Change Order does not include changes in the Contract Sum, Contract Time or Guaranteed Maximum Price which have been authorized by Construction Change Directive until the cost and time have been agreed upon by both the Owner and Contractor, in which case a Change Order is executed to supersede the Construction Change Directive.)

NOT VALID UNTIL SIGNED BY THE ARCHITECT, CONTRACTOR AND OWNER.

| | | |
|---------------------------------------|--|-----------------------------------|
| _____ ARCHITECT <i>(Firm name)</i> | _____ CONTRACTOR <i>(Firm name)</i> | _____ OWNER <i>(Firm name)</i> |
| _____ ADDRESS | _____ ADDRESS | _____ ADDRESS |
| _____ BY <i>(Signature)</i> | _____ BY <i>(Signature)</i> | _____ BY <i>(Signature)</i> |
| _____ <i>(Typed name)</i> | _____ <i>(Typed name)</i> | _____ <i>(Typed name)</i> |
| _____ DATE | _____ DATE | _____ DATE |

CAUTION: You should sign an original AIA Contract Document, on which this text appears in RED. An original assures that changes will not be obscured.



Document G701™ – 2001 Instructions

Change Order

GENERAL INFORMATION

Purpose

AIA Document G701 is for implementing changes in the Work agreed to by the Owner, Contractor and Architect. Execution of a completed G701 indicates agreement upon all the terms of the change, including any changes in the Contract Sum (or Guaranteed Maximum Price) and Contract Time.

Use of Current Documents

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COMPLETING THE G701 FORM

Description of Change in the Contract

Insert a detailed description of the change or reference specific exhibits describing, in detail, the change to be made in the Contract by this Change Order. Include any drawings, specifications, documents or other supporting data to clarify the scope of the change.

Determination of Costs

Insert in the blanks provided, or strike out the terms in parentheses that do not apply, the original Contract Sum or Guaranteed Maximum Price; the net change by previously authorized Change Order (note that this does not include changes authorized by Construction Change Directive unless such changes were subsequently agreed to by the Contractor and recorded as a Change Order); the Contract Sum or Guaranteed Maximum Price prior to this Change Order; the amount of increase or decrease, if any, in the Contract Sum or Guaranteed Maximum Price; and the new Contract Sum or Guaranteed Maximum Price as adjusted by this Change Order.

Change in Contract Time

Insert in the blanks provided, and strike out the unused terms in parentheses, the amount (in days) of the increase or decrease, if any in the Contract Time. Also insert the date of Substantial Completion, including any adjustment effected by this Change Order.

EXECUTION OF THE DOCUMENT

When the Owner and Contractor, in concurrence with the Architect, have reached agreement on the change to be made in the Contract, including any adjustments in the Contract Sum (or Guaranteed Maximum Price) and Contract Time, the G701 document should be executed in triplicate by the two parties and the Architect, each retaining an original.

TO OWNER: PROJECT: _____
 FROM CONTRACTOR: VIA ARCHITECT: _____
 APPLICATION NO: _____ Distribution to:
 PERIOD TO: OWNER
 PROJECT NOS.: ARCHITECT
 CONTRACT DATE: CONTRACTOR

CONTRACT FOR: _____

CONTRACTOR'S APPLICATION FOR PAYMENT
 Application is made for payment, as shown below, in connection with the Contract. Continuation Sheet, AIA Document G703, is attached.

1. ORIGINAL CONTRACT SUM \$ _____
2. Net change by Change Orders \$ _____
3. CONTRACT SUM TO DATE (Line 1 ± 2) \$ _____
4. TOTAL COMPLETED & STORED TO DATE \$ _____
 (Column G on G703)
5. RETAINAGE:
 - a. _____% of Completed Work \$ _____
 (Columns D + E on G703)
 - b. _____% of Stored Material \$ _____
 (Column F on G703)
 Total Retainage (Line 5a + 5b or Total in Column I of G703) \$ _____
6. TOTAL EARNED LESS RETAINAGE \$ _____
 (Line 4 less Line 5 Total)

7. LESS PREVIOUS CERTIFICATES FOR PAYMENT \$ _____
 (Line 6 from prior Certificate)
8. CURRENT PAYMENT DUE \$ _____
9. BALANCE TO FINISH, INCLUDING RETAINAGE \$ _____
 (Line 3 less Line 6)

| CHANGE ORDER SUMMARY | ADDITIONS | DEDUCTIONS |
|--|-----------|------------|
| Total changes approved in previous months by Owner | | |
| Total approved this Month | | |
| TOTALS | | |
| NET CHANGES by Change Order | | |

The undersigned Contractor certifies that to the best of the Contractor's knowledge, information and belief the Work covered by this Application for Payment has been completed in accordance with the Contract Documents, that all amounts have been paid by the Contractor for Work for which previous Certificates for Payment were issued and payments received from the Owner, and that current payment shown herein is now due.

CONTRACTOR:
 By: _____ Date: _____

State of: _____
 County of: _____
 Subscribed and sworn to before me this _____ day of _____
 Notary Public:
 My Commission expires: _____

ARCHITECT'S CERTIFICATE FOR PAYMENT

In accordance with the Contract Documents, based on on-site observations and the data comprising this application, the Architect certifies to the Owner that to the best of the Architect's knowledge, information and belief the Work has progressed as indicated, the quality of the Work is in accordance with the Contract Documents, and the Contractor is entitled to payment of the AMOUNT CERTIFIED.

AMOUNT CERTIFIED \$ _____
 (Attach explanation if amount certified differs from the amount applied for. Initial all figures on this Application and on the Continuation Sheet that are changed to conform to the amount certified.)
 ARCHITECT: _____

By: _____ Date: _____
 This Certificate is not negotiable. The AMOUNT CERTIFIED is payable only to the Contractor named herein. Issuance, payment and acceptance of payment are without prejudice to any rights of the Owner or Contractor under this Contract.

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INSTRUCTION SHEET

FOR AIA DOCUMENT G702

A. GENERAL INFORMATION

1. Purpose and Related Documents

AIA Document G702, Application and Certificate for Payment, is to be used in conjunction with AIA Document G703, Continuation Sheet. These documents are designed to be used on a Project where a Contractor has a direct Agreement with the Owner. Procedures for their use are covered in AIA Document A201, General Conditions of the Contract for Construction, 1987 Edition.

2. Use of Current Documents

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B. COMPLETING THE G702 FORM:

After the Contractor has completed AIA Document G703, Continuation Sheet, summary information should be transferred to AIA Document G702, Application and Certificate for Payment.

The Contractor should sign G702, have it notarized, and submit it, together with G703, to the Architect.

The Architect should review G702 and G703 and, if they are acceptable, complete the Architect's Certificate for Payment on G702. The Architect may certify a different amount than that applied for, pursuant to Paragraphs 9.5 and 9.6 of A201. The Architect should then initial all figures on G702 and G703 that have been changed to conform to the amount certified and attach an explanation. The completed G702 and G703 should be forwarded to the Owner.

The following is an example of an Application for Payment for work in progress. Please note that dollar amounts shown below are for illustrative purposes only, and are not intended to reflect actual construction costs.

CONTRACTOR'S APPLICATION FOR PAYMENT

Application is made for payment, as shown below, in connection with the Contract, Continuation Sheet, AIA Document G703, is attached.

| | |
|---|---------------|
| 1. ORIGINAL CONTRACT SUM | \$ 100,000.00 |
| 2. Net change by Change Orders | \$ 5,000.00 |
| 3. CONTRACT SUM TO DATE (Line 1 + 2) | \$ 105,000.00 |
| 4. TOTAL COMPLETED & STORED TO DATE (Column G on G703) | \$ 40,000.00 |
| 5. RETAINAGE: | |
| a. _____% of Completed Work (Columns D + E on G703) | \$ 3,000.00 |
| b. _____% of Stored Material (Column F on G703) | \$ 500.00 |
| Total Retainage (Line 5a + 5b or Total in Column I of G703) | \$ 3,500.00 |
| 6. TOTAL EARNED LESS RETAINAGE (Line 4 less Line 5 Total) | \$ 36,500.00 |
| 7. LESS PREVIOUS CERTIFICATES FOR PAYMENT (Line 6 from prior Certificate) | \$ 18,000.00 |
| 8. CURRENT PAYMENT DUE | \$ 18,500.00 |
| 9. BALANCE TO FINISH, INCLUDING RETAINAGE (Line 3 less Line 6) | \$ 66,500.00 |

| CHANGE ORDER SUMMARY | ADDITIONS | DEDUCTIONS |
|--|-----------|------------|
| Total changes approved in previous months by Owner | | |
| Total approved this Month | 10,000.00 | 5,000.00 |
| TOTALS | 10,000.00 | 5,000.00 |
| NET CHANGES by Change Order | 5,000.00 | |

The undersigned Contractor certifies that to the best of the Contractor's knowledge, information and belief the Work covered by this Application for Payment has been completed in accordance with the Contract Documents, that all amounts have been paid by the Contractor for Work for which previous Certificates for Payment were issued and payments received from the Owner, and that current payment shown hereon is now due.

CONTRACTOR: Robert Apple
 By: ROBERT APPLE, PRESIDENT Date: AUGUST 1, 1992
 State of: VIRGINIA
 County of: FAIRFAX
 Subscribed and sworn to before me this FIRST day of AUGUST 1992
Jean Smith
 Notary Public,
 My Commission expires: DEC. 31, 1993

ARCHITECT'S CERTIFICATE FOR PAYMENT

In accordance with the Contract Documents, based on on-site observations and the data comprising this application, the Architect certifies to the Owner that to the best of the Architect's knowledge, information and belief the Work has progressed as indicated, the quality of the Work is in accordance with the Contract Documents, and the Contractor is entitled to payment of the AMOUNT CERTIFIED.

AMOUNT CERTIFIED \$ _____

(Attach explanation if amount certified differs from the amount applied for. Initial all figures on this Application and on the Continuation Sheet that are changed to conform to the amount certified.)

ARCHITECT:
 By: _____ Date: _____

This Certificate is not negotiable. The AMOUNT CERTIFIED is payable only to the Contractor named herein. Issuance, payment and acceptance of payment are without prejudice to any rights of the Owner or Contractor under this Contract.

C. MAKING PAYMENT

The Owner should make payment directly to the Contractor based on the amount certified by the Architect on AIA Document G702, Application and Certificate for Payment. The completed form contains the name and address of the Contractor. Payment should not be made to any other party unless specifically indicated on G702.

D. EXECUTION OF THE DOCUMENT

Each person executing the Agreement should indicate the capacity in which they are acting (i.e., president, secretary, partner, etc.) and the authority under which they are executing the Agreement. Where appropriate, a copy of the resolution authorizing the individual to act on behalf of the firm or entity should be attached.

CONTINUATION SHEET

AIA DOCUMENT G703 (Instructions on reverse side)

AIA Document G702, APPLICATION AND CERTIFICATE FOR PAYMENT, containing Contractor's signed Certification, is attached.

In tabulations below, amounts are stated to the nearest dollar.

Use Column I on Contracts where variable retainage for line items may apply.

APPLICATION NO.:

APPLICATION DATE:

PERIOD TO:

ARCHITECT'S PROJECT NO.:

| A ITEM NO. | B DESCRIPTION OF WORK | C SCHEDULED VALUE | D WORK COMPLETED | | E THIS PERIOD | F MATERIALS PRESENTLY STORED (NOT IN D OR E) | G TOTAL COMPLETED AND STORED TO DATE (D+E+F) | H BALANCE TO FINISH (C - G) | I RETAINAGE (IF VARIABLE RATE) |
|---------------|--------------------------|----------------------|-----------------------------------|-------------|------------------|---|---|--------------------------------|-----------------------------------|
| | | | FROM PREVIOUS APPLICATION (D + E) | THIS PERIOD | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |

AIA DOCUMENT G703 • CONTINUATION SHEET FOR G702 • 1992 EDITION • AIA® • ©1992 • THE AMERICAN INSTITUTE OF ARCHITECTS, 1735 NEW YORK AVENUE, N.W., WASHINGTON, D.C. 20006-5292 • WARNING: Unlicensed photocopying violates U.S. copyright laws and will subject the violator to legal prosecution.

G703-1992



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INSTRUCTION SHEET

FOR AIA DOCUMENT G703

A. GENERAL INFORMATION

1. Purpose and Related Documents

AIA Document G702, Application and Certificate for Payment, is to be used in conjunction with AIA Document G703, Continuation Sheet. These documents are designed for use on Projects where the Contractor has a direct Agreement with the Owner. Procedures for their use are covered in AIA Document A201, General Conditions of the Contract for Construction, 1987 Edition.

2. Use of Current Documents

The user should consult the AIA, an AIA component chapter or a current AIA Documents List to determine the current edition of each document.

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B. COMPLETING THE G703 FORM:

Heading: This information should be completed in a manner consistent with similar information on AIA Document G702, Application and Certificate for Payment.

Columns A, B & C: These columns should be completed by identifying the various portions of the Project and their scheduled values consistent with the schedule of values submitted to the Architect at the commencement of the Project or as subsequently adjusted. The breakdown may be by sections of the Work or by Subcontractors and should remain consistent throughout the Project. Multiple pages should be used when required.

Column C should be subtotaled at the bottom when more than one page is used and totaled on the last page. Initially, this total should equal the original Contract Sum. The total of column C may be adjusted by Change Orders during the Project.

Column D: Enter in this column the amount of completed Work covered by the previous application (columns D & E from the previous application). Values from column F (Materials Presently Stored) from the previous application should not be entered in this column.

Column E: Enter here the value of Work completed at the time of this application, including the value of materials incorporated in the project that were listed on the previous application under Materials Presently Stored (column F).

Column F: Enter here the value of Materials Presently Stored for which payment is sought. The total of the column must be recalculated at the end of each pay period. This value covers both materials newly stored for which payment is sought and materials previously stored which are not yet incorporated into the Project. Mere payment by the Owner for stored materials does not result in a deduction from this column. Only as materials are incorporated into the Project is their value deducted from this column and incorporated into column E (Work Completed—This Period.)

Column G: Enter here the total of columns D, E and F. Calculate the percentage completed by dividing column G by column C.

Column H: Enter here the difference between column C (Scheduled Value) and column G (Total Completed and Stored to Date).

Column I: This column is normally used only for contracts where variable retainage is permitted on a line-item basis. It need not be completed on projects where a constant retainage is withheld from the overall contract amount.

Change Orders: Although Change Orders could be incorporated by changing the schedule of values each time a Change Order is added to the Project, this is not normally done. Usually, Change Orders are listed separately, either on their own G703 form or at the end of the basic schedule. The amount of the original contract adjusted by Change Orders is to be entered in the appropriate location on the G702 form.

Construction Change Directives: Amounts not in dispute that have been included in Construction Change Directives should be incorporated into one or more Change Orders. Amounts remaining in dispute should be dealt with according to Paragraph 7.3 in A201.

The following is an example of a Continuation Sheet for work in progress. Please note that dollar amounts shown below are for illustrative purposes only, and are not intended to reflect actual construction costs.

| A ITEM NO. | B DESCRIPTION OF WORK | C SCHEDULED VALUE | D WORK COMPLETED | | F MATERIALS PRESENTLY STORED (NOT IN D OR E) | G TOTAL COMPLETED AND STORED TO DATE (D + E + F) | | H BALANCE TO FINISH (C - G) | I RETAINAGE (IF VARIABLE) RATE |
|---------------|--------------------------|----------------------|-----------------------------------|-------------|---|---|-----|--------------------------------|---|
| | | | FROM PREVIOUS APPLICATION (D + E) | THIS PERIOD | | % (G ÷ C) | | | |
| 1 | MOBILIZATION | 5,000 | 5,000 | 0 | 0 | 5,000 | 100 | 0 | NOT APPLICABLE TO CONSTANT RATE RETAINAGE |
| 2 | STUMP REMOVAL | 5,000 | 5,000 | 0 | 0 | 5,000 | 100 | 0 | |
| 3 | EARTH WORK | 15,000 | 10,000 | 5,000 | 0 | 15,000 | 100 | 0 | |
| 4 | LOWER RETAINING WALL | 10,000 | 0 | 5,000 | 0 | 5,000 | 50 | 5,000 | |
| 5 | CURBS & MISC. CONC. | 5,000 | 0 | 0 | 0 | 0 | 0 | 5,000 | |
| 6 | PAVING, UPPER DRIVE | 20,000 | 0 | 0 | 0 | 0 | 0 | 20,000 | |
| 7 | PAVING, LOWER DRIVE | 20,000 | 0 | 0 | 0 | 0 | 0 | 20,000 | |
| 8 | PAVERS | 10,000 | 0 | 0 | 10,000 | 10,000 | 50 | 10,000 | |
| 9 | BRICK WORK | 5,000 | 0 | 0 | 0 | 0 | 0 | 5,000 | |
| | | 105,000 | 20,000 | 10,000 | 10,000 | 40,000 | | 65,000 | |

Certificate of Substantial Completion

(Instructions on reverse side)

PROJECT:
(Name and address)

PROJECT NUMBER:

OWNER

CONTRACT FOR:

ARCHITECT

CONTRACT DATE:

CONTRACTOR

TO OWNER:
(Name and address)

TO CONTRACTOR:
(Name and address)

FIELD

OTHER

PROJECT OR PORTION OF THE PROJECT DESIGNATED FOR PARTIAL OCCUPANCY OR USE SHALL INCLUDE:

The Work performed under this Contract has been reviewed and found, to the Architect's best knowledge, information and belief, to be substantially complete. Substantial Completion is the stage in the progress of the Work when the Work or designated portion is sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work for its intended use. The date of Substantial Completion of the Project or portion designated above is the date of issuance established by this Certificate, which is also the date of commencement of applicable warranties required by the Contract Documents, except as stated below:

ARCHITECT BY DATE OF ISSUANCE

A list of items to be completed or corrected is attached hereto. The failure to include any items on such list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents. Unless otherwise agreed to in writing, the date of commencement of warranties for items on the attached list will be the date of issuance of the final Certificate of Payment or the date of final payment.

Cost estimate of Work that is incomplete or defective:

The Contractor will complete or correct the Work on the list of items attached hereto within _____ () days from the above date of Substantial Completion.

CONTRACTOR BY DATE

The Owner accepts the Work or designated portion as substantially complete and will assume full possession at _____ (time) on _____ (date).

OWNER BY DATE

The responsibilities of the Owner and Contractor for security, maintenance, heat, utilities, damage to the Work and insurance shall be as follows:
(Note: Owner's and Contractor's legal and insurance counsel should determine and review insurance requirements and coverage.)



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AIA DOCUMENT G704-2000
CERTIFICATE OF
SUBSTANTIAL COMPLETION

Instructions

GENERAL INFORMATION

PURPOSE. This document was developed to establish the date of Substantial Completion for the purpose of commencement of applicable warranties and to allow the Owner to occupy or utilize the Work or designated portion.

RELATED DOCUMENTS. This document was prepared for use under the terms of AIA general conditions, including AIA Document A201, General Conditions of the Contract for Construction, and the general conditions contained in AIA Document A107, Abbreviated Owner-Contractor Agreement Form for Construction Projects of Limited Scope—Stipulated Sum.

USE OF CURRENT DOCUMENTS. Prior to using any AIA document, the user should consult the AIA, an AIA component chapter or a current AIA Documents Price List to determine the current edition of each document.

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A limited license is hereby granted to retail purchasers to reproduce a maximum of TEN copies of a completed or executed G704, but only for use in connection with a particular project.

COMPLETING THE G704 FORM

- After the words "Project or Portion of the Project Designated For Partial Occupancy Or Use Shall Include:"; insert a detailed description of the Project or portion(s) of the Project that have been accepted as being substantially complete.
- Determine Work to be completed. Provide a list of items that are to be completed or corrected and attach.
- Determine dates for completion of the Work.
- Establish an amount to be withheld to complete the Work.

EXECUTION OF THE DOCUMENT

The G704 document should be executed in not less than triplicate by the Owner, Architect and Contractor, each of whom retains an original.



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AIA DOCUMENT G704-2000
INSTRUCTIONS

CONTRACTOR'S AFFIDAVIT OF PAYMENT OF DEBTS AND CLAIMS

AIA Document G706

(Instructions on reverse side)

OWNER
ARCHITECT
CONTRACTOR
SURETY
OTHER

TO OWNER:
(Name and address)

ARCHITECT'S PROJECT NO.:

CONTRACT FOR:

PROJECT:
(Name and address)

CONTRACT DATED:

STATE OF:
COUNTY OF:

The undersigned hereby certifies that, except as listed below, payment has been made in full and all obligations have otherwise been satisfied for all materials and equipment furnished, for all work, labor, and services performed, and for all known indebtedness and claims against the Contractor for damages arising in any manner in connection with the performance of the Contract referenced above for which the Owner or Owner's property might in any way be held responsible or encumbered.

EXCEPTIONS:

SUPPORTING DOCUMENTS ATTACHED HERETO:

1. Consent of Surety to Final Payment. Whenever Surety is involved, Consent of Surety is required. AIA Document G707, Consent of Surety, may be used for this purpose.

Indicate attachment: yes no

The following supporting documents should be attached hereto if required by the Owner:

1. Contractor's Release or Waiver of Liens, conditional upon receipt of final payment.
2. Separate Releases or Waivers of Liens from Subcontractors and material and equipment suppliers, to the extent required by the Owner, accompanied by a list thereof.
3. Contractor's Affidavit of Release of Liens (AIA Document G706A).

CONTRACTOR:
(Name and address)

BY: _____
(Signature of authorized representative)

(Printed name and title)

Subscribed and sworn to before me on this date:

Notary Public:

My Commission Expires:



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INSTRUCTION SHEET

FOR AIA DOCUMENT G706, CONTRACTOR'S AFFIDAVIT OF PAYMENT OF DEBTS AND CLAIMS

A. GENERAL INFORMATION

1. Purpose

This document is intended for use when the Contractor is required to provide a sworn statement verifying that debts and claims have been settled, except for those listed by the Contractor under "EXCEPTIONS" in the document. G706 is typically executed as a condition of final payment.

2. Related Documents

This document may be used with most of the AIA's Owner-Contractor agreements and general conditions, such as A201 and its related family of documents. G706 also requires the attachment of several supporting documents, including G706A, Contractor's Affidavit of Release of Liens, and G707, Consent of Surety to Reduction in or Release of Retainage.

3. Use of Current Documents

Prior to using any AIA document, the user should consult the AIA, an AIA component chapter or a current AIA Documents List to determine the current edition of each document.

4. Limited License for Reproduction

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B. CHANGES FROM THE PREVIOUS EDITION

A cross-reference to AIA Document A201 has been deleted to permit the use of G706 with other families of AIA documents, including construction management, interiors and design/build.

C. COMPLETING THE G706 FORM

GENERAL: The Owner-Contractor Agreement is the usual source of required information such as the contract date and the names and addresses of the Owner, Project and Contractor.

ARCHITECT'S PROJECT NO.: This information is typically supplied by the Architect and entered on the form by the Contractor.

CONTRACT FOR: This refers to the scope of the contract, such as "General Construction" or "Mechanical Work".

AFFIDAVIT: Indicate the state and county where the Affidavit is made. This is not necessarily the same location as the Project, but should be the location where the notary is authorized to administer sworn oaths. If there are any EXCEPTIONS to the statement, these should be listed in the space provided; otherwise enter as "None". It may be a stipulation of the Contract Documents that the Owner has the right to require the Contractor to furnish a bond to cover each exception listed on the Affidavit.

SUPPORTING DOCUMENTS: The AIA documents listed as attachments to the G706 form should be of the same (current) edition date as G706. The AIA does not publish a "Release or Waiver of Liens" for contractors or subcontractors because of the great diversity of releases or waivers permitted by various state mechanics lien laws. Forms for such purposes may be available from local contractors' associations or may be written with the assistance of legal counsel.

D. EXECUTION OF THE DOCUMENT

The Notary Public should administer a sworn oath to the Contractor referencing the written statements appearing on G706, and should duly sign and seal this document containing the Contractor's signature. G706 should be signed by the Contractor or the Contractor's authorized representative.

CONTRACTOR'S AFFIDAVIT OF RELEASE OF LIENS

AIA Document G706A

(Instructions on reverse side)

OWNER
ARCHITECT
CONTRACTOR
SURETY
OTHER

TO OWNER:
(Name and address)

ARCHITECT'S PROJECT NO.:

CONTRACT FOR:

PROJECT:
(Name and address)

CONTRACT DATED:

STATE OF:
COUNTY OF:

The undersigned hereby certifies that to the best of the undersigned's knowledge, information and belief, except as listed below, the Releases or Waivers of Lien attached hereto include the Contractor, all Subcontractors, all suppliers of materials and equipment, and all performers of Work, labor or services who have or may have liens or encumbrances or the right to assert liens or encumbrances against any property of the Owner arising in any manner out of the performance of the Contract referenced above.

EXCEPTIONS:

SUPPORTING DOCUMENTS ATTACHED HERETO:

1. Contractor's Release or Waiver of Liens, conditional upon receipt of final payment.
2. Separate Releases or Waivers of Liens from Subcontractors and material and equipment suppliers, to the extent required by the Owner, accompanied by a list thereof.

CONTRACTOR:
(Name and address)

BY: _____
(Signature of authorized representative)

(Printed name and title)

Subscribed and sworn to before me on this date:

Notary Public:

My Commission Expires:



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G706A—1994

INSTRUCTION SHEET

FOR AIA DOCUMENT G706A, CONTRACTOR'S AFFIDAVIT OF RELEASE OF LIENS

A. GENERAL INFORMATION

1. Purpose

This document is intended for use as a companion to AIA Document G706, Contractor's Affidavit of Payment of Debts and Claims.

2. Related Documents

This document may be used with most of the AIA's Owner-Contractor agreements and general conditions, such as A201 and its related family of documents. As noted above, G706A is a companion document to AIA Document G706.

3. Use of Current Documents

Prior to using any AIA document, the user should consult the AIA, an AIA component chapter or a current AIA Documents List to determine the current edition of each document.

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B. CHANGES FROM THE PREVIOUS EDITION

A cross-reference to AIA Document A201 has been deleted to permit the use of G706A with other families of AIA documents, including construction management, interiors and design/build.

C. COMPLETING THE G706A FORM

GENERAL: The Owner-Contractor Agreement is the usual source of required information such as the contract date and the names and addresses of the Owner, Project and Contractor.

ARCHITECT'S PROJECT NO.: This information is typically supplied by the Architect and entered on the form by the Contractor.

CONTRACT FOR: This refers to the scope of the contract, such as "General Construction" or "Mechanical Work".

AFFIDAVIT: Indicate the state and county where the Affidavit is made. This is not necessarily the same location as the Project, but should be the location where the notary is authorized to administer sworn oaths. If there are any EXCEPTIONS to the statement, these should be listed in the space provided; otherwise enter as "None". It may be a stipulation of the Contract Documents that the Owner has the right to require the Contractor to furnish a bond to cover each exception listed on the Affidavit.

SUPPORTING DOCUMENTS: The AIA does not publish a "Release or Waiver of Liens" for contractors or subcontractors because of the great diversity of releases or waivers permitted by various state mechanics lien laws. Forms for such purposes may be available from local contractors' associations or may be written with the assistance of legal counsel.

D. EXECUTION OF THE DOCUMENT

The Notary Public should administer a sworn oath to the Contractor referencing the written statements appearing on G706A, and should duly sign and seal this document containing the Contractor's signature. G706A should be signed by the Contractor or the Contractor's authorized representative.

**CONSENT OF SURETY
TO FINAL PAYMENT**

AIA Document G707

(Instructions on reverse side)

- OWNER
- ARCHITECT
- CONTRACTOR
- SURETY
- OTHER

TO OWNER:
(Name and address)

ARCHITECT'S PROJECT NO.:

CONTRACT FOR:

PROJECT:
(Name and address)

CONTRACT DATED:

In accordance with the provisions of the Contract between the Owner and the Contractor as indicated above, the
(Insert name and address of Surety)

, SURETY,

on bond of
(Insert name and address of Contractor)

, CONTRACTOR,

hereby approves of the final payment to the Contractor, and agrees that final payment to the Contractor shall not relieve the Surety of any of its obligations to
(Insert name and address of Owner)

, OWNER,

as set forth in said Surety's bond.

IN WITNESS WHEREOF, the Surety has hereunto set its hand on this date:
(Insert in writing the month followed by the numeric date and year.)

(Surety)

(Signature of authorized representative)

Attest:
(Seal):

(Printed name and title)



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INSTRUCTION SHEET

FOR AIA DOCUMENT G707, CONSENT OF SURETY TO FINAL PAYMENT

A. GENERAL INFORMATION

1. Purpose

This document is intended for use as a companion to AIA Document G706, Contractor's Affidavit of Payment of Debts and Claims, on construction projects where the Contractor is required to furnish a bond. By obtaining the Surety's approval of final payment to the Contractor and its agreement that final payment will not relieve the Surety of any of its obligations, the Owner may preserve its rights under the bond.

2. Related Documents

This document may be used with most of the AIA's Owner-Contractor agreements and general conditions, such as A201 and its related family of documents. As noted above, this is a companion document to AIA Document G706.

3. Use of Current Documents

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B. CHANGES FROM THE PREVIOUS EDITION

Changes in the location of various items of information were made, without revision to the substance of the document.

C. COMPLETING THE G707 FORM

GENERAL: The bond form is the usual source of required information such as the contract date and the names and addresses of the Surety, Owner, Contractor and Project.

ARCHITECT'S PROJECT NO.: This information is typically supplied by the Architect and entered on the form by the Contractor.

CONTRACT FOR: This refers to the scope of the contract, such as "General Construction" or "Mechanical Work".

D. EXECUTION OF THE DOCUMENT

The G707 form requires both the Surety's seal and the signature of the Surety's authorized representative.

CONSENT OF SURETY TO REDUCTION IN OR PARTIAL RELEASE OF RETAINAGE

AIA Document G707A

(Instructions on reverse side)

| | |
|------------|--------------------------|
| OWNER | <input type="checkbox"/> |
| ARCHITECT | <input type="checkbox"/> |
| CONTRACTOR | <input type="checkbox"/> |
| SURETY | <input type="checkbox"/> |
| OTHER | <input type="checkbox"/> |

TO OWNER:
(Name and address)

ARCHITECT'S PROJECT NO.:

CONTRACT FOR:

PROJECT:
(Name and address)

CONTRACT DATED:

In accordance with the provisions of the Contract between the Owner and the Contractor as indicated above, the
(Insert name and address of Surety)

, SURETY,

on bond of
(Insert name and address of Contractor)

, CONTRACTOR,

hereby approves the reduction in or partial release of retainage to the Contractor as follows:

The Surety agrees that such reduction in or partial release of retainage to the Contractor shall not relieve the Surety of any of its obligations to
(Insert name and address of Owner)

, OWNER,

as set forth in said Surety's bond.

IN WITNESS WHEREOF, the Surety has hereunto set its hand on this date:
(Insert in writing the month followed by the numeric date and year.)

(Surety)

(Signature of authorized representative)

Attest:
(Seal):

(Printed name and title)



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G707A—1994

INSTRUCTION SHEET

FOR AIA DOCUMENT G707A, CONSENT OF SURETY TO FINAL REDUCTION IN OR PARTIAL RELEASE OF RETAINAGE

A. GENERAL INFORMATION

1. Purpose

This document is intended for use when the Contractor requests a reduction or release of retainage from the Owner. The G707A form, when duly executed, assures the Owner that such reduction or partial release of retainage does not relieve the Surety of its obligations.

2. Related Documents

This document may be used with most of the AIA's Owner-Contractor agreements and general conditions, such as A201 and its related family of documents. It is often used as accompanying documentation to AIA Document G702, Application and Certificate for Payment, when release or reduction of retainage is requested by the Contractor.

3. Use of Current Documents

Prior to using any AIA document, the user should consult the AIA, an AIA component chapter or a current AIA Documents List to determine the current edition of each document.

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B. CHANGES FROM THE PREVIOUS EDITION

Changes in the location of various items of information were made, without revision to the substance of the document.

C. COMPLETING THE G707A FORM

GENERAL: The Owner-Contractor Agreement is the usual source of required information such as the contract date and the names and addresses of the Owner, Project and Contractor.

ARCHITECT'S PROJECT NO.: This information is typically supplied by the Architect and entered on the form by the Contractor.

CONTRACT FOR: This refers to the scope of the contract, such as "General Construction" or "Mechanical Work".

D. EXECUTION OF THE DOCUMENT

The G707A form requires both the Surety's seal and the signature of the Surety's authorized representative.

COMPLIANCE STATEMENT

This statement relates to a proposed contract with _____

(Name of borrower or grantee)

who expects to finance the contract with assistance from either the Rural Housing Service (RHS), Rural Business-Cooperative Service (RBS), or the Rural Utilities Service (RUS) or their successor agencies, United States Department of Agriculture (whether by a loan, grant, loan insurance, guarantee, or other form of financial assistance). I am the undersigned bidder or prospective contractor, I represent that:

1. I have, have not, participated in a previous contract or subcontract subject to Executive Order 11246 (regarding equal employment opportunity) or a preceding similar Executive Order.
2. If I have participated in such a contract or subcontract, I have, have not, filed all compliance reports that have been required to file in connection with the contract or subcontract.

If the proposed contract is for \$50,000 or more and I have 50 or more employees, I also represent that:

3. I have, have not previously had contracts subject to the written affirmative action programs requirements of the Secretary of Labor.
4. If I have participated in such a contract or subcontract, I have, have not developed and placed on file at each establishment affirmative action programs as required by the rules and regulations of the Secretary of Labor.

I understand that if I have failed to file any compliance reports that have been required of me, I am not eligible and will not be eligible to have my bid considered or to enter into the proposed contract unless and until I make an arrangement regarding such reports that is satisfactory to either the RHS, RBS or RUS, or to the office where the reports are required to be filed.

I also certify that I do not maintain or provide for my employees any segregated facilities at any of my establishments, and that I do not permit my employees to perform their services at any location, under my control, where segregated facilities are maintained. I certify further that I will not maintain or provide for my employees any segregated facilities at any of my establishments, and that I will not permit my employees to perform their services at any location, under my control, where segregated facilities are maintained. I agree that a breach of this certification is a violation of the Equal Opportunity clause in my contract. As used in this certification, the term "segregated facilities" means any waiting rooms, work areas, restrooms and wash rooms, restaurants and other eating areas time clocks, locker rooms and other storage or dressing areas, parking lots, drinking fountains, recreation or entertainment areas, transportation, and housing facilities provided for employees which are segregated by explicit directive or are in fact segregated on the basis of race, creed, color, or national origin, because of habit, local custom, or otherwise. I further agree that (except where I have obtained identical certifications for proposed subcontractors for specific time periods) I will obtain identical certifications from proposed subcontractors prior to the award of subcontracts exceeding \$10,000 which are not exempt from the provisions of the Equal Opportunity clause; that I will retain such certifications in my files; and that I will forward the following notice to such proposed subcontractors (except where the proposed subcontractors have submitted identical certifications for specific time periods): (See Reverse).

According to the Paperwork Reduction Act of 1995, an agency may not conduct or sponsor, and a person is not required to respond to a collection of information unless it displays the valid OMB control number. The valid OMB control number for this information collection is 0575-0018. The time required to complete this information collection is estimated to average 10 minutes per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information.

**NOTICE TO PROSPECTIVE SUBCONTRACTORS OF REQUIREMENTS FOR
CERTIFICATIONS OF NON-SEGREGATED FACILITIES**

A certification of Nonsegregated Facilities, as required by the May 9, 1967, order (32F.R. 7439, may 19, 1967) on Elimination of Segregated Facilities, by the Secretary of Labor, must be submitted prior to the award of a subcontract exceeding \$ 10,000 which is not exempt from the provisions of the Equal Opportunity clause. The certification may be submitted either for each subcontract or for all subcontracts during a period (i.e., quarterly, semiannually, or annually).

NOTE: The penalty for making false statements in offers is prescribed in 18 U.S.C. 1001.

Date _____

(Signature of Bidder or Prospective Contractor)

Address (including Zip Code)

CERTIFICATION FOR CONTRACTS, GRANTS AND LOANS

The undersigned certifies, to the best of his or her knowledge and belief, that:

1. No Federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant or Federal loan, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant or loan.

2. If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant or loan, the undersigned shall complete and submit Standard Form - LLL, "Disclosure of Lobbying Activities," in accordance with its instructions.

3. The undersigned shall require that the language of this certification be included in the award documents for all subawards at all tiers (including contracts, subcontracts, and subgrants under grants and loans) and that all subrecipients shall certify and disclose accordingly.

This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by section 1352, title 31, U.S. Code. Any person who fails to file the required certification shall be subject to a civil penalty of not less than \$10,000 and not more than \$100,000 for each such failure.

(name)

(date)

(title)

000



AIA[®] Document A201[™] – 2007

General Conditions of the Contract for Construction

for the following PROJECT:
(Name and location or address)

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

THE OWNER:
(Name, legal status and address)

THE ARCHITECT:
(Name, legal status and address)

TABLE OF ARTICLES

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ARTICLE 1 GENERAL PROVISIONS

§ 1.1 Basic Definitions

§ 1.1.1 The Contract Documents

The Contract Documents are enumerated in the Agreement between the Owner and Contractor (hereinafter the Agreement) and consist of the Agreement, Conditions of the Contract (General, Supplementary and other Conditions), Drawings, Specifications, Addenda issued prior to execution of the Contract, other documents listed in the Agreement and Modifications issued after execution of the Contract. A Modification is (1) a written amendment to the Contract signed by both parties, (2) a Change Order, (3) a Construction Change Directive or (4) a written order for a minor change in the Work issued by the Architect. Unless specifically enumerated in the Agreement, the Contract Documents do not include the advertisement or invitation to bid, Instructions to Bidders, sample forms, other information furnished by the Owner in anticipation of receiving bids or proposals, the Contractor's bid or proposal, or portions of Addenda relating to bidding requirements.

§ 1.1.2 The Contract

The Contract Documents form the Contract for Construction. The Contract represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations or agreements, either written or oral. The Contract may be amended or modified only by a Modification. The Contract Documents shall not be construed to create a contractual relationship of any kind (1) between the Contractor and the Architect or the Architect's consultants, (2) between the Owner and a Subcontractor or a Sub-subcontractor, (3) between the Owner and the Architect or the Architect's consultants or (4) between any persons or entities other than the Owner and the Contractor. The Architect shall, however, be entitled to performance and enforcement of obligations under the Contract intended to facilitate performance of the Architect's duties.

§ 1.1.3 The Work

The term "Work" means the construction and services required by the Contract Documents, whether completed or partially completed, and includes all other labor, materials, equipment and services provided or to be provided by the Contractor to fulfill the Contractor's obligations. The Work may constitute the whole or a part of the Project.

§ 1.1.4 The Project

The Project is the total construction of which the Work performed under the Contract Documents may be the whole or a part and which may include construction by the Owner and by separate contractors.

§ 1.1.5 The Drawings

The Drawings are the graphic and pictorial portions of the Contract Documents showing the design, location and dimensions of the Work, generally including plans, elevations, sections, details, schedules and diagrams.

§ 1.1.6 The Specifications

The Specifications are that portion of the Contract Documents consisting of the written requirements for materials, equipment, systems, standards and workmanship for the Work, and performance of related services.

§ 1.1.7 Instruments Of Service

Instruments of Service are representations, in any medium of expression now known or later developed, of the tangible and intangible creative work performed by the Architect and the Architect's consultants under their respective professional services agreements. Instruments of Service may include, without limitation, studies, surveys, models, sketches, drawings, specifications, and other similar materials.

§ 1.1.8 Initial Decision Maker

The Initial Decision Maker is the person identified in the Agreement to render initial decisions on Claims in accordance with Section 15.2 and certify termination of the Agreement under Section 14.2.2.

§ 1.2 Correlation and Intent of the Contract Documents

§ 1.2.1 The intent of the Contract Documents is to include all items necessary for the proper execution and completion of the Work by the Contractor. The Contract Documents are complementary, and what is required by one shall be as binding as if required by all; performance by the Contractor shall be required only to the extent consistent with the Contract Documents and reasonably inferable from them as being necessary to produce the indicated results.

§ 1.2.2 Organization of the Specifications into divisions, sections and articles, and arrangement of Drawings shall not control the Contractor in dividing the Work among Subcontractors or in establishing the extent of Work to be performed by any trade.

§ 1.2.3 Unless otherwise stated in the Contract Documents, words that have well-known technical or construction industry meanings are used in the Contract Documents in accordance with such recognized meanings.

§ 1.3 Capitalization

Terms capitalized in these General Conditions include those that are (1) specifically defined, (2) the titles of numbered articles or (3) the titles of other documents published by the American Institute of Architects.

§ 1.4 Interpretation

In the interest of brevity the Contract Documents frequently omit modifying words such as “all” and “any” and articles such as “the” and “an,” but the fact that a modifier or an article is absent from one statement and appears in another is not intended to affect the interpretation of either statement.

§ 1.5 Ownership and Use of Drawings, Specifications and Other Instruments of Service

§ 1.5.1 The Architect and the Architect’s consultants shall be deemed the authors and owners of their respective Instruments of Service, including the Drawings and Specifications, and will retain all common law, statutory and other reserved rights, including copyrights. The Contractor, Subcontractors, Sub-subcontractors, and material or equipment suppliers shall not own or claim a copyright in the Instruments of Service. Submittal or distribution to meet official regulatory requirements or for other purposes in connection with this Project is not to be construed as publication in derogation of the Architect’s or Architect’s consultants’ reserved rights.

§ 1.5.2 The Contractor, Subcontractors, Sub-subcontractors and material or equipment suppliers are authorized to use and reproduce the Instruments of Service provided to them solely and exclusively for execution of the Work. All copies made under this authorization shall bear the copyright notice, if any, shown on the Instruments of Service. The Contractor, Subcontractors, Sub-subcontractors, and material or equipment suppliers may not use the Instruments of Service on other projects or for additions to this Project outside the scope of the Work without the specific written consent of the Owner, Architect and the Architect’s consultants.

§ 1.6 Transmission of Data in Digital Form

If the parties intend to transmit Instruments of Service or any other information or documentation in digital form, they shall endeavor to establish necessary protocols governing such transmissions, unless otherwise already provided in the Agreement or the Contract Documents.

ARTICLE 2 OWNER

§ 2.1 General

§ 2.1.1 The Owner is the person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The Owner shall designate in writing a representative who shall have express authority to bind the Owner with respect to all matters requiring the Owner’s approval or authorization. Except as otherwise provided in Section 4.2.1, the Architect does not have such authority. The term “Owner” means the Owner or the Owner’s authorized representative.

§ 2.1.2 The Owner shall furnish to the Contractor within fifteen days after receipt of a written request, information necessary and relevant for the Contractor to evaluate, give notice of or enforce mechanic’s lien rights. Such information shall include a correct statement of the record legal title to the property on which the Project is located, usually referred to as the site, and the Owner’s interest therein.

§ 2.2 Information and Services Required of the Owner

§ 2.2.1 Prior to commencement of the Work, the Contractor may request in writing that the Owner provide reasonable evidence that the Owner has made financial arrangements to fulfill the Owner’s obligations under the Contract. Thereafter, the Contractor may only request such evidence if (1) the Owner fails to make payments to the Contractor as the Contract Documents require; (2) a change in the Work materially changes the Contract Sum; or (3) the Contractor identifies in writing a reasonable concern regarding the Owner’s ability to make payment when due. The Owner shall furnish such evidence as a condition precedent to commencement or continuation of the Work or the portion of the Work affected by a material change. After the Owner furnishes the evidence, the Owner shall not materially vary such financial arrangements without prior notice to the Contractor.

§ 2.2.2 Except for permits and fees that are the responsibility of the Contractor under the Contract Documents, including those required under Section 3.7.1, the Owner shall secure and pay for necessary approvals, easements, assessments and charges required for construction, use or occupancy of permanent structures or for permanent changes in existing facilities.

§ 2.2.3 The Owner shall furnish surveys describing physical characteristics, legal limitations and utility locations for the site of the Project, and a legal description of the site. The Contractor shall be entitled to rely on the accuracy of information furnished by the Owner but shall exercise proper precautions relating to the safe performance of the Work.

§ 2.2.4 The Owner shall furnish information or services required of the Owner by the Contract Documents with reasonable promptness. The Owner shall also furnish any other information or services under the Owner's control and relevant to the Contractor's performance of the Work with reasonable promptness after receiving the Contractor's written request for such information or services.

§ 2.2.5 Unless otherwise provided in the Contract Documents, the Owner shall furnish to the Contractor one copy of the Contract Documents for purposes of making reproductions pursuant to Section 1.5.2.

§ 2.3 Owner's Right to Stop the Work

If the Contractor fails to correct Work that is not in accordance with the requirements of the Contract Documents as required by Section 12.2 or repeatedly fails to carry out Work in accordance with the Contract Documents, the Owner may issue a written order to the Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, the right of the Owner to stop the Work shall not give rise to a duty on the part of the Owner to exercise this right for the benefit of the Contractor or any other person or entity, except to the extent required by Section 6.1.3.

§ 2.4 Owner's Right to Carry Out the Work

If the Contractor defaults or neglects to carry out the Work in accordance with the Contract Documents and fails within a ten-day period after receipt of written notice from the Owner to commence and continue correction of such default or neglect with diligence and promptness, the Owner may, without prejudice to other remedies the Owner may have, correct such deficiencies. In such case an appropriate Change Order shall be issued deducting from payments then or thereafter due the Contractor the reasonable cost of correcting such deficiencies, including Owner's expenses and compensation for the Architect's additional services made necessary by such default, neglect or failure. Such action by the Owner and amounts charged to the Contractor are both subject to prior approval of the Architect. If payments then or thereafter due the Contractor are not sufficient to cover such amounts, the Contractor shall pay the difference to the Owner.

ARTICLE 3 CONTRACTOR

§ 3.1 General

§ 3.1.1 The Contractor is the person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The Contractor shall be lawfully licensed, if required in the jurisdiction where the Project is located. The Contractor shall designate in writing a representative who shall have express authority to bind the Contractor with respect to all matters under this Contract. The term "Contractor" means the Contractor or the Contractor's authorized representative.

§ 3.1.2 The Contractor shall perform the Work in accordance with the Contract Documents.

§ 3.1.3 The Contractor shall not be relieved of obligations to perform the Work in accordance with the Contract Documents either by activities or duties of the Architect in the Architect's administration of the Contract, or by tests, inspections or approvals required or performed by persons or entities other than the Contractor.

§ 3.2 Review of Contract Documents and Field Conditions by Contractor

§ 3.2.1 Execution of the Contract by the Contractor is a representation that the Contractor has visited the site, become generally familiar with local conditions under which the Work is to be performed and correlated personal observations with requirements of the Contract Documents.

§ 3.2.2 Because the Contract Documents are complementary, the Contractor shall, before starting each portion of the Work, carefully study and compare the various Contract Documents relative to that portion of the Work, as well as the information furnished by the Owner pursuant to Section 2.2.3, shall take field measurements of any existing conditions related to that portion of the Work, and shall observe any conditions at the site affecting it. These obligations are for the purpose of facilitating coordination and construction by the Contractor and are not for the purpose of discovering errors, omissions, or inconsistencies in the Contract Documents; however, the Contractor shall promptly report to the Architect any errors, inconsistencies or omissions discovered by or made known to the Contractor as a request for information in such form as the Architect may require. It is recognized that the Contractor's review is made in the Contractor's capacity as a contractor and not as a licensed design professional, unless otherwise specifically provided in the Contract Documents.

§ 3.2.3 The Contractor is not required to ascertain that the Contract Documents are in accordance with applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of public authorities, but the Contractor shall promptly report to the Architect any nonconformity discovered by or made known to the Contractor as a request for information in such form as the Architect may require.

§ 3.2.4 If the Contractor believes that additional cost or time is involved because of clarifications or instructions the Architect issues in response to the Contractor's notices or requests for information pursuant to Sections 3.2.2 or 3.2.3, the Contractor shall make Claims as provided in Article 15. If the Contractor fails to perform the obligations of Sections 3.2.2 or 3.2.3, the Contractor shall pay such costs and damages to the Owner as would have been avoided if the Contractor had performed such obligations. If the Contractor performs those obligations, the Contractor shall not be liable to the Owner or Architect for damages resulting from errors, inconsistencies or omissions in the Contract Documents, for differences between field measurements or conditions and the Contract Documents, or for nonconformities of the Contract Documents to applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities.

§ 3.3 Supervision and Construction Procedures

§ 3.3.1 The Contractor shall supervise and direct the Work, using the Contractor's best skill and attention. The Contractor shall be solely responsible for, and have control over, construction means, methods, techniques, sequences and procedures and for coordinating all portions of the Work under the Contract, unless the Contract Documents give other specific instructions concerning these matters. If the Contract Documents give specific instructions concerning construction means, methods, techniques, sequences or procedures, the Contractor shall evaluate the jobsite safety thereof and, except as stated below, shall be fully and solely responsible for the jobsite safety of such means, methods, techniques, sequences or procedures. If the Contractor determines that such means, methods, techniques, sequences or procedures may not be safe, the Contractor shall give timely written notice to the Owner and Architect and shall not proceed with that portion of the Work without further written instructions from the Architect. If the Contractor is then instructed to proceed with the required means, methods, techniques, sequences or procedures without acceptance of changes proposed by the Contractor, the Owner shall be solely responsible for any loss or damage arising solely from those Owner-required means, methods, techniques, sequences or procedures.

§ 3.3.2 The Contractor shall be responsible to the Owner for acts and omissions of the Contractor's employees, Subcontractors and their agents and employees, and other persons or entities performing portions of the Work for, or on behalf of, the Contractor or any of its Subcontractors.

§ 3.3.3 The Contractor shall be responsible for inspection of portions of Work already performed to determine that such portions are in proper condition to receive subsequent Work.

§ 3.4 Labor and Materials

§ 3.4.1 Unless otherwise provided in the Contract Documents, the Contractor shall provide and pay for labor, materials, equipment, tools, construction equipment and machinery, water, heat, utilities, transportation, and other facilities and services necessary for proper execution and completion of the Work, whether temporary or permanent and whether or not incorporated or to be incorporated in the Work.

§ 3.4.2 Except in the case of minor changes in the Work authorized by the Architect in accordance with Sections 3.12.8 or 7.4, the Contractor may make substitutions only with the consent of the Owner, after evaluation by the Architect and in accordance with a Change Order or Construction Change Directive.

§ 3.4.3 The Contractor shall enforce strict discipline and good order among the Contractor's employees and other persons carrying out the Work. The Contractor shall not permit employment of unfit persons or persons not properly skilled in tasks assigned to them.

§ 3.5 Warranty

The Contractor warrants to the Owner and Architect that materials and equipment furnished under the Contract will be of good quality and new unless the Contract Documents require or permit otherwise. The Contractor further warrants that the Work will conform to the requirements of the Contract Documents and will be free from defects, except for those inherent in the quality of the Work the Contract Documents require or permit. Work, materials, or equipment not conforming to these requirements may be considered defective. The Contractor's warranty excludes remedy for damage or defect caused by abuse, alterations to the Work not executed by the Contractor, improper or insufficient maintenance, improper operation, or normal wear and tear and normal usage. If required by the Architect, the Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment.

§ 3.6 Taxes

The Contractor shall pay sales, consumer, use and similar taxes for the Work provided by the Contractor that are legally enacted when bids are received or negotiations concluded, whether or not yet effective or merely scheduled to go into effect.

§ 3.7 Permits, Fees, Notices and Compliance with Laws

§ 3.7.1 Unless otherwise provided in the Contract Documents, the Contractor shall secure and pay for the building permit as well as for other permits, fees, licenses, and inspections by government agencies necessary for proper execution and completion of the Work that are customarily secured after execution of the Contract and legally required at the time bids are received or negotiations concluded.

§ 3.7.2 The Contractor shall comply with and give notices required by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities applicable to performance of the Work.

§ 3.7.3 If the Contractor performs Work knowing it to be contrary to applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of public authorities, the Contractor shall assume appropriate responsibility for such Work and shall bear the costs attributable to correction.

§ 3.7.4 Concealed or Unknown Conditions

If the Contractor encounters conditions at the site that are (1) subsurface or otherwise concealed physical conditions that differ materially from those indicated in the Contract Documents or (2) unknown physical conditions of an unusual nature that differ materially from those ordinarily found to exist and generally recognized as inherent in construction activities of the character provided for in the Contract Documents, the Contractor shall promptly provide notice to the Owner and the Architect before conditions are disturbed and in no event later than 21 days after first observance of the conditions. The Architect will promptly investigate such conditions and, if the Architect determines that they differ materially and cause an increase or decrease in the Contractor's cost of, or time required for, performance of any part of the Work, will recommend an equitable adjustment in the Contract Sum or Contract Time, or both. If the Architect determines that the conditions at the site are not materially different from those indicated in the Contract Documents and that no change in the terms of the Contract is justified, the Architect shall promptly notify the Owner and Contractor in writing, stating the reasons. If either party disputes the Architect's determination or recommendation, that party may proceed as provided in Article 15.

§ 3.7.5 If, in the course of the Work, the Contractor encounters human remains or recognizes the existence of burial markers, archaeological sites or wetlands not indicated in the Contract Documents, the Contractor shall immediately suspend any operations that would affect them and shall notify the Owner and Architect. Upon receipt of such notice, the Owner shall promptly take any action necessary to obtain governmental authorization required to resume the operations. The Contractor shall continue to suspend such operations until otherwise instructed by the Owner but shall continue with all other operations that do not affect those remains or features. Requests for adjustments in the Contract Sum and Contract Time arising from the existence of such remains or features may be made as provided in Article 15.

§ 3.8 Allowances

§ 3.8.1 The Contractor shall include in the Contract Sum all allowances stated in the Contract Documents. Items covered by allowances shall be supplied for such amounts and by such persons or entities as the Owner may direct,

but the Contractor shall not be required to employ persons or entities to whom the Contractor has reasonable objection.

§ 3.8.2 Unless otherwise provided in the Contract Documents,

- .1 allowances shall cover the cost to the Contractor of materials and equipment delivered at the site and all required taxes, less applicable trade discounts;
- .2 Contractor's costs for unloading and handling at the site, labor, installation costs, overhead, profit and other expenses contemplated for stated allowance amounts shall be included in the Contract Sum but not in the allowances; and
- .3 whenever costs are more than or less than allowances, the Contract Sum shall be adjusted accordingly by Change Order. The amount of the Change Order shall reflect (1) the difference between actual costs and the allowances under Section 3.8.2.1 and (2) changes in Contractor's costs under Section 3.8.2.2.

§ 3.8.3 Materials and equipment under an allowance shall be selected by the Owner with reasonable promptness.

§ 3.9 Superintendent

§ 3.9.1 The Contractor shall employ a competent superintendent and necessary assistants who shall be in attendance at the Project site during performance of the Work. The superintendent shall represent the Contractor, and communications given to the superintendent shall be as binding as if given to the Contractor.

§ 3.9.2 The Contractor, as soon as practicable after award of the Contract, shall furnish in writing to the Owner through the Architect the name and qualifications of a proposed superintendent. The Architect may reply within 14 days to the Contractor in writing stating (1) whether the Owner or the Architect has reasonable objection to the proposed superintendent or (2) that the Architect requires additional time to review. Failure of the Architect to reply within the 14 day period shall constitute notice of no reasonable objection.

§ 3.9.3 The Contractor shall not employ a proposed superintendent to whom the Owner or Architect has made reasonable and timely objection. The Contractor shall not change the superintendent without the Owner's consent, which shall not unreasonably be withheld or delayed.

§ 3.10 Contractor's Construction Schedules

§ 3.10.1 The Contractor, promptly after being awarded the Contract, shall prepare and submit for the Owner's and Architect's information a Contractor's construction schedule for the Work. The schedule shall not exceed time limits current under the Contract Documents, shall be revised at appropriate intervals as required by the conditions of the Work and Project, shall be related to the entire Project to the extent required by the Contract Documents, and shall provide for expeditious and practicable execution of the Work.

§ 3.10.2 The Contractor shall prepare a submittal schedule, promptly after being awarded the Contract and thereafter as necessary to maintain a current submittal schedule, and shall submit the schedule(s) for the Architect's approval. The Architect's approval shall not unreasonably be delayed or withheld. The submittal schedule shall (1) be coordinated with the Contractor's construction schedule, and (2) allow the Architect reasonable time to review submittals. If the Contractor fails to submit a submittal schedule, the Contractor shall not be entitled to any increase in Contract Sum or extension of Contract Time based on the time required for review of submittals.

§ 3.10.3 The Contractor shall perform the Work in general accordance with the most recent schedules submitted to the Owner and Architect.

§ 3.11 Documents and Samples at the Site

The Contractor shall maintain at the site for the Owner one copy of the Drawings, Specifications, Addenda, Change Orders and other Modifications, in good order and marked currently to indicate field changes and selections made during construction, and one copy of approved Shop Drawings, Product Data, Samples and similar required submittals. These shall be available to the Architect and shall be delivered to the Architect for submittal to the Owner upon completion of the Work as a record of the Work as constructed.

§ 3.12 Shop Drawings, Product Data and Samples

§ 3.12.1 Shop Drawings are drawings, diagrams, schedules and other data specially prepared for the Work by the Contractor or a Subcontractor, Sub-subcontractor, manufacturer, supplier or distributor to illustrate some portion of the Work.

§ 3.12.2 Product Data are illustrations, standard schedules, performance charts, instructions, brochures, diagrams and other information furnished by the Contractor to illustrate materials or equipment for some portion of the Work.

§ 3.12.3 Samples are physical examples that illustrate materials, equipment or workmanship and establish standards by which the Work will be judged.

§ 3.12.4 Shop Drawings, Product Data, Samples and similar submittals are not Contract Documents. Their purpose is to demonstrate the way by which the Contractor proposes to conform to the information given and the design concept expressed in the Contract Documents for those portions of the Work for which the Contract Documents require submittals. Review by the Architect is subject to the limitations of Section 4.2.7. Informational submittals upon which the Architect is not expected to take responsive action may be so identified in the Contract Documents. Submittals that are not required by the Contract Documents may be returned by the Architect without action.

§ 3.12.5 The Contractor shall review for compliance with the Contract Documents, approve and submit to the Architect Shop Drawings, Product Data, Samples and similar submittals required by the Contract Documents in accordance with the submittal schedule approved by the Architect or, in the absence of an approved submittal schedule, with reasonable promptness and in such sequence as to cause no delay in the Work or in the activities of the Owner or of separate contractors.

§ 3.12.6 By submitting Shop Drawings, Product Data, Samples and similar submittals, the Contractor represents to the Owner and Architect that the Contractor has (1) reviewed and approved them, (2) determined and verified materials, field measurements and field construction criteria related thereto, or will do so and (3) checked and coordinated the information contained within such submittals with the requirements of the Work and of the Contract Documents.

§ 3.12.7 The Contractor shall perform no portion of the Work for which the Contract Documents require submittal and review of Shop Drawings, Product Data, Samples or similar submittals until the respective submittal has been approved by the Architect.

§ 3.12.8 The Work shall be in accordance with approved submittals except that the Contractor shall not be relieved of responsibility for deviations from requirements of the Contract Documents by the Architect's approval of Shop Drawings, Product Data, Samples or similar submittals unless the Contractor has specifically informed the Architect in writing of such deviation at the time of submittal and (1) the Architect has given written approval to the specific deviation as a minor change in the Work, or (2) a Change Order or Construction Change Directive has been issued authorizing the deviation. The Contractor shall not be relieved of responsibility for errors or omissions in Shop Drawings, Product Data, Samples or similar submittals by the Architect's approval thereof.

§ 3.12.9 The Contractor shall direct specific attention, in writing or on resubmitted Shop Drawings, Product Data, Samples or similar submittals, to revisions other than those requested by the Architect on previous submittals. In the absence of such written notice, the Architect's approval of a resubmission shall not apply to such revisions.

§ 3.12.10 The Contractor shall not be required to provide professional services that constitute the practice of architecture or engineering unless such services are specifically required by the Contract Documents for a portion of the Work or unless the Contractor needs to provide such services in order to carry out the Contractor's responsibilities for construction means, methods, techniques, sequences and procedures. The Contractor shall not be required to provide professional services in violation of applicable law. If professional design services or certifications by a design professional related to systems, materials or equipment are specifically required of the Contractor by the Contract Documents, the Owner and the Architect will specify all performance and design criteria that such services must satisfy. The Contractor shall cause such services or certifications to be provided by a properly licensed design professional, whose signature and seal shall appear on all drawings, calculations, specifications, certifications, Shop Drawings and other submittals prepared by such professional. Shop Drawings and other submittals related to the Work designed or certified by such professional, if prepared by others, shall bear such professional's written approval when submitted to the Architect. The Owner and the Architect shall be entitled

to rely upon the adequacy, accuracy and completeness of the services, certifications and approvals performed or provided by such design professionals, provided the Owner and Architect have specified to the Contractor all performance and design criteria that such services must satisfy. Pursuant to this Section 3.12.10, the Architect will review, approve or take other appropriate action on submittals only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents. The Contractor shall not be responsible for the adequacy of the performance and design criteria specified in the Contract Documents.

§ 3.13 Use of Site

The Contractor shall confine operations at the site to areas permitted by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities and the Contract Documents and shall not unreasonably encumber the site with materials or equipment.

§ 3.14 Cutting and Patching

§ 3.14.1 The Contractor shall be responsible for cutting, fitting or patching required to complete the Work or to make its parts fit together properly. All areas requiring cutting, fitting and patching shall be restored to the condition existing prior to the cutting, fitting and patching, unless otherwise required by the Contract Documents.

§ 3.14.2 The Contractor shall not damage or endanger a portion of the Work or fully or partially completed construction of the Owner or separate contractors by cutting, patching or otherwise altering such construction, or by excavation. The Contractor shall not cut or otherwise alter such construction by the Owner or a separate contractor except with written consent of the Owner and of such separate contractor; such consent shall not be unreasonably withheld. The Contractor shall not unreasonably withhold from the Owner or a separate contractor the Contractor's consent to cutting or otherwise altering the Work.

§ 3.15 Cleaning Up

§ 3.15.1 The Contractor shall keep the premises and surrounding area free from accumulation of waste materials or rubbish caused by operations under the Contract. At completion of the Work, the Contractor shall remove waste materials, rubbish, the Contractor's tools, construction equipment, machinery and surplus materials from and about the Project.

§ 3.15.2 If the Contractor fails to clean up as provided in the Contract Documents, the Owner may do so and Owner shall be entitled to reimbursement from the Contractor.

§ 3.16 Access to Work

The Contractor shall provide the Owner and Architect access to the Work in preparation and progress wherever located.

§ 3.17 Royalties, Patents and Copyrights

The Contractor shall pay all royalties and license fees. The Contractor shall defend suits or claims for infringement of copyrights and patent rights and shall hold the Owner and Architect harmless from loss on account thereof, but shall not be responsible for such defense or loss when a particular design, process or product of a particular manufacturer or manufacturers is required by the Contract Documents, or where the copyright violations are contained in Drawings, Specifications or other documents prepared by the Owner or Architect. However, if the Contractor has reason to believe that the required design, process or product is an infringement of a copyright or a patent, the Contractor shall be responsible for such loss unless such information is promptly furnished to the Architect.

§ 3.18 Indemnification

§ 3.18.1 To the fullest extent permitted by law the Contractor shall indemnify and hold harmless the Owner, Architect, Architect's consultants, and agents and 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, provided that such claim, damage, loss or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself), but only to the extent caused by the negligent acts or omissions of the Contractor, a Subcontractor, anyone directly or indirectly employed by them or anyone for whose acts they may be liable, regardless of whether or not such claim, damage, loss or expense is caused in part by a party indemnified hereunder. Such obligation shall not be construed to negate, abridge, or reduce

other rights or obligations of indemnity that would otherwise exist as to a party or person described in this Section 3.18.

§ 3.18.2 In claims against any person or entity indemnified under this Section 3.18 by an employee of the Contractor, a Subcontractor, anyone directly or indirectly employed by them or anyone for whose acts they may be liable, the indemnification obligation under Section 3.18.1 shall not be limited by a limitation on amount or type of damages, compensation or benefits payable by or for the Contractor or a Subcontractor under workers' compensation acts, disability benefit acts or other employee benefit acts.

ARTICLE 4 ARCHITECT

§ 4.1 General

§ 4.1.1 The Owner shall retain an architect lawfully licensed to practice architecture or an entity lawfully practicing architecture in the jurisdiction where the Project is located. That person or entity is identified as the Architect in the Agreement and is referred to throughout the Contract Documents as if singular in number.

§ 4.1.2 Duties, responsibilities and limitations of authority of the Architect as set forth in the Contract Documents shall not be restricted, modified or extended without written consent of the Owner, Contractor and Architect. Consent shall not be unreasonably withheld.

§ 4.1.3 If the employment of the Architect is terminated, the Owner shall employ a successor architect as to whom the Contractor has no reasonable objection and whose status under the Contract Documents shall be that of the Architect.

§ 4.2 Administration of the Contract

§ 4.2.1 The Architect will provide administration of the Contract as described in the Contract Documents and will be an Owner's representative during construction until the date the Architect issues the final Certificate for Payment. The Architect will have authority to act on behalf of the Owner only to the extent provided in the Contract Documents.

§ 4.2.2 The Architect will visit the site at intervals appropriate to the stage of construction, or as otherwise agreed with the Owner, to become generally familiar with the progress and quality of the portion of the Work completed, and to determine in general if the Work observed is being performed in a manner indicating that the Work, when fully completed, will be in accordance with the Contract Documents. However, the Architect will not be required to make exhaustive or continuous on-site inspections to check the quality or quantity of the Work. The Architect will not have control over, charge of, or responsibility for, the construction means, methods, techniques, sequences or procedures, or for the safety precautions and programs in connection with the Work, since these are solely the Contractor's rights and responsibilities under the Contract Documents, except as provided in Section 3.3.1.

§ 4.2.3 On the basis of the site visits, the Architect will keep the Owner reasonably informed about the progress and quality of the portion of the Work completed, and report to the Owner (1) known deviations from the Contract Documents and from the most recent construction schedule submitted by the Contractor, and (2) defects and deficiencies observed in the Work. The Architect will not be responsible for the Contractor's failure to perform the Work in accordance with the requirements of the Contract Documents. The Architect will not have control over or charge of and will not be responsible for acts or omissions of the Contractor, Subcontractors, or their agents or employees, or any other persons or entities performing portions of the Work.

§ 4.2.4 Communications Facilitating Contract Administration

Except as otherwise provided in the Contract Documents or when direct communications have been specially authorized, the Owner and Contractor shall endeavor to communicate with each other through the Architect about matters arising out of or relating to the Contract. Communications by and with the Architect's consultants shall be through the Architect. Communications by and with Subcontractors and material suppliers shall be through the Contractor. Communications by and with separate contractors shall be through the Owner.

§ 4.2.5 Based on the Architect's evaluations of the Contractor's Applications for Payment, the Architect will review and certify the amounts due the Contractor and will issue Certificates for Payment in such amounts.

§ 4.2.6 The Architect has authority to reject Work that does not conform to the Contract Documents. Whenever the Architect considers it necessary or advisable, the Architect will have authority to require inspection or testing of the

Work in accordance with Sections 13.5.2 and 13.5.3, whether or not such Work is fabricated, installed or completed. However, neither this authority of the Architect nor a decision made in good faith either to exercise or not to exercise such authority shall give rise to a duty or responsibility of the Architect to the Contractor, Subcontractors, material and equipment suppliers, their agents or employees, or other persons or entities performing portions of the Work.

§ 4.2.7 The Architect will review and approve, or take other appropriate action upon, the Contractor's submittals such as Shop Drawings, Product Data and Samples, but only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents. The Architect's action will be taken in accordance with the submittal schedule approved by the Architect or, in the absence of an approved submittal schedule, with reasonable promptness while allowing sufficient time in the Architect's professional judgment to permit adequate review. Review of such submittals is not conducted for the purpose of determining the accuracy and completeness of other details such as dimensions and quantities, or for substantiating instructions for installation or performance of equipment or systems, all of which remain the responsibility of the Contractor as required by the Contract Documents. The Architect's review of the Contractor's submittals shall not relieve the Contractor of the obligations under Sections 3.3, 3.5 and 3.12. The Architect's review shall not constitute approval of safety precautions or, unless otherwise specifically stated by the Architect, of any construction means, methods, techniques, sequences or procedures. The Architect's approval of a specific item shall not indicate approval of an assembly of which the item is a component.

§ 4.2.8 The Architect will prepare Change Orders and Construction Change Directives, and may authorize minor changes in the Work as provided in Section 7.4. The Architect will investigate and make determinations and recommendations regarding concealed and unknown conditions as provided in Section 3.7.4.

§ 4.2.9 The Architect will conduct inspections to determine the date or dates of Substantial Completion and the date of final completion; issue Certificates of Substantial Completion pursuant to Section 9.8; receive and forward to the Owner, for the Owner's review and records, written warranties and related documents required by the Contract and assembled by the Contractor pursuant to Section 9.10; and issue a final Certificate for Payment pursuant to Section 9.10.

§ 4.2.10 If the Owner and Architect agree, the Architect will provide one or more project representatives to assist in carrying out the Architect's responsibilities at the site. The duties, responsibilities and limitations of authority of such project representatives shall be as set forth in an exhibit to be incorporated in the Contract Documents.

§ 4.2.11 The Architect will interpret and decide matters concerning performance under, and requirements of, the Contract Documents on written request of either the Owner or Contractor. The Architect's response to such requests will be made in writing within any time limits agreed upon or otherwise with reasonable promptness.

§ 4.2.12 Interpretations and decisions of the Architect will be consistent with the intent of, and reasonably inferable from, the Contract Documents and will be in writing or in the form of drawings. When making such interpretations and decisions, the Architect will endeavor to secure faithful performance by both Owner and Contractor, will not show partiality to either and will not be liable for results of interpretations or decisions rendered in good faith.

§ 4.2.13 The Architect's decisions on matters relating to aesthetic effect will be final if consistent with the intent expressed in the Contract Documents.

§ 4.2.14 The Architect will review and respond to requests for information about the Contract Documents. The Architect's response to such requests will be made in writing within any time limits agreed upon or otherwise with reasonable promptness. If appropriate, the Architect will prepare and issue supplemental Drawings and Specifications in response to the requests for information.

ARTICLE 5 SUBCONTRACTORS

§ 5.1 Definitions

§ 5.1.1 A Subcontractor is a person or entity who has a direct contract with the Contractor to perform a portion of the Work at the site. The term "Subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Subcontractor or an authorized representative of the Subcontractor. The term "Subcontractor" does not include a separate contractor or subcontractors of a separate contractor.

§ 5.1.2 A Sub-subcontractor is a person or entity who has a direct or indirect contract with a Subcontractor to perform a portion of the Work at the site. The term "Sub-subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Sub-subcontractor or an authorized representative of the Sub-subcontractor.

§ 5.2 Award of Subcontracts and Other Contracts for Portions of the Work

§ 5.2.1 Unless otherwise stated in the Contract Documents or the bidding requirements, the Contractor, as soon as practicable after award of the Contract, shall furnish in writing to the Owner through the Architect the names of persons or entities (including those who are to furnish materials or equipment fabricated to a special design) proposed for each principal portion of the Work. The Architect may reply within 14 days to the Contractor in writing stating (1) whether the Owner or the Architect has reasonable objection to any such proposed person or entity or (2) that the Architect requires additional time for review. Failure of the Owner or Architect to reply within the 14-day period shall constitute notice of no reasonable objection.

§ 5.2.2 The Contractor shall not contract with a proposed person or entity to whom the Owner or Architect has made reasonable and timely objection. The Contractor shall not be required to contract with anyone to whom the Contractor has made reasonable objection.

§ 5.2.3 If the Owner or Architect has reasonable objection to a person or entity proposed by the Contractor, the Contractor shall propose another to whom the Owner or Architect has no reasonable objection. If the proposed but rejected Subcontractor was reasonably capable of performing the Work, the Contract Sum and Contract Time shall be increased or decreased by the difference, if any, occasioned by such change, and an appropriate Change Order shall be issued before commencement of the substitute Subcontractor's Work. However, no increase in the Contract Sum or Contract Time shall be allowed for such change unless the Contractor has acted promptly and responsively in submitting names as required.

§ 5.2.4 The Contractor shall not substitute a Subcontractor, person or entity previously selected if the Owner or Architect makes reasonable objection to such substitution.

§ 5.3 Subcontractual Relations

By appropriate agreement, written where legally required for validity, the Contractor shall require each Subcontractor, to the extent of the Work to be performed by the Subcontractor, to be bound to the Contractor by terms of the Contract Documents, and to assume toward the Contractor all the obligations and responsibilities, including the responsibility for safety of the Subcontractor's Work, which the Contractor, by these Documents, assumes toward the Owner and Architect. Each subcontract agreement shall preserve and protect the rights of the Owner and Architect under the Contract Documents with respect to the Work to be performed by the Subcontractor so that subcontracting thereof will not prejudice such rights, and shall allow to the Subcontractor, unless specifically provided otherwise in the subcontract agreement, the benefit of all rights, remedies and redress against the Contractor that the Contractor, by the Contract Documents, has against the Owner. Where appropriate, the Contractor shall require each Subcontractor to enter into similar agreements with Sub-subcontractors. The Contractor shall make available to each proposed Subcontractor, prior to the execution of the subcontract agreement, copies of the Contract Documents to which the Subcontractor will be bound, and, upon written request of the Subcontractor, identify to the Subcontractor terms and conditions of the proposed subcontract agreement that may be at variance with the Contract Documents. Subcontractors will similarly make copies of applicable portions of such documents available to their respective proposed Sub-subcontractors.

§ 5.4 Contingent Assignment of Subcontracts

§ 5.4.1 Each subcontract agreement for a portion of the Work is assigned by the Contractor to the Owner, provided that

- .1 assignment is effective only after termination of the Contract by the Owner for cause pursuant to Section 14.2 and only for those subcontract agreements that the Owner accepts by notifying the Subcontractor and Contractor in writing; and
- .2 assignment is subject to the prior rights of the surety, if any, obligated under bond relating to the Contract.

When the Owner accepts the assignment of a subcontract agreement, the Owner assumes the Contractor's rights and obligations under the subcontract.

§ 5.4.2 Upon such assignment, if the Work has been suspended for more than 30 days, the Subcontractor's compensation shall be equitably adjusted for increases in cost resulting from the suspension.

§ 5.4.3 Upon such assignment to the Owner under this Section 5.4, the Owner may further assign the subcontract to a successor contractor or other entity. If the Owner assigns the subcontract to a successor contractor or other entity, the Owner shall nevertheless remain legally responsible for all of the successor contractor's obligations under the subcontract.

ARTICLE 6 CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS

§ 6.1 Owner's Right to Perform Construction and to Award Separate Contracts

§ 6.1.1 The Owner reserves the right to perform construction or operations related to the Project with the Owner's own forces, and to award separate contracts in connection with other portions of the Project or other construction or operations on the site under Conditions of the Contract identical or substantially similar to these including those portions related to insurance and waiver of subrogation. If the Contractor claims that delay or additional cost is involved because of such action by the Owner, the Contractor shall make such Claim as provided in Article 15.

§ 6.1.2 When separate contracts are awarded for different portions of the Project or other construction or operations on the site, the term "Contractor" in the Contract Documents in each case shall mean the Contractor who executes each separate Owner-Contractor Agreement.

§ 6.1.3 The Owner shall provide for coordination of the activities of the Owner's own forces and of each separate contractor with the Work of the Contractor, who shall cooperate with them. The Contractor shall participate with other separate contractors and the Owner in reviewing their construction schedules. The Contractor shall make any revisions to the construction schedule deemed necessary after a joint review and mutual agreement. The construction schedules shall then constitute the schedules to be used by the Contractor, separate contractors and the Owner until subsequently revised.

§ 6.1.4 Unless otherwise provided in the Contract Documents, when the Owner performs construction or operations related to the Project with the Owner's own forces, the Owner shall be deemed to be subject to the same obligations and to have the same rights that apply to the Contractor under the Conditions of the Contract, including, without excluding others, those stated in Article 3, this Article 6 and Articles 10, 11 and 12.

§ 6.2 Mutual Responsibility

§ 6.2.1 The Contractor shall afford the Owner and separate contractors reasonable opportunity for introduction and storage of their materials and equipment and performance of their activities, and shall connect and coordinate the Contractor's construction and operations with theirs as required by the Contract Documents.

§ 6.2.2 If part of the Contractor's Work depends for proper execution or results upon construction or operations by the Owner or a separate contractor, the Contractor shall, prior to proceeding with that portion of the Work, promptly report to the Architect apparent discrepancies or defects in such other construction that would render it unsuitable for such proper execution and results. Failure of the Contractor so to report shall constitute an acknowledgment that the Owner's or separate contractor's completed or partially completed construction is fit and proper to receive the Contractor's Work, except as to defects not then reasonably discoverable.

§ 6.2.3 The Contractor shall reimburse the Owner for costs the Owner incurs that are payable to a separate contractor because of the Contractor's delays, improperly timed activities or defective construction. The Owner shall be responsible to the Contractor for costs the Contractor incurs because of a separate contractor's delays, improperly timed activities, damage to the Work or defective construction.

§ 6.2.4 The Contractor shall promptly remedy damage the Contractor wrongfully causes to completed or partially completed construction or to property of the Owner or separate contractors as provided in Section 10.2.5.

§ 6.2.5 The Owner and each separate contractor shall have the same responsibilities for cutting and patching as are described for the Contractor in Section 3.14.

§ 6.3 Owner's Right to Clean Up

If a dispute arises among the Contractor, separate contractors and the Owner as to the responsibility under their respective contracts for maintaining the premises and surrounding area free from waste materials and rubbish, the Owner may clean up and the Architect will allocate the cost among those responsible.

ARTICLE 7 CHANGES IN THE WORK

§ 7.1 General

§ 7.1.1 Changes in the Work may be accomplished after execution of the Contract, and without invalidating the Contract, by Change Order, Construction Change Directive or order for a minor change in the Work, subject to the limitations stated in this Article 7 and elsewhere in the Contract Documents.

§ 7.1.2 A Change Order shall be based upon agreement among the Owner, Contractor and Architect; a Construction Change Directive requires agreement by the Owner and Architect and may or may not be agreed to by the Contractor; an order for a minor change in the Work may be issued by the Architect alone.

§ 7.1.3 Changes in the Work shall be performed under applicable provisions of the Contract Documents, and the Contractor shall proceed promptly, unless otherwise provided in the Change Order, Construction Change Directive or order for a minor change in the Work.

§ 7.2 Change Orders

§ 7.2.1 A Change Order is a written instrument prepared by the Architect and signed by the Owner, Contractor and Architect stating their agreement upon all of the following:

- .1 The change in the Work;
- .2 The amount of the adjustment, if any, in the Contract Sum; and
- .3 The extent of the adjustment, if any, in the Contract Time.

§ 7.3 Construction Change Directives

§ 7.3.1 A Construction Change Directive is a written order prepared by the Architect and signed by the Owner and Architect, directing a change in the Work prior to agreement on adjustment, if any, in the Contract Sum or Contract Time, or both. The Owner may by Construction Change Directive, without invalidating the Contract, order changes in the Work within the general scope of the Contract consisting of additions, deletions or other revisions, the Contract Sum and Contract Time being adjusted accordingly.

§ 7.3.2 A Construction Change Directive shall be used in the absence of total agreement on the terms of a Change Order.

§ 7.3.3 If the Construction Change Directive provides for an adjustment to the Contract Sum, the adjustment shall be based on one of the following methods:

- .1 Mutual acceptance of a lump sum properly itemized and supported by sufficient substantiating data to permit evaluation;
- .2 Unit prices stated in the Contract Documents or subsequently agreed upon;
- .3 Cost to be determined in a manner agreed upon by the parties and a mutually acceptable fixed or percentage fee; or
- .4 As provided in Section 7.3.7.

§ 7.3.4 If unit prices are stated in the Contract Documents or subsequently agreed upon, and if quantities originally contemplated are materially changed in a proposed Change Order or Construction Change Directive so that application of such unit prices to quantities of Work proposed will cause substantial inequity to the Owner or Contractor, the applicable unit prices shall be equitably adjusted.

§ 7.3.5 Upon receipt of a Construction Change Directive, the Contractor shall promptly proceed with the change in the Work involved and advise the Architect of the Contractor's agreement or disagreement with the method, if any, provided in the Construction Change Directive for determining the proposed adjustment in the Contract Sum or Contract Time.

§ 7.3.6 A Construction Change Directive signed by the Contractor indicates the Contractor's agreement therewith, including adjustment in Contract Sum and Contract Time or the method for determining them. Such agreement shall be effective immediately and shall be recorded as a Change Order.

§ 7.3.7 If the Contractor does not respond promptly or disagrees with the method for adjustment in the Contract Sum, the Architect shall determine the method and the adjustment on the basis of reasonable expenditures and savings of those performing the Work attributable to the change, including, in case of an increase in the Contract Sum, an amount for overhead and profit as set forth in the Agreement, or if no such amount is set forth in the Agreement, a reasonable amount. In such case, and also under Section 7.3.3.3, the Contractor shall keep and present, in such form as the Architect may prescribe, an itemized accounting together with appropriate supporting data. Unless otherwise provided in the Contract Documents, costs for the purposes of this Section 7.3.7 shall be limited to the following:

- .1 Costs of labor, including social security, old age and unemployment insurance, fringe benefits required by agreement or custom, and workers' compensation insurance;
- .2 Costs of materials, supplies and equipment, including cost of transportation, whether incorporated or consumed;
- .3 Rental costs of machinery and equipment, exclusive of hand tools, whether rented from the Contractor or others;
- .4 Costs of premiums for all bonds and insurance, permit fees, and sales, use or similar taxes related to the Work; and
- .5 Additional costs of supervision and field office personnel directly attributable to the change.

§ 7.3.8 The amount of credit to be allowed by the Contractor to the Owner for a deletion or change that results in a net decrease in the Contract Sum shall be actual net cost as confirmed by the Architect. When both additions and credits covering related Work or substitutions are involved in a change, the allowance for overhead and profit shall be figured on the basis of net increase, if any, with respect to that change.

§ 7.3.9 Pending final determination of the total cost of a Construction Change Directive to the Owner, the Contractor may request payment for Work completed under the Construction Change Directive in Applications for Payment. The Architect will make an interim determination for purposes of monthly certification for payment for those costs and certify for payment the amount that the Architect determines, in the Architect's professional judgment, to be reasonably justified. The Architect's interim determination of cost shall adjust the Contract Sum on the same basis as a Change Order, subject to the right of either party to disagree and assert a Claim in accordance with Article 15.

§ 7.3.10 When the Owner and Contractor agree with a determination made by the Architect concerning the adjustments in the Contract Sum and Contract Time, or otherwise reach agreement upon the adjustments, such agreement shall be effective immediately and the Architect will prepare a Change Order. Change Orders may be issued for all or any part of a Construction Change Directive.

§ 7.4 Minor Changes in the Work

The Architect has authority to order minor changes in the Work not involving adjustment in the Contract Sum or extension of the Contract Time and not inconsistent with the intent of the Contract Documents. Such changes will be effected by written order signed by the Architect and shall be binding on the Owner and Contractor.

ARTICLE 8 TIME

§ 8.1 Definitions

§ 8.1.1 Unless otherwise provided, Contract Time is the period of time, including authorized adjustments, allotted in the Contract Documents for Substantial Completion of the Work.

§ 8.1.2 The date of commencement of the Work is the date established in the Agreement.

§ 8.1.3 The date of Substantial Completion is the date certified by the Architect in accordance with Section 9.8.

§ 8.1.4 The term "day" as used in the Contract Documents shall mean calendar day unless otherwise specifically defined.

§ 8.2 Progress and Completion

§ 8.2.1 Time limits stated in the Contract Documents are of the essence of the Contract. By executing the Agreement the Contractor confirms that the Contract Time is a reasonable period for performing the Work.

§ 8.2.2 The Contractor shall not knowingly, except by agreement or instruction of the Owner in writing, prematurely commence operations on the site or elsewhere prior to the effective date of insurance required by Article 11 to be

furnished by the Contractor and Owner. The date of commencement of the Work shall not be changed by the effective date of such insurance.

§ 8.2.3 The Contractor shall proceed expeditiously with adequate forces and shall achieve Substantial Completion within the Contract Time.

§ 8.3 Delays and Extensions of Time

§ 8.3.1 If the Contractor is delayed at any time in the commencement or progress of the Work by an act or neglect of the Owner or Architect, or of an employee of either, or of a separate contractor employed by the Owner; or by changes ordered in the Work; or by labor disputes, fire, unusual delay in deliveries, unavoidable casualties or other causes beyond the Contractor's control; or by delay authorized by the Owner pending mediation and arbitration; or by other causes that the Architect determines may justify delay, then the Contract Time shall be extended by Change Order for such reasonable time as the Architect may determine.

§ 8.3.2 Claims relating to time shall be made in accordance with applicable provisions of Article 15.

§ 8.3.3 This Section 8.3 does not preclude recovery of damages for delay by either party under other provisions of the Contract Documents.

ARTICLE 9 PAYMENTS AND COMPLETION

§ 9.1 Contract Sum

The Contract Sum is stated in the Agreement and, including authorized adjustments, is the total amount payable by the Owner to the Contractor for performance of the Work under the Contract Documents.

§ 9.2 Schedule of Values

Where the Contract is based on a stipulated sum or Guaranteed Maximum Price, the Contractor shall submit to the Architect, before the first Application for Payment, a schedule of values allocating the entire Contract Sum to the various portions of the Work and prepared in such form and supported by such data to substantiate its accuracy as the Architect may require. This schedule, unless objected to by the Architect, shall be used as a basis for reviewing the Contractor's Applications for Payment.

§ 9.3 Applications for Payment

§ 9.3.1 At least ten days before the date established for each progress payment, the Contractor shall submit to the Architect an itemized Application for Payment prepared in accordance with the schedule of values, if required under Section 9.2, for completed portions of the Work. Such application shall be notarized, if required, and supported by such data substantiating the Contractor's right to payment as the Owner or Architect may require, such as copies of requisitions from Subcontractors and material suppliers, and shall reflect retainage if provided for in the Contract Documents.

§ 9.3.1.1 As provided in Section 7.3.9, such applications may include requests for payment on account of changes in the Work that have been properly authorized by Construction Change Directives, or by interim determinations of the Architect, but not yet included in Change Orders.

§ 9.3.1.2 Applications for Payment shall not include requests for payment for portions of the Work for which the Contractor does not intend to pay a Subcontractor or material supplier, unless such Work has been performed by others whom the Contractor intends to pay.

§ 9.3.2 Unless otherwise provided in the Contract Documents, payments shall be made on account of materials and equipment delivered and suitably stored at the site for subsequent incorporation in the Work. If approved in advance by the Owner, payment may similarly be made for materials and equipment suitably stored off the site at a location agreed upon in writing. Payment for materials and equipment stored on or off the site shall be conditioned upon compliance by the Contractor with procedures satisfactory to the Owner to establish the Owner's title to such materials and equipment or otherwise protect the Owner's interest, and shall include the costs of applicable insurance, storage and transportation to the site for such materials and equipment stored off the site.

§ 9.3.3 The Contractor warrants that title to all Work covered by an Application for Payment will pass to the Owner no later than the time of payment. The Contractor further warrants that upon submittal of an Application for Payment all Work for which Certificates for Payment have been previously issued and payments received from the

Owner shall, to the best of the Contractor's knowledge, information and belief, be free and clear of liens, claims, security interests or encumbrances in favor of the Contractor, Subcontractors, material suppliers, or other persons or entities making a claim by reason of having provided labor, materials and equipment relating to the Work.

§ 9.4 Certificates for Payment

§ 9.4.1 The Architect will, within seven days after receipt of the Contractor's Application for Payment, either issue to the Owner a Certificate for Payment, with a copy to the Contractor, for such amount as the Architect determines is properly due, or notify the Contractor and Owner in writing of the Architect's reasons for withholding certification in whole or in part as provided in Section 9.5.1.

§ 9.4.2 The issuance of a Certificate for Payment will constitute a representation by the Architect to the Owner, based on the Architect's evaluation of the Work and the data comprising the Application for Payment, that, to the best of the Architect's knowledge, information and belief, the Work has progressed to the point indicated and that the quality of the Work is in accordance with the Contract Documents. The foregoing representations are subject to an evaluation of the Work for conformance with the Contract Documents upon Substantial Completion, to results of subsequent tests and inspections, to correction of minor deviations from the Contract Documents prior to completion and to specific qualifications expressed by the Architect. The issuance of a Certificate for Payment will further constitute a representation that the Contractor is entitled to payment in the amount certified. However, the issuance of a Certificate for Payment will not be a representation that the Architect has (1) made exhaustive or continuous on-site inspections to check the quality or quantity of the Work, (2) reviewed construction means, methods, techniques, sequences or procedures, (3) reviewed copies of requisitions received from Subcontractors and material suppliers and other data requested by the Owner to substantiate the Contractor's right to payment, or (4) made examination to ascertain how or for what purpose the Contractor has used money previously paid on account of the Contract Sum.

§ 9.5 Decisions to Withhold Certification

§ 9.5.1 The Architect may withhold a Certificate for Payment in whole or in part, to the extent reasonably necessary to protect the Owner, if in the Architect's opinion the representations to the Owner required by Section 9.4.2 cannot be made. If the Architect is unable to certify payment in the amount of the Application, the Architect will notify the Contractor and Owner as provided in Section 9.4.1. If the Contractor and Architect cannot agree on a revised amount, the Architect will promptly issue a Certificate for Payment for the amount for which the Architect is able to make such representations to the Owner. The Architect may also withhold a Certificate for Payment or, because of subsequently discovered evidence, may nullify the whole or a part of a Certificate for Payment previously issued, to such extent as may be necessary in the Architect's opinion to protect the Owner from loss for which the Contractor is responsible, including loss resulting from acts and omissions described in Section 3.3.2, because of

- .1 defective Work not remedied;
- .2 third party claims filed or reasonable evidence indicating probable filing of such claims unless security acceptable to the Owner is provided by the Contractor;
- .3 failure of the Contractor to make payments properly to Subcontractors or for labor, materials or equipment;
- .4 reasonable evidence that the Work cannot be completed for the unpaid balance of the Contract Sum;
- .5 damage to the Owner or a separate contractor;
- .6 reasonable evidence that the Work will not be completed within the Contract Time, and that the unpaid balance would not be adequate to cover actual or liquidated damages for the anticipated delay; or
- .7 repeated failure to carry out the Work in accordance with the Contract Documents.

§ 9.5.2 When the above reasons for withholding certification are removed, certification will be made for amounts previously withheld.

§ 9.5.3 If the Architect withholds certification for payment under Section 9.5.1.3, the Owner may, at its sole option, issue joint checks to the Contractor and to any Subcontractor or material or equipment suppliers to whom the Contractor failed to make payment for Work properly performed or material or equipment suitably delivered. If the Owner makes payments by joint check, the Owner shall notify the Architect and the Architect will reflect such payment on the next Certificate for Payment.

§ 9.6 Progress Payments

§ 9.6.1 After the Architect has issued a Certificate for Payment, the Owner shall make payment in the manner and within the time provided in the Contract Documents, and shall so notify the Architect.

§ 9.6.2 The Contractor shall pay each Subcontractor no later than seven days after receipt of payment from the Owner the amount to which the Subcontractor is entitled, reflecting percentages actually retained from payments to the Contractor on account of the Subcontractor's portion of the Work. The Contractor shall, by appropriate agreement with each Subcontractor, require each Subcontractor to make payments to Sub-subcontractors in a similar manner.

§ 9.6.3 The Architect will, on request, furnish to a Subcontractor, if practicable, information regarding percentages of completion or amounts applied for by the Contractor and action taken thereon by the Architect and Owner on account of portions of the Work done by such Subcontractor.

§ 9.6.4 The Owner has the right to request written evidence from the Contractor that the Contractor has properly paid Subcontractors and material and equipment suppliers amounts paid by the Owner to the Contractor for subcontracted Work. If the Contractor fails to furnish such evidence within seven days, the Owner shall have the right to contact Subcontractors to ascertain whether they have been properly paid. Neither the Owner nor Architect shall have an obligation to pay or to see to the payment of money to a Subcontractor, except as may otherwise be required by law.

§ 9.6.5 Contractor payments to material and equipment suppliers shall be treated in a manner similar to that provided in Sections 9.6.2, 9.6.3 and 9.6.4.

§ 9.6.6 A Certificate for Payment, a progress payment, or partial or entire use or occupancy of the Project by the Owner shall not constitute acceptance of Work not in accordance with the Contract Documents.

§ 9.6.7 Unless the Contractor provides the Owner with a payment bond in the full penal sum of the Contract Sum, payments received by the Contractor for Work properly performed by Subcontractors and suppliers shall be held by the Contractor for those Subcontractors or suppliers who performed Work or furnished materials, or both, under contract with the Contractor for which payment was made by the Owner. Nothing contained herein shall require money to be placed in a separate account and not commingled with money of the Contractor, shall create any fiduciary liability or tort liability on the part of the Contractor for breach of trust or shall entitle any person or entity to an award of punitive damages against the Contractor for breach of the requirements of this provision.

§ 9.7 Failure of Payment

If the Architect does not issue a Certificate for Payment, through no fault of the Contractor, within seven days after receipt of the Contractor's Application for Payment, or if the Owner does not pay the Contractor within seven days after the date established in the Contract Documents the amount certified by the Architect or awarded by binding dispute resolution, then the Contractor may, upon seven additional days' written notice to the Owner and Architect, stop the Work until payment of the amount owing has been received. The Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable costs of shut-down, delay and start-up, plus interest as provided for in the Contract Documents.

§ 9.8 Substantial Completion

§ 9.8.1 Substantial Completion is the stage in the progress of the Work when the Work or designated portion thereof is sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work for its intended use.

§ 9.8.2 When the Contractor considers that the Work, or a portion thereof which the Owner agrees to accept separately, is substantially complete, the Contractor shall prepare and submit to the Architect a comprehensive list of items to be completed or corrected prior to final payment. Failure to include an item on such list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents.

§ 9.8.3 Upon receipt of the Contractor's list, the Architect will make an inspection to determine whether the Work or designated portion thereof is substantially complete. If the Architect's inspection discloses any item, whether or not included on the Contractor's list, which is not sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work or designated portion thereof for its intended use, the Contractor shall, before issuance of the Certificate of Substantial Completion, complete or correct such item upon notification by the Architect. In such case, the Contractor shall then submit a request for another inspection by the Architect to determine Substantial Completion.

§ 9.8.4 When the Work or designated portion thereof is substantially complete, the Architect will prepare a Certificate of Substantial Completion that shall establish the date of Substantial Completion, shall establish responsibilities of the Owner and Contractor for security, maintenance, heat, utilities, damage to the Work and insurance, and shall fix the time within which the Contractor shall finish all items on the list accompanying the Certificate. Warranties required by the Contract Documents shall commence on the date of Substantial Completion of the Work or designated portion thereof unless otherwise provided in the Certificate of Substantial Completion.

§ 9.8.5 The Certificate of Substantial Completion shall be submitted to the Owner and Contractor for their written acceptance of responsibilities assigned to them in such Certificate. Upon such acceptance and consent of surety, if any, the Owner shall make payment of retainage applying to such Work or designated portion thereof. Such payment shall be adjusted for Work that is incomplete or not in accordance with the requirements of the Contract Documents.

§ 9.9 Partial Occupancy or Use

§ 9.9.1 The Owner may occupy or use any completed or partially completed portion of the Work at any stage when such portion is designated by separate agreement with the Contractor, provided such occupancy or use is consented to by the insurer as required under Section 11.3.1.5 and authorized by public authorities having jurisdiction over the Project. Such partial occupancy or use may commence whether or not the portion is substantially complete, provided the Owner and Contractor have accepted in writing the responsibilities assigned to each of them for payments, retainage, if any, security, maintenance, heat, utilities, damage to the Work and insurance, and have agreed in writing concerning the period for correction of the Work and commencement of warranties required by the Contract Documents. When the Contractor considers a portion substantially complete, the Contractor shall prepare and submit a list to the Architect as provided under Section 9.8.2. Consent of the Contractor to partial occupancy or use shall not be unreasonably withheld. The stage of the progress of the Work shall be determined by written agreement between the Owner and Contractor or, if no agreement is reached, by decision of the Architect.

§ 9.9.2 Immediately prior to such partial occupancy or use, the Owner, Contractor and Architect shall jointly inspect the area to be occupied or portion of the Work to be used in order to determine and record the condition of the Work.

§ 9.9.3 Unless otherwise agreed upon, partial occupancy or use of a portion or portions of the Work shall not constitute acceptance of Work not complying with the requirements of the Contract Documents.

§ 9.10 Final Completion and Final Payment

§ 9.10.1 Upon receipt of the Contractor's written notice that the Work is ready for final inspection and acceptance and upon receipt of a final Application for Payment, the Architect will promptly make such inspection and, when the Architect finds the Work acceptable under the Contract Documents and the Contract fully performed, the Architect will promptly issue a final Certificate for Payment stating that to the best of the Architect's knowledge, information and belief, and on the basis of the Architect's on-site visits and inspections, the Work has been completed in accordance with terms and conditions of the Contract Documents and that the entire balance found to be due the Contractor and noted in the final Certificate is due and payable. The Architect's final Certificate for Payment will constitute a further representation that conditions listed in Section 9.10.2 as precedent to the Contractor's being entitled to final payment have been fulfilled.

§ 9.10.2 Neither final payment nor any remaining retained percentage shall become due until the Contractor submits to the Architect (1) an affidavit that payrolls, bills for materials and equipment, and other indebtedness connected with the Work for which the Owner or the Owner's property might be responsible or encumbered (less amounts withheld by Owner) have been paid or otherwise satisfied, (2) a certificate evidencing that insurance required by the Contract Documents to remain in force after final payment is currently in effect and will not be canceled or allowed to expire until at least 30 days' prior written notice has been given to the Owner, (3) a written statement that the Contractor knows of no substantial reason that the insurance will not be renewable to cover the period required by the Contract Documents, (4) consent of surety, if any, to final payment and (5), if required by the Owner, other data establishing payment or satisfaction of obligations, such as receipts, releases and waivers of liens, claims, security interests or encumbrances arising out of the Contract, to the extent and in such form as may be designated by the Owner. If a Subcontractor refuses to furnish a release or waiver required by the Owner, the Contractor may furnish a bond satisfactory to the Owner to indemnify the Owner against such lien. If such lien remains unsatisfied after payments are made, the Contractor shall refund to the Owner all money that the Owner may be compelled to pay in discharging such lien, including all costs and reasonable attorneys' fees.

§ 9.10.3 If, after Substantial Completion of the Work, final completion thereof is materially delayed through no fault of the Contractor or by issuance of Change Orders affecting final completion, and the Architect so confirms, the Owner shall, upon application by the Contractor and certification by the Architect, and without terminating the Contract, make payment of the balance due for that portion of the Work fully completed and accepted. If the remaining balance for Work not fully completed or corrected is less than retainage stipulated in the Contract Documents, and if bonds have been furnished, the written consent of surety to payment of the balance due for that portion of the Work fully completed and accepted shall be submitted by the Contractor to the Architect prior to certification of such payment. Such payment shall be made under terms and conditions governing final payment, except that it shall not constitute a waiver of claims.

§ 9.10.4 The making of final payment shall constitute a waiver of Claims by the Owner except those arising from

- .1 liens, Claims, security interests or encumbrances arising out of the Contract and unsettled;
- .2 failure of the Work to comply with the requirements of the Contract Documents; or
- .3 terms of special warranties required by the Contract Documents.

§ 9.10.5 Acceptance of final payment by the Contractor, a Subcontractor or material supplier shall constitute a waiver of claims by that payee except those previously made in writing and identified by that payee as unsettled at the time of final Application for Payment.

ARTICLE 10 PROTECTION OF PERSONS AND PROPERTY

§ 10.1 Safety Precautions and Programs

The Contractor shall be responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the performance of the Contract.

§ 10.2 Safety of Persons and Property

§ 10.2.1 The Contractor shall take reasonable precautions for safety of, and shall provide reasonable protection to prevent damage, injury or loss to

- .1 employees on the Work and other persons who may be affected thereby;
- .2 the Work and materials and equipment to be incorporated therein, whether in storage on or off the site, under care, custody or control of the Contractor or the Contractor's Subcontractors or Sub-subcontractors; and
- .3 other property at the site or adjacent thereto, such as trees, shrubs, lawns, walks, pavements, roadways, structures and utilities not designated for removal, relocation or replacement in the course of construction.

§ 10.2.2 The Contractor shall comply with and give notices required by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities bearing on safety of persons or property or their protection from damage, injury or loss.

§ 10.2.3 The Contractor shall erect and maintain, as required by existing conditions and performance of the Contract, reasonable safeguards for safety and protection, including posting danger signs and other warnings against hazards, promulgating safety regulations and notifying owners and users of adjacent sites and utilities.

§ 10.2.4 When use or storage of explosives or other hazardous materials or equipment or unusual methods are necessary for execution of the Work, the Contractor shall exercise utmost care and carry on such activities under supervision of properly qualified personnel.

§ 10.2.5 The Contractor shall promptly remedy damage and loss (other than damage or loss insured under property insurance required by the Contract Documents) to property referred to in Sections 10.2.1.2 and 10.2.1.3 caused in whole or in part by the Contractor, a Subcontractor, a Sub-subcontractor, or anyone directly or indirectly employed by any of them, or by anyone for whose acts they may be liable and for which the Contractor is responsible under Sections 10.2.1.2 and 10.2.1.3, except damage or loss attributable to acts or omissions of the Owner or Architect or anyone directly or indirectly employed by either of them, or by anyone for whose acts either of them may be liable, and not attributable to the fault or negligence of the Contractor. The foregoing obligations of the Contractor are in addition to the Contractor's obligations under Section 3.18.

§ 10.2.6 The Contractor shall designate a responsible member of the Contractor's organization at the site whose duty shall be the prevention of accidents. This person shall be the Contractor's superintendent unless otherwise designated by the Contractor in writing to the Owner and Architect.

§ 10.2.7 The Contractor shall not permit any part of the construction or site to be loaded so as to cause damage or create an unsafe condition.

§ 10.2.8 Injury or Damage to Person or Property

If either party suffers injury or damage to person or property because of an act or omission of the other party, or of others for whose acts such party is legally responsible, written notice of such injury or damage, whether or not insured, shall be given to the other party within a reasonable time not exceeding 21 days after discovery. The notice shall provide sufficient detail to enable the other party to investigate the matter.

§ 10.3 Hazardous Materials

§ 10.3.1 The Contractor is responsible for compliance with any requirements included in the Contract Documents regarding hazardous materials. If the Contractor encounters a hazardous material or substance not addressed in the Contract Documents and if reasonable precautions will be inadequate to prevent foreseeable bodily injury or death to persons resulting from a material or substance, including but not limited to asbestos or polychlorinated biphenyl (PCB), encountered on the site by the Contractor, the Contractor shall, upon recognizing the condition, immediately stop Work in the affected area and report the condition to the Owner and Architect in writing.

§ 10.3.2 Upon receipt of the Contractor's written notice, the Owner shall obtain the services of a licensed laboratory to verify the presence or absence of the material or substance reported by the Contractor and, in the event such material or substance is found to be present, to cause it to be rendered harmless. Unless otherwise required by the Contract Documents, the Owner shall furnish in writing to the Contractor and Architect the names and qualifications of persons or entities who are to perform tests verifying the presence or absence of such material or substance or who are to perform the task of removal or safe containment of such material or substance. The Contractor and the Architect will promptly reply to the Owner in writing stating whether or not either has reasonable objection to the persons or entities proposed by the Owner. If either the Contractor or Architect has an objection to a person or entity proposed by the Owner, the Owner shall propose another to whom the Contractor and the Architect have no reasonable objection. When the material or substance has been rendered harmless, Work in the affected area shall resume upon written agreement of the Owner and Contractor. By Change Order, the Contract Time shall be extended appropriately and the Contract Sum shall be increased in the amount of the Contractor's reasonable additional costs of shut-down, delay and start-up.

§ 10.3.3 To the fullest extent permitted by law, the Owner shall indemnify and hold harmless the Contractor, Subcontractors, Architect, Architect's consultants and agents and 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 in the affected area if in fact the material or substance presents the risk of bodily injury or death as described in Section 10.3.1 and has not been rendered harmless, provided that such claim, damage, loss or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself), except to the extent that such damage, loss or expense is due to the fault or negligence of the party seeking indemnity.

§ 10.3.4 The Owner shall not be responsible under this Section 10.3 for materials or substances the Contractor brings to the site unless such materials or substances are required by the Contract Documents. The Owner shall be responsible for materials or substances required by the Contract Documents, except to the extent of the Contractor's fault or negligence in the use and handling of such materials or substances.

§ 10.3.5 The Contractor shall indemnify the Owner for the cost and expense the Owner incurs (1) for remediation of a material or substance the Contractor brings to the site and negligently handles, or (2) where the Contractor fails to perform its obligations under Section 10.3.1, except to the extent that the cost and expense are due to the Owner's fault or negligence.

§ 10.3.6 If, without negligence on the part of the Contractor, the Contractor is held liable by a government agency for the cost of remediation of a hazardous material or substance solely by reason of performing Work as required by the Contract Documents, the Owner shall indemnify the Contractor for all cost and expense thereby incurred.

§ 10.4 Emergencies

In an emergency affecting safety of persons or property, the Contractor shall act, at the Contractor's discretion, to prevent threatened damage, injury or loss. Additional compensation or extension of time claimed by the Contractor on account of an emergency shall be determined as provided in Article 15 and Article 7.

ARTICLE 11 INSURANCE AND BONDS

§ 11.1 Contractor's Liability Insurance

§ 11.1.1 The Contractor shall purchase from and maintain in a company or companies lawfully authorized to do business in the jurisdiction in which the Project is located such insurance as will protect the Contractor from claims set forth below which may arise out of or result from the Contractor's operations and completed operations under the Contract and for which the Contractor may be legally liable, whether such operations be by the Contractor or by a Subcontractor or by anyone directly or indirectly employed by any of them, or by anyone for whose acts any of them may be liable:

- .1 Claims under workers' compensation, disability benefit and other similar employee benefit acts that are applicable to the Work to be performed;
- .2 Claims for damages because of bodily injury, occupational sickness or disease, or death of the Contractor's employees;
- .3 Claims for damages because of bodily injury, sickness or disease, or death of any person other than the Contractor's employees;
- .4 Claims for damages insured by usual personal injury liability coverage;
- .5 Claims for damages, other than to the Work itself, because of injury to or destruction of tangible property, including loss of use resulting therefrom;
- .6 Claims for damages because of bodily injury, death of a person or property damage arising out of ownership, maintenance or use of a motor vehicle;
- .7 Claims for bodily injury or property damage arising out of completed operations; and
- .8 Claims involving contractual liability insurance applicable to the Contractor's obligations under Section 3.18.

§ 11.1.2 The insurance required by Section 11.1.1 shall be written for not less than limits of liability specified in the Contract Documents or required by law, whichever coverage is greater. Coverages, whether written on an occurrence or claims-made basis, shall be maintained without interruption from the date of commencement of the Work until the date of final payment and termination of any coverage required to be maintained after final payment, and, with respect to the Contractor's completed operations coverage, until the expiration of the period for correction of Work or for such other period for maintenance of completed operations coverage as specified in the Contract Documents.

§ 11.1.3 Certificates of insurance acceptable to the Owner shall be filed with the Owner prior to commencement of the Work and thereafter upon renewal or replacement of each required policy of insurance. These certificates and the insurance policies required by this Section 11.1 shall contain a provision that coverages afforded under the policies will not be canceled or allowed to expire until at least 30 days' prior written notice has been given to the Owner. An additional certificate evidencing continuation of liability coverage, including coverage for completed operations, shall be submitted with the final Application for Payment as required by Section 9.10.2 and thereafter upon renewal or replacement of such coverage until the expiration of the time required by Section 11.1.2. Information concerning reduction of coverage on account of revised limits or claims paid under the General Aggregate, or both, shall be furnished by the Contractor with reasonable promptness.

§ 11.1.4 The Contractor shall cause the commercial liability coverage required by the Contract Documents to include (1) the Owner, the Architect and the Architect's consultants as additional insureds for claims caused in whole or in part by the Contractor's negligent acts or omissions during the Contractor's operations; and (2) the Owner as an additional insured for claims caused in whole or in part by the Contractor's negligent acts or omissions during the Contractor's completed operations.

§ 11.2 Owner's Liability Insurance

The Owner shall be responsible for purchasing and maintaining the Owner's usual liability insurance.

§ 11.3 Property Insurance

§ 11.3.1 Unless otherwise provided, the Owner shall purchase and maintain, in a company or companies lawfully authorized to do business in the jurisdiction in which the Project is located, property insurance written on a builder's

risk “all-risk” or equivalent policy form in the amount of the initial Contract Sum, plus value of subsequent Contract Modifications and cost of materials supplied or installed by others, comprising total value for the entire Project at the site on a replacement cost basis without optional deductibles. Such property insurance shall be maintained, unless otherwise provided in the Contract Documents or otherwise agreed in writing by all persons and entities who are beneficiaries of such insurance, until final payment has been made as provided in Section 9.10 or until no person or entity other than the Owner has an insurable interest in the property required by this Section 11.3 to be covered, whichever is later. This insurance shall include interests of the Owner, the Contractor, Subcontractors and Sub-subcontractors in the Project.

§ 11.3.1.1 Property insurance shall be on an “all-risk” or equivalent policy form and shall include, without limitation, insurance against the perils of fire (with extended coverage) and physical loss or damage including, without duplication of coverage, theft, vandalism, malicious mischief, collapse, earthquake, flood, windstorm, falsework, testing and startup, temporary buildings and debris removal including demolition occasioned by enforcement of any applicable legal requirements, and shall cover reasonable compensation for Architect’s and Contractor’s services and expenses required as a result of such insured loss.

§ 11.3.1.2 If the Owner does not intend to purchase such property insurance required by the Contract and with all of the coverages in the amount described above, the Owner shall so inform the Contractor in writing prior to commencement of the Work. The Contractor may then effect insurance that will protect the interests of the Contractor, Subcontractors and Sub-subcontractors in the Work, and by appropriate Change Order the cost thereof shall be charged to the Owner. If the Contractor is damaged by the failure or neglect of the Owner to purchase or maintain insurance as described above, without so notifying the Contractor in writing, then the Owner shall bear all reasonable costs properly attributable thereto.

§ 11.3.1.3 If the property insurance requires deductibles, the Owner shall pay costs not covered because of such deductibles.

§ 11.3.1.4 This property insurance shall cover portions of the Work stored off the site, and also portions of the Work in transit.

§ 11.3.1.5 Partial occupancy or use in accordance with Section 9.9 shall not commence until the insurance company or companies providing property insurance have consented to such partial occupancy or use by endorsement or otherwise. The Owner and the Contractor shall take reasonable steps to obtain consent of the insurance company or companies and shall, without mutual written consent, take no action with respect to partial occupancy or use that would cause cancellation, lapse or reduction of insurance.

§ 11.3.2 Boiler and Machinery Insurance

The Owner shall purchase and maintain boiler and machinery insurance required by the Contract Documents or by law, which shall specifically cover such insured objects during installation and until final acceptance by the Owner; this insurance shall include interests of the Owner, Contractor, Subcontractors and Sub-subcontractors in the Work, and the Owner and Contractor shall be named insureds.

§ 11.3.3 Loss of Use Insurance

The Owner, at the Owner’s option, may purchase and maintain such insurance as will insure the Owner against loss of use of the Owner’s property due to fire or other hazards, however caused. The Owner waives all rights of action against the Contractor for loss of use of the Owner’s property, including consequential losses due to fire or other hazards however caused.

§ 11.3.4 If the Contractor requests in writing that insurance for risks other than those described herein or other special causes of loss be included in the property insurance policy, the Owner shall, if possible, include such insurance, and the cost thereof shall be charged to the Contractor by appropriate Change Order.

§ 11.3.5 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 is 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. All separate policies shall provide this waiver of subrogation by endorsement or otherwise.

§ 11.3.6 Before an exposure to loss may occur, the Owner shall file with the Contractor a copy of each policy that includes insurance coverages required by this Section 11.3. Each policy shall contain all generally applicable conditions, definitions, exclusions and endorsements related to this Project. Each policy shall contain a provision that the policy will not be canceled or allowed to expire, and that its limits will not be reduced, until at least 30 days' prior written notice has been given to the Contractor.

§ 11.3.7 Waivers of Subrogation

The Owner and Contractor waive all rights against (1) each other and any of their subcontractors, sub-subcontractors, agents and 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. The Owner or Contractor, as appropriate, shall require of the Architect, Architect's consultants, separate contractors described in Article 6, if any, and the subcontractors, sub-subcontractors, agents and employees of any of them, by appropriate agreements, written where legally required for validity, similar waivers each in favor of other parties enumerated herein. The policies shall provide such waivers of subrogation by endorsement or otherwise. A waiver of subrogation shall be effective as to a person or entity even though that person or entity would otherwise have a duty of indemnification, contractual or otherwise, did not pay the insurance premium directly or indirectly, and whether or not the person or entity had an insurable interest in the property damaged.

§ 11.3.8 A loss insured under the Owner's property insurance shall be adjusted by the Owner as fiduciary and made payable to the Owner as fiduciary for the insureds, as their interests may appear, subject to requirements of any applicable mortgagee clause and of Section 11.3.10. The Contractor shall pay Subcontractors their just shares of insurance proceeds received by the Contractor, and by appropriate agreements, written where legally required for validity, shall require Subcontractors to make payments to their Sub-subcontractors in similar manner.

§ 11.3.9 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. The cost of required bonds shall be charged against proceeds received as fiduciary. The Owner shall deposit in a separate account proceeds so received, which the Owner shall distribute in accordance with such agreement as the parties in interest may reach, or as determined in accordance with the method of binding dispute resolution selected in the Agreement between the Owner and Contractor. If after such loss no other special agreement is made and unless the Owner terminates the Contract for convenience, replacement of damaged property shall be performed by the Contractor after notification of a Change in the Work in accordance with Article 7.

§ 11.3.10 The Owner as fiduciary shall have power to adjust and settle a loss with insurers unless one of the parties in interest shall object in writing within five days after occurrence of loss to the Owner's exercise of this power; if such objection is made, the dispute shall be resolved in the manner selected by the Owner and Contractor as the method of binding dispute resolution in the Agreement. If the Owner and Contractor have selected arbitration as the method of binding dispute resolution, the Owner as fiduciary shall make settlement with insurers or, in the case of a dispute over distribution of insurance proceeds, in accordance with the directions of the arbitrators.

§ 11.4 Performance Bond and Payment Bond

§ 11.4.1 The Owner shall have the right to require the Contractor to furnish bonds covering faithful performance of the Contract and payment of obligations arising thereunder as stipulated in bidding requirements or specifically required in the Contract Documents on the date of execution of the Contract.

§ 11.4.2 Upon the request of any person or entity appearing to be a potential beneficiary of bonds covering payment of obligations arising under the Contract, the Contractor shall promptly furnish a copy of the bonds or shall authorize a copy to be furnished.

ARTICLE 12 UNCOVERING AND CORRECTION OF WORK

§ 12.1 Uncovering of Work

§ 12.1.1 If a portion of the Work is covered contrary to the Architect's request or to requirements specifically expressed in the Contract Documents, it must, if requested in writing by the Architect, be uncovered for the Architect's examination and be replaced at the Contractor's expense without change in the Contract Time.

§ 12.1.2 If a portion of the Work has been covered that the Architect has not specifically requested to examine prior to its being covered, the Architect may request to see such Work and it shall be uncovered by the Contractor. If such Work is in accordance with the Contract Documents, costs of uncovering and replacement shall, by appropriate Change Order, be at the Owner's expense. If such Work is not in accordance with the Contract Documents, such costs and the cost of correction shall be at the Contractor's expense unless the condition was caused by the Owner or a separate contractor in which event the Owner shall be responsible for payment of such costs.

§ 12.2 Correction of Work

§ 12.2.1 Before or After Substantial Completion

The Contractor shall promptly correct Work rejected by the Architect or failing to conform to the requirements of the Contract Documents, whether discovered before or after Substantial Completion and whether or not fabricated, installed or completed. Costs of correcting such rejected Work, including additional testing and inspections, the cost of uncovering and replacement, and compensation for the Architect's services and expenses made necessary thereby, shall be at the Contractor's expense.

§ 12.2.2 After Substantial Completion

§ 12.2.2.1 In addition to the Contractor's obligations under Section 3.5, if, within one year after the date of Substantial Completion of the Work or designated portion thereof or after the date for commencement of warranties established under Section 9.9.1, or by terms of an applicable special warranty required by the Contract Documents, any of the Work is found to be not in accordance with the requirements of the Contract Documents, the Contractor shall correct it promptly after receipt of written notice from the Owner to do so unless the Owner has previously given the Contractor a written acceptance of such condition. The Owner shall give such notice promptly after discovery of the condition. During the one-year period for correction of Work, if the Owner fails to notify the Contractor and give the Contractor an opportunity to make the correction, the Owner waives the rights to require correction by the Contractor and to make a claim for breach of warranty. If the Contractor fails to correct nonconforming Work within a reasonable time during that period after receipt of notice from the Owner or Architect, the Owner may correct it in accordance with Section 2.4.

§ 12.2.2.2 The one-year period for correction of Work shall be extended with respect to portions of Work first performed after Substantial Completion by the period of time between Substantial Completion and the actual completion of that portion of the Work.

§ 12.2.2.3 The one-year period for correction of Work shall not be extended by corrective Work performed by the Contractor pursuant to this Section 12.2.

§ 12.2.3 The Contractor shall remove from the site portions of the Work that are not in accordance with the requirements of the Contract Documents and are neither corrected by the Contractor nor accepted by the Owner.

§ 12.2.4 The Contractor shall bear the cost of correcting destroyed or damaged construction, whether completed or partially completed, of the Owner or separate contractors caused by the Contractor's correction or removal of Work that is not in accordance with the requirements of the Contract Documents.

§ 12.2.5 Nothing contained in this Section 12.2 shall be construed to establish a period of limitation with respect to other obligations the Contractor has under the Contract Documents. Establishment of the one-year period for correction of Work as described in Section 12.2.2 relates only to the specific obligation of the Contractor to correct the Work, and has no relationship to the time within which the obligation to comply with the Contract Documents may be sought to be enforced, nor to the time within which proceedings may be commenced to establish the Contractor's liability with respect to the Contractor's obligations other than specifically to correct the Work.

§ 12.3 Acceptance of Nonconforming Work

If the Owner prefers to accept Work that is not in accordance with the requirements of the Contract Documents, the Owner may do so instead of requiring its removal and correction, in which case the Contract Sum will be reduced as appropriate and equitable. Such adjustment shall be effected whether or not final payment has been made.

ARTICLE 13 MISCELLANEOUS PROVISIONS

§ 13.1 Governing Law

The Contract shall be governed by the law of the place where the Project is located except that, if the parties have selected arbitration as the method of binding dispute resolution, the Federal Arbitration Act shall govern Section 15.4.

§ 13.2 Successors and Assigns

§ 13.2.1 The Owner and Contractor respectively bind themselves, their partners, successors, assigns and legal representatives to covenants, agreements and obligations contained in the Contract Documents. Except as provided in Section 13.2.2, neither party to the Contract shall assign the Contract as a whole without written consent of the other. If either party attempts to make such an assignment without such consent, that party shall nevertheless remain legally responsible for all obligations under the Contract.

§ 13.2.2 The Owner may, without consent of the Contractor, assign the Contract to a lender providing construction financing for the Project, if the lender assumes the Owner's rights and obligations under the Contract Documents. The Contractor shall execute all consents reasonably required to facilitate such assignment.

§ 13.3 Written Notice

Written notice shall be deemed to have been duly served if delivered in person to the individual, to a member of the firm or entity, or to an officer of the corporation for which it was intended; or if delivered at, or sent by registered or certified mail or by courier service providing proof of delivery to, the last business address known to the party giving notice.

§ 13.4 Rights and Remedies

§ 13.4.1 Duties and obligations imposed by the Contract Documents and rights and remedies available thereunder shall be in addition to and not a limitation of duties, obligations, rights and remedies otherwise imposed or available by law.

§ 13.4.2 No action or failure to act by the Owner, Architect or Contractor shall constitute a waiver of a right or duty afforded them under the Contract, nor shall such action or failure to act constitute approval of or acquiescence in a breach there under, except as may be specifically agreed in writing.

§ 13.5 Tests and Inspections

§ 13.5.1 Tests, inspections and approvals of portions of the Work shall be made as required by the Contract Documents and by applicable laws, statutes, ordinances, codes, rules and regulations or lawful orders of public authorities. Unless otherwise provided, the Contractor shall make arrangements for such tests, inspections and approvals with an independent testing laboratory or entity acceptable to the Owner, or with the appropriate public authority, and shall bear all related costs of tests, inspections and approvals. The Contractor shall give the Architect timely notice of when and where tests and inspections are to be made so that the Architect may be present for such procedures. The Owner shall bear costs of (1) tests, inspections or approvals that do not become requirements until after bids are received or negotiations concluded, and (2) tests, inspections or approvals where building codes or applicable laws or regulations prohibit the Owner from delegating their cost to the Contractor.

§ 13.5.2 If the Architect, Owner or public authorities having jurisdiction determine that portions of the Work require additional testing, inspection or approval not included under Section 13.5.1, the Architect will, upon written authorization from the Owner, instruct the Contractor to make arrangements for such additional testing, inspection or approval by an entity acceptable to the Owner, and the Contractor shall give timely notice to the Architect of when and where tests and inspections are to be made so that the Architect may be present for such procedures. Such costs, except as provided in Section 13.5.3, shall be at the Owner's expense.

§ 13.5.3 If such procedures for testing, inspection or approval under Sections 13.5.1 and 13.5.2 reveal failure of the portions of the Work to comply with requirements established by the Contract Documents, all costs made necessary by such failure including those of repeated procedures and compensation for the Architect's services and expenses shall be at the Contractor's expense.

§ 13.5.4 Required certificates of testing, inspection or approval shall, unless otherwise required by the Contract Documents, be secured by the Contractor and promptly delivered to the Architect.

§ 13.5.5 If the Architect is to observe tests, inspections or approvals required by the Contract Documents, the Architect will do so promptly and, where practicable, at the normal place of testing.

§ 13.5.6 Tests or inspections conducted pursuant to the Contract Documents shall be made promptly to avoid unreasonable delay in the Work.

§ 13.6 Interest

Payments due and unpaid under the Contract Documents shall bear interest from the date payment is due at such rate as the parties may agree upon in writing or, in the absence thereof, at the legal rate prevailing from time to time at the place where the Project is located.

§ 13.7 Time Limits on Claims

The Owner and Contractor shall commence all claims and causes of action, whether in contract, tort, breach of warranty or otherwise, against the other arising out of or related to the Contract in accordance with the requirements of the final dispute resolution method selected in the Agreement within the time period specified by applicable law, but in any case not more than 10 years after the date of Substantial Completion of the Work. The Owner and Contractor waive all claims and causes of action not commenced in accordance with this Section 13.7.

ARTICLE 14 TERMINATION OR SUSPENSION OF THE CONTRACT

§ 14.1 Termination by the Contractor

§ 14.1.1 The Contractor may terminate the Contract if the Work is stopped for a period of 30 consecutive days through no act or fault of the Contractor or a Subcontractor, Sub-subcontractor or their agents or employees or any other persons or entities performing portions of the Work under direct or indirect contract with the Contractor, for any of the following reasons:

- .1 Issuance of an order of a court or other public authority having jurisdiction that requires all Work to be stopped;
- .2 An act of government, such as a declaration of national emergency that requires all Work to be stopped;
- .3 Because the Architect has not issued a Certificate for Payment and has not notified the Contractor of the reason for withholding certification as provided in Section 9.4.1, or because the Owner has not made payment on a Certificate for Payment within the time stated in the Contract Documents; or
- .4 The Owner has failed to furnish to the Contractor promptly, upon the Contractor's request, reasonable evidence as required by Section 2.2.1.

§ 14.1.2 The Contractor may terminate the Contract if, through no act or fault of the Contractor or a Subcontractor, Sub-subcontractor or their agents or employees or any other persons or entities performing portions of the Work under direct or indirect contract with the Contractor, repeated suspensions, delays or interruptions of the entire Work by the Owner as described in Section 14.3 constitute in the aggregate more than 100 percent of the total number of days scheduled for completion, or 120 days in any 365-day period, whichever is less.

§ 14.1.3 If one of the reasons described in Section 14.1.1 or 14.1.2 exists, the Contractor may, upon seven days' written notice to the Owner and Architect, terminate the Contract and recover from the Owner payment for Work executed, including reasonable overhead and profit, costs incurred by reason of such termination, and damages.

§ 14.1.4 If the Work is stopped for a period of 60 consecutive days through no act or fault of the Contractor or a Subcontractor or their agents or employees or any other persons performing portions of the Work under contract with the Contractor because the Owner has repeatedly failed to fulfill the Owner's obligations under the Contract Documents with respect to matters important to the progress of the Work, the Contractor may, upon seven additional days' written notice to the Owner and the Architect, terminate the Contract and recover from the Owner as provided in Section 14.1.3.

§ 14.2 Termination by the Owner for Cause

§ 14.2.1 The Owner may terminate the Contract if the Contractor

- .1 repeatedly refuses or fails to supply enough properly skilled workers or proper materials;
- .2 fails to make payment to Subcontractors for materials or labor in accordance with the respective agreements between the Contractor and the Subcontractors;
- .3 repeatedly disregards applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of a public authority; or
- .4 otherwise is guilty of substantial breach of a provision of the Contract Documents.

§ 14.2.2 When any of the above reasons exist, the Owner, upon certification by the Initial Decision Maker that sufficient cause exists to justify such action, may without prejudice to any other rights or remedies of the Owner and after giving the Contractor and the Contractor's surety, if any, seven days' written notice, terminate employment of the Contractor and may, subject to any prior rights of the surety:

- .1 Exclude the Contractor from the site and take possession of all materials, equipment, tools, and construction equipment and machinery thereon owned by the Contractor;
- .2 Accept assignment of subcontracts pursuant to Section 5.4; and
- .3 Finish the Work by whatever reasonable method the Owner may deem expedient. Upon written request of the Contractor, the Owner shall furnish to the Contractor a detailed accounting of the costs incurred by the Owner in finishing the Work.

§ 14.2.3 When the Owner terminates the Contract for one of the reasons stated in Section 14.2.1, the Contractor shall not be entitled to receive further payment until the Work is finished.

§ 14.2.4 If the unpaid balance of the Contract Sum exceeds costs of finishing the Work, including compensation for the Architect's services and expenses made necessary thereby, and other damages incurred by the Owner and not expressly waived, such excess shall be paid to the Contractor. If such costs and damages exceed the unpaid balance, the Contractor shall pay the difference to the Owner. The amount to be paid to the Contractor or Owner, as the case may be, shall be certified by the Initial Decision Maker, upon application, and this obligation for payment shall survive termination of the Contract.

§ 14.3 Suspension by the Owner for Convenience

§ 14.3.1 The Owner may, without cause, order the Contractor in writing to suspend, delay or interrupt the Work in whole or in part for such period of time as the Owner may determine.

§ 14.3.2 The Contract Sum and Contract Time shall be adjusted for increases in the cost and time caused by suspension, delay or interruption as described in Section 14.3.1. Adjustment of the Contract Sum shall include profit. No adjustment shall be made to the extent

- .1 that performance is, was or would have been so suspended, delayed or interrupted by another cause for which the Contractor is responsible; or
- .2 that an equitable adjustment is made or denied under another provision of the Contract.

§ 14.4 Termination by the Owner for Convenience

§ 14.4.1 The Owner may, at any time, terminate the Contract for the Owner's convenience and without cause.

§ 14.4.2 Upon receipt of written notice from the Owner of such termination for the Owner's convenience, the Contractor shall

- .1 cease operations as directed by the Owner in the notice;
- .2 take actions necessary, or that the Owner may direct, for the protection and preservation of the Work; and
- .3 except for Work directed to be performed prior to the effective date of termination stated in the notice, terminate all existing subcontracts and purchase orders and enter into no further subcontracts and purchase orders.

§ 14.4.3 In case of such termination for the Owner's convenience, the Contractor shall be entitled to receive payment for Work executed, and costs incurred by reason of such termination, along with reasonable overhead and profit on the Work not executed.

ARTICLE 15 CLAIMS AND DISPUTES

§ 15.1 Claims

§ 15.1.1 Definition

A Claim is a demand or assertion by one of the parties seeking, as a matter of right, payment of money, or other relief with respect to the terms of the Contract. The term "Claim" also includes other disputes and matters in question between the Owner and Contractor arising out of or relating to the Contract. The responsibility to substantiate Claims shall rest with the party making the Claim.

§ 15.1.2 Notice of Claims

Claims by either the Owner or Contractor must be initiated by written notice to the other party and to the Initial Decision Maker with a copy sent to the Architect, if the Architect is not serving as the Initial Decision Maker.

Claims by either party must be initiated within 21 days after occurrence of the event giving rise to such Claim or within 21 days after the claimant first recognizes the condition giving rise to the Claim, whichever is later.

§ 15.1.3 Continuing Contract Performance

Pending final resolution of a Claim, except as otherwise agreed in writing or as provided in Section 9.7 and Article 14, the Contractor shall proceed diligently with performance of the Contract and the Owner shall continue to make payments in accordance with the Contract Documents. The Architect will prepare Change Orders and issue Certificates for Payment in accordance with the decisions of the Initial Decision Maker.

§ 15.1.4 Claims for Additional Cost

If the Contractor wishes to make a Claim for an increase in the Contract Sum, written notice as provided herein shall be given before proceeding to execute the Work. Prior notice is not required for Claims relating to an emergency endangering life or property arising under Section 10.4.

§ 15.1.5 Claims for Additional Time

§ 15.1.5.1 If the Contractor wishes to make a Claim for an increase in the Contract Time, written notice as provided herein shall be given. The Contractor's Claim shall include an estimate of cost and of probable effect of delay on progress of the Work. In the case of a continuing delay, only one Claim is necessary.

§ 15.1.5.2 If adverse weather conditions are the basis for a Claim for additional time, such Claim shall be documented by data substantiating that weather conditions were abnormal for the period of time, could not have been reasonably anticipated and had an adverse effect on the scheduled construction.

§ 15.1.6 Claims for Consequential Damages

The Contractor and Owner waive Claims against each other for consequential damages arising out of or relating to this Contract. This mutual waiver includes

- .1 damages incurred by the Owner for rental expenses, for losses of use, income, profit, financing, business and reputation, and for loss of management or employee productivity or of the services of such persons; and
- .2 damages incurred by the Contractor for principal office expenses including the compensation of personnel stationed there, for losses of financing, business and reputation, and for loss of profit except anticipated profit arising directly from the Work.

This mutual waiver is applicable, without limitation, to all consequential damages due to either party's termination in accordance with Article 14. Nothing contained in this Section 15.1.6 shall be deemed to preclude an award of liquidated damages, when applicable, in accordance with the requirements of the Contract Documents.

§ 15.2 Initial Decision

§ 15.2.1 Claims, excluding those arising under Sections 10.3, 10.4, 11.3.9, and 11.3.10, shall be referred to the Initial Decision Maker for initial decision. The Architect will serve as the Initial Decision Maker, unless otherwise indicated in the Agreement. Except for those Claims excluded by this Section 15.2.1, an initial decision shall be required as a condition precedent to mediation of any Claim arising prior to the date final payment is due, unless 30 days have passed after the Claim has been referred to the Initial Decision Maker with no decision having been rendered. Unless the Initial Decision Maker and all affected parties agree, the Initial Decision Maker will not decide disputes between the Contractor and persons or entities other than the Owner.

§ 15.2.2 The Initial Decision Maker will review Claims and within ten days of the receipt of a Claim take one or more of the following actions: (1) request additional supporting data from the claimant or a response with supporting data from the other party, (2) reject the Claim in whole or in part, (3) approve the Claim, (4) suggest a compromise, or (5) advise the parties that the Initial Decision Maker is unable to resolve the Claim if the Initial Decision Maker lacks sufficient information to evaluate the merits of the Claim or if the Initial Decision Maker concludes that, in the Initial Decision Maker's sole discretion, it would be inappropriate for the Initial Decision Maker to resolve the Claim.

§ 15.2.3 In evaluating Claims, the Initial Decision Maker may, but shall not be obligated to, consult with or seek information from either party or from persons with special knowledge or expertise who may assist the Initial Decision Maker in rendering a decision. The Initial Decision Maker may request the Owner to authorize retention of such persons at the Owner's expense.

§ 15.2.4 If the Initial Decision Maker requests a party to provide a response to a Claim or to furnish additional supporting data, such party shall respond, within ten days after receipt of such request, and shall either (1) provide a response on the requested supporting data, (2) advise the Initial Decision Maker when the response or supporting data will be furnished or (3) advise the Initial Decision Maker that no supporting data will be furnished. Upon receipt of the response or supporting data, if any, the Initial Decision Maker will either reject or approve the Claim in whole or in part.

§ 15.2.5 The Initial Decision Maker will render an initial decision approving or rejecting the Claim, or indicating that the Initial Decision Maker is unable to resolve the Claim. This initial decision shall (1) be in writing; (2) state the reasons therefor; and (3) notify the parties and the Architect, if the Architect is not serving as the Initial Decision Maker, of any change in the Contract Sum or Contract Time or both. 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 Either party may file for mediation of an initial decision at any time, subject to the terms of Section 15.2.6.1.

§ 15.2.6.1 Either party may, within 30 days from the date of an initial decision, demand in writing that the other party file for mediation within 60 days of the initial decision. If such a demand is made and the party receiving the demand fails to file for mediation within the time required, then both parties waive their rights to mediate or pursue binding dispute resolution proceedings with respect to the initial decision.

§ 15.2.7 In the event of a Claim against the Contractor, the Owner may, but is not obligated to, notify the surety, if any, of the nature and amount of the Claim. If the Claim relates to a possibility of a Contractor's default, the Owner may, but is not obligated to, notify the surety and request the surety's assistance in resolving the controversy.

§ 15.2.8 If a Claim relates to or is the subject of a mechanic's lien, the party asserting such Claim may proceed in accordance with applicable law to comply with the lien notice or filing deadlines.

§ 15.3 Mediation

§ 15.3.1 Claims, disputes, or other matters in controversy arising out of or related to the Contract except those waived as provided for in Sections 9.10.4, 9.10.5, and 15.1.6 shall be subject to mediation as a condition precedent to binding dispute resolution.

§ 15.3.2 The parties shall endeavor to resolve their Claims by mediation which, unless the parties mutually agree otherwise, shall be administered by the American Arbitration Association in accordance with its Construction Industry Mediation Procedures in effect on the date of the Agreement. A request for mediation shall be made in writing, delivered to the other party to the Contract, and filed with the person or entity administering the mediation. The request may be made concurrently with the filing of binding dispute resolution proceedings but, in such event, mediation shall proceed in advance of binding dispute resolution proceedings, which shall be stayed pending mediation for a period of 60 days from the date of filing, unless stayed for a longer period by agreement of the parties or court order. If an arbitration is stayed pursuant to this Section 15.3.2, the parties may nonetheless proceed to the selection of the arbitrator(s) and agree upon a schedule for later proceedings.

§ 15.3.3 The parties shall share the mediator's fee and any filing fees equally. The mediation shall be held in the place where the Project is located, unless another location is mutually agreed upon. Agreements reached in mediation shall be enforceable as settlement agreements in any court having jurisdiction thereof.

§ 15.4 Arbitration

§ 15.4.1 If the parties have selected arbitration as the method for binding dispute resolution in the Agreement, any Claim subject to, but not resolved by, mediation shall be subject to arbitration which, unless the parties mutually agree otherwise, shall be administered by the American Arbitration Association in accordance with its Construction Industry Arbitration Rules in effect on the date of the Agreement. A demand for arbitration shall be made in writing, delivered to the other party to the Contract, and filed with the person or entity administering the arbitration. The party filing a notice of demand for arbitration must assert in the demand all Claims then known to that party on which arbitration is permitted to be demanded.

§ 15.4.1.1 A demand for arbitration shall be made no earlier than concurrently with the filing of a request for mediation, but in no event shall it be made after the date when the institution of legal or equitable proceedings based on the Claim would be barred by the applicable statute of limitations. For statute of limitations purposes, receipt of a written demand for arbitration by the person or entity administering the arbitration shall constitute the institution of legal or equitable proceedings based on the Claim.

§ 15.4.2 The award rendered by the arbitrator or arbitrators shall be final, and judgment may be entered upon it in accordance with applicable law in any court having jurisdiction thereof.

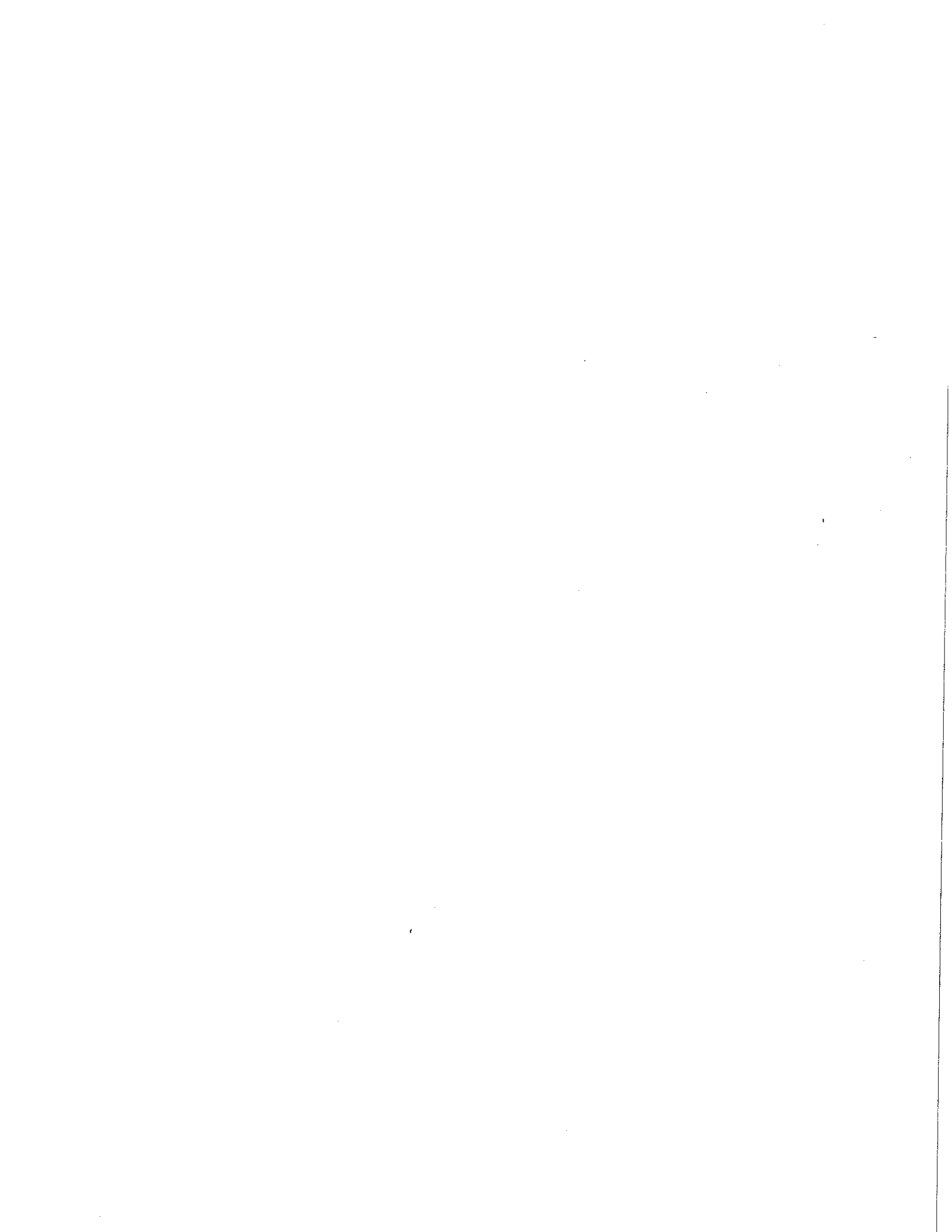
§ 15.4.3 The foregoing agreement to arbitrate and other agreements to arbitrate with an additional person or entity duly consented to by parties to the Agreement shall be specifically enforceable under applicable law in any court having jurisdiction thereof.

§ 15.4.4 Consolidation or Joinder

§ 15.4.4.1 Either party, at its sole discretion, may consolidate an arbitration conducted under this Agreement with any other arbitration to which it is a party provided that (1) the arbitration agreement governing the other arbitration permits consolidation, (2) the arbitrations to be consolidated substantially involve common questions of law or fact, and (3) the arbitrations employ materially similar procedural rules and methods for selecting arbitrator(s).

§ 15.4.4.2 Either party, at its sole discretion, may include by joinder persons or entities substantially involved in a common question of law or fact whose presence is required if complete relief is to be accorded in arbitration, provided that the party sought to be joined consents in writing to such joinder. Consent to arbitration involving an additional person or entity shall not constitute consent to arbitration of any claim, dispute or other matter in question not described in the written consent.

§ 15.4.4.3 The Owner and Contractor grant to any person or entity made a party to an arbitration conducted under this Section 15.4, whether by joinder or consolidation, the same rights of joinder and consolidation as the Owner and Contractor under this Agreement.



ATTACHMENT TO AIA DOCUMENT A201-2007, *General Conditions of the Contract for Construction*

The provisions of this attachment shall delete, modify and supplement the provisions contained in the "*General Conditions of the Contract for Construction*," AIA Document A201-2007 Edition. The provisions contained in this attachment will supersede any conflicting provisions of the AIA Document. The term "Agency," as used in this Attachment, shall mean the United States of America, acting through the United States Department of Agriculture.

ARTICLE 1, GENERAL PROVISIONS

Add the following subparagraph:

1.2.4 Concurrence of the Contract by the Agency is required before it is effective.

ARTICLE 2, OWNER

Delete subparagraph 2.2.5 and substitute the following:

2.2.5 The Contractor will be furnished, free of charge, _____ copies of the Drawings and Projects Manuals necessary for execution of the Work. Additional copies will be available from the Architect at the cost of reproduction and handling.

ARTICLE 4, ARCHITECT

Add the following to subparagraph 4.1.1:

The term "Architect" means the Architect, or the Engineer when the nature of the work is within the authority granted engineers by the State licensure law, or an authorized representative of the Architect or Engineer.

ARTICLE 5, SUBCONTRACTORS

Add the following to subparagraph 5.2.2:

The Contractor shall not contract with any party who is suspended or debarred by any Federal government agency from participating in Federally assisted construction projects

or to whom the Owner or the Architect has made reasonable and timely objection.

ARTICLE 7, CHANGES IN THE WORK

Delete the words ", Construction Change Directive" from subparagraph 7.1.1.

Insert the words ", Agency " after the word "Owner," and delete the words "; a Construction Change Directive requires agreement by the Owner and Architect and may or may not be agreed to by the Contractor" in subparagraph 7.1.2.

Delete the words "Construction Change Directive" from subparagraph 7.1.3.

Delete subparagraph 7.2.1 and substitute the following:

7.2.1 A Change Order is a written order to the Contractor utilizing Form RD 1924-7, "Contract Change Order," or AIA G-701 signed by the Owner, Architect, Contractor, and the Agency representative. It is issued after the execution of the Contract, authorizing a change in the Work or an adjustment in the Contract Sum or the Contract Time. The Contract Sum and the Contract Time may be changed only by Change Order. The Contractor's signing of a Change Order indicates complete agreement therein.

Add subparagraph 7.2.2:

7.2.2 Methods used in determining adjustments to the Contract Sum may include any of the following:

- .1 Mutual acceptance of a lump sum properly itemized and supported by sufficient substantiating data to permit evaluating.
- .2 Unit prices stated in the Contract Documents or subsequently agreed upon.

Add the following sentence to paragraph 7.3: "A Construction Change Directive may be used only for a change in response to an emergency as described in paragraph 10.4.

ARTICLE 8, TIME

Add the following subparagraphs:

8.2.4 The Notice to Proceed shall be issued within twenty (20) calendar days of the execution of the Agreement by the Owner. Should there be reasons why the Notice to Proceed cannot be issued within such period, the time may be extended by mutual agreement of the Owner and Contractor, with the concurrence of the Agency. If the Notice to Proceed has not been issued within the twenty (20) calendar day period or within the period mutually agreed, the Contractor may terminate the Agreement without further liability on the part of either party.

8.3.4 As outlined in Article 3 of the Agreement, the Contractor agrees to pay liquidated damages to the Owner for each calendar day the Contractor shall be in default.

ARTICLE 9, PAYMENTS AND COMPLETION

Delete clause 9.3.1.1 and substitute the following:

9.3.1.1 Work performed and materials supplied under a Change Order may be included for payment only after the Change Order has been approved by all appropriate parties, including the Agency.

Add the words ", using AIA Document 702, 'Application and Certificate for Payment' or Form RD 1924-18, 'Partial Payment Estimate'," after "Certificate for Payment" in subparagraph 9.4.1.

Add the following subparagraph:

9.6.8 No progress payments will be made that deplete the retainage, nor place in escrow any funds that are required for retainage, nor invest the retainage for the benefit of the Contractor. Retainage will not be adjusted until after construction is substantially complete.

Replace the word "seven" with the words "fifteen (15)" in the first sentence , third line of subparagraph 9.7.

Delete subparagraph 9.8.5, after the first sentence, and substitute the following:

9.8.5 When the Work has been substantially completed, except for Work which cannot be completed because of weather conditions, lack of materials or other reasons, which, in the judgment of the Owner, are valid reasons for non-completion, the Owner may make additional payments, retaining at all times an amount sufficient to cover the estimated cost of the Work still to be completed. Provide a copy of the Certificate to the Agency.

Delete subparagraphs 9.9.1 through 9.9.3 and substitute the following:

9.9.1 The Contractor agrees to the use and occupancy of a portion or unit of the Project before formal acceptance by the Owner under the following conditions:

- .1 A "Certificate of Substantial Completion" shall be prepared and executed as provided in subparagraph 9.8.4, except that when, in the opinion of the Architect, the Contractor is chargeable with unwarranted delay in completing the Work or other Contract requirements, the signature of the Contractor will not be required. The Certificate of Substantial Completion shall be accompanied by a written endorsement of the Contractor's insurance carrier and surety permitting occupancy by the Owner during the remaining period of the Project Work. Occupancy and use by the Owner shall not commence until authorized by public authorities having jurisdiction over the Work.
- .2 Occupancy by the Owner shall not be construed by the Contractor as being an acceptance of that part of the Project to be occupied.
- .3 The Contractor shall not be held responsible for any damage to the occupied part of the Project resulting from the Owner's occupancy.
- .4 Occupancy by the Owner shall not be deemed to constitute a waiver of existing claims in behalf of the Owner or Contractor against each other.
- .5 If the Project consists of more than one building, and one of the buildings is to be

occupied, the Owner, prior to occupancy of that building, shall secure permanent property insurance on the building to be occupied and necessary permits which may be required for use and occupancy.

9.9.2 With the exception of clause 9.9.1.5, use and occupancy by the Owner prior to Project acceptance does not relieve the Contractor of responsibility to maintain all insurance and bonds required of the Contractor under the Contract Documents until the Project is completed and accepted by the Owner.

Delete the second and third sentences of subparagraph 9.10.2.

ARTICLE 11, INSURANCE AND BONDS

Replace the words "the Contract Documents" with the words "subparagraph 11.1.5" in the first sentence of subparagraph 11.1.2.

Add the following subparagraph:

11.1.5. Insurance shall be:

- .1 Written with a limit of liability of not less than \$500,000 for all damages arising out of bodily injury, including death, at any time resulting therefrom, sustained by any one person in any one accident; and a limit of liability of not less than \$500,000 aggregate for any such damages sustained by two or more persons in any one accident. Insurance shall be written with a limit of liability of not less than \$200,000 for all property damage sustained by any one person in any one accident; and a limit of liability of not less than \$200,000 aggregate for any such damage sustained by two or more persons in any one accident, or,
- .2 Written with a combined bodily injury and damage liability of not less than \$700,000 per occurrence; and with an aggregate of not less than \$700,000 per occurrence.

Add the following sentence to the end of subparagraph 11.3.1

The policy shall name as the insured the Contractor and the Owner.

Insert the word "Owner" after the words "protect the interests of the" in the second sentence of subparagraph 11.3.1.2.

Add the following sentence to the end of subparagraph 11.3.6:

The provisions of this subparagraph shall apply to the Contractor if the Contractor purchases and maintains said insurance coverage.

Delete subparagraph 11.3.7 in its entirety.

Delete subparagraph 11.4.1 and substitute the following:

11.4.1 The Contractor shall furnish the Owner bonds covering faithful performance of the Contract and payment of obligations arising thereunder within ten (10) calendar days after receipt of the Notice of Award. The surety company executing the bonds must hold a certificate of authority as an acceptable surety on Federal bonds as listed in Treasury Circular 570, and be authorized to transact business in the State where the Project is located. The bonds (using the forms included in the Bidding Documents) shall each be equal to the amount of the Contract Sum. The cost of these bonds shall be included in the Contract Sum

Add the following subparagraphs:

11.4.1.1 The Contractor shall require the attorney-in-fact who executes the required bonds on behalf of the surety to affix thereto a certified and current power of attorney.

11.4.1.2 If at any time a surety on any such bond is declared bankrupt or loses its right to do business in the State in which the work is to be performed or is removed from the list of surety companies accepted on Federal Bonds, the Contractor shall within ten (10) calendar days after notice from the Owner to do so, substitute an acceptable bond in such form and sum and signed by such other surety or sureties as may be satisfactory to the Owner. The premiums of such bond shall be paid by any Contractor. No further payment shall be deemed due nor shall be made until the new surety or sureties shall have furnished an acceptable bond to the Owner.

ARTICLE 13, MISCELLANEOUS PROVISIONS

Add the following paragraphs:

13.8 LANDS AND RIGHTS-OF WAY

13.8.1 Prior to the start of construction, the Owner shall obtain all lands and rights-of-way necessary for the execution and completion of work to be performed under this contract.

13.9 EQUAL OPPORTUNITY REQUIREMENTS

Non-discrimination in Employment by Federally Assisted Construction Contractors, by Executive Order 11246.

13.9.1 This section summarizes Executive Order 11246, which prohibits employment discrimination and requires employers holding non-exempt Federal contracts and subcontracts and federally-assisted construction contracts and subcontracts in excess of \$10,000 to take affirmative action to ensure equal employment opportunity without regard to race, color, religion, sex, or national origin. The Executive Order requires, as a condition for the approval of any federally assisted construction contract, that the applicant incorporate nondiscrimination and affirmative action clauses into its non-exempt federally assisted construction contracts.

13.9.2 Executive Order 11246, is administered and enforced by the Office of Federal Contract Compliance Programs (OFCCP), an agency in the U.S. Department of Labor's Employment Standards Administration. OFCCP has issued regulations at 41 C.F.R. chapter 60 implementing the Executive Order. The regulations at 41 C.F.R. part 60-4 establish the procedures which the Agency, as an administering agency, must follow when making grants, contracts, loans, insurance or guarantees involving federally assisted construction which is not exempt from the requirements of Executive Order 11246. The regulations which apply to Federal or federally assisted construction contractors also are published at 41 C.F.R. part 60-4.

13.9.3 OFCCP has established numerical goals for minority and female utilization in construction work. The goals are expressed in percentage terms for the contractor's aggregate workforce in each trade. OFCCP has set goals for minority utilization based on the percentage of minorities in the civilian labor force in the relevant area. There is

a single nationwide goal of 6.9 percent for utilization of women. The goals apply to all construction work in the covered geographic area, whether or not it is federal, federally assisted or non-federal. A notice advises bidders of the applicable goals for the area where the project is to be located.

13.9.4 Application. This section applies to all of a construction contractor's or subcontractor's employees who are engaged in on-site construction including those construction employees who work on a non-Federal or non-Federally assisted construction site.

13.9.4.1 Agency officials will notify the appropriate Regional Director of OFCCP that an Agency financed construction contract has been awarded, and that the equal opportunity clauses are included in the contract documents.

13.9.4.2 The Regional Director, OFCCP-DOL, will enforce the non-discrimination requirements of Executive Order 11246.

13.9.5 The prospective contractor or subcontractor must comply with the Immigration Reform and Control Act of 1986, by completing and retaining Form I-9, "Employment Eligibility Verification," for employees hired. This form is available from the Immigration and Naturalization Service, and Department of Justice.

13.9.6 The prospective contractor or subcontractor must submit Form RD 400-6, "Compliance Statement," to the applicant and an Agency official as part of the bid package, prior to any contract bid negotiations and comply with the Executive Order 11246 as stated in the contract documents.

13.10 STATUTES

13.10.1 The Contractor and each Subcontractor shall comply with the following statutes (and with regulations issued pursuant thereto, which are incorporated herein by reference):

13.10.1.1 Copeland Anti-Kickback Act (18 U.S.C. 874) as supplemented in Department of Labor regulations (29 C.F.R. part 3). This Act provides that each Contractor shall be prohibited from inducing, by any means, any person in connection with construction to give up any part of the compensation to which the person is otherwise entitled.

13.10.1.2 Clean Air Act (42 U.S.C. 7414), section 114, and Water Pollution Control Act (33 U.S.C. 1813), section 308. Under Executive Order 11738 and Environmental Protection Agency (EPA) regulations 40 C.F.R. part 15, all Contracts in excess of \$100,000 are required to comply with these Acts. The Acts require the Contractor to:

- .1 Notify the Owner of the receipt of any communication from EPA indicating that a facility to be utilized in the performance of the Contract is under consideration to be listed on the EPA list of Violating Facilities.
- .2 Certify that any facility to be utilized in the performance of any nonexempt Contractor or Subcontractor is not listed on the EPA list of Violating Facilities as of the date of the Contract Award.
- .3 Include or cause to be included the above criteria and requirements of paragraphs .1 and .2 in every nonexempt subcontract, and that the Contractor will take such action as the Government may direct as a means of enforcing such provisions.

13.10.1.3 Restrictions on Lobbying (Public Law 101-121, section 319) as supplemented in Department of Agriculture regulations (7 C.F.R. part 3018). This statute applies to the recipients of contracts or subcontracts that exceed \$100,000 at any tier under a Federal loan that exceeds \$150,000 or a Federal grant that exceeds \$100,000. If applicable, the Contractor must complete a certification form on lobbying activities related to the specific Federal loan or grant that is a funding source for this contract. The certification and disclosure forms shall be provided by the Owner.

13.11 RECORDS

13.11.1 If the Contract is based on a negotiated Bid, the Owner, the Agency, the Comptroller General of the United States, or any of their duly authorized representatives, shall have access to any books, documents, papers, and records of the Contractor which are pertinent to a specific Federal loan program for the purpose of making audit, examination, excerpts, and transcriptions. The Contractor shall maintain records for at least three years after the Owner makes final payment and all other pending matters are closed.

13.12 ENVIRONMENTAL REQUIREMENTS

13.12.1 Mitigation Measures - The contractor shall comply with applicable mitigation measures established in the environmental assessment for the project. These may be obtained from the Agency representative.

13.12.2 The Contractor, when constructing a Project involving trenching, excavating, or other earth moving activity, shall comply with the following environmental constraints:

13.12.2.1 Endangered Species, Historic Preservation, Human Remains and Cultural Items, Hazardous Materials, and Paleontology - Any excavation or other earth moving activity by the Contractor that provides evidence of the presence of endangered or threatened species or their critical habitat, uncovers a historical or archaeological artifact, human remains or cultural items, hazardous materials, a fossil or other paleontological materials will require the Contractor to:

- .1 Temporarily stop work;
- .2 Provide immediate notice to the Architect and the Agency, and in the case of potentially hazardous materials, provide immediate notice to local first responders and take such measures as necessary to protect the public and workers;
- .3 Take reasonable measures as necessary to protect the discovered materials or protected resource;
- .4 Abide by such direction as provided by the Agency, or Agencies responsible for resource protection or hazardous materials management; and
- .5 Resume work only upon notice from the Architect and the Agency.

13.12.3 Lead-Based Paint - The Contractor and Owner shall comply with applicable Agency requirements of the Lead-Based Paint Poisoning Prevention Act, as amended (42 U.S.C. 4821), and the Residential Lead-Based Paint Hazard Reduction Act of 1992 (42 U.S.C. 4851) for rehabilitation work on residential property built prior to 1978.

13.13 DEBARMENT AND SUSPENSION

13.13.1 The Contractor shall comply with the requirements of 7 C.F.R. part 3017, which pertains to the debarment or suspension of a person from participating in a Federal program or activity.

ARTICLE 15 CLAIMS AND DISPUTES

Add the words "may be" after "on the parties but" in the last sentence of subparagraph 15.2.5.

Replace the word "shall" with the word "may" in the first sentence, first occurrence of subparagraph 15.3.2

15.4.1.2 The arbitrators will select a hearing location as close to the Owner's locale as possible.

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U.S. DEPARTMENT OF AGRICULTURE

**Certification Regarding Debarment, Suspension, Ineligibility
and Voluntary Exclusion - Lower Tier Covered Transactions**

This certification is required by the regulations implementing Executive Order 12549, Debarment and Suspension, 7 CFR Part 3017, Section 3017.510, Participants' responsibilities. The regulations were published as Part IV of the January 30, 1989, Federal Register (pages 4722-4733). Copies of the regulations may be obtained by contacting the Department of Agriculture agency with which this transaction originated.

(BEFORE COMPLETING CERTIFICATION, READ INSTRUCTIONS ON REVERSE)

- (1) The prospective lower tier participant certifies, by submission of this proposal, that neither it nor its principals is presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from participation in this transaction by any Federal department or agency.
- (2) Where the prospective lower tier participant is unable to certify to any of the statements in this certification, such prospective participant shall attach an explanation to this proposal.

Organization Name

PR/Award Number or Project Name

Name(s) and Title(s) of Authorized Representative(s)

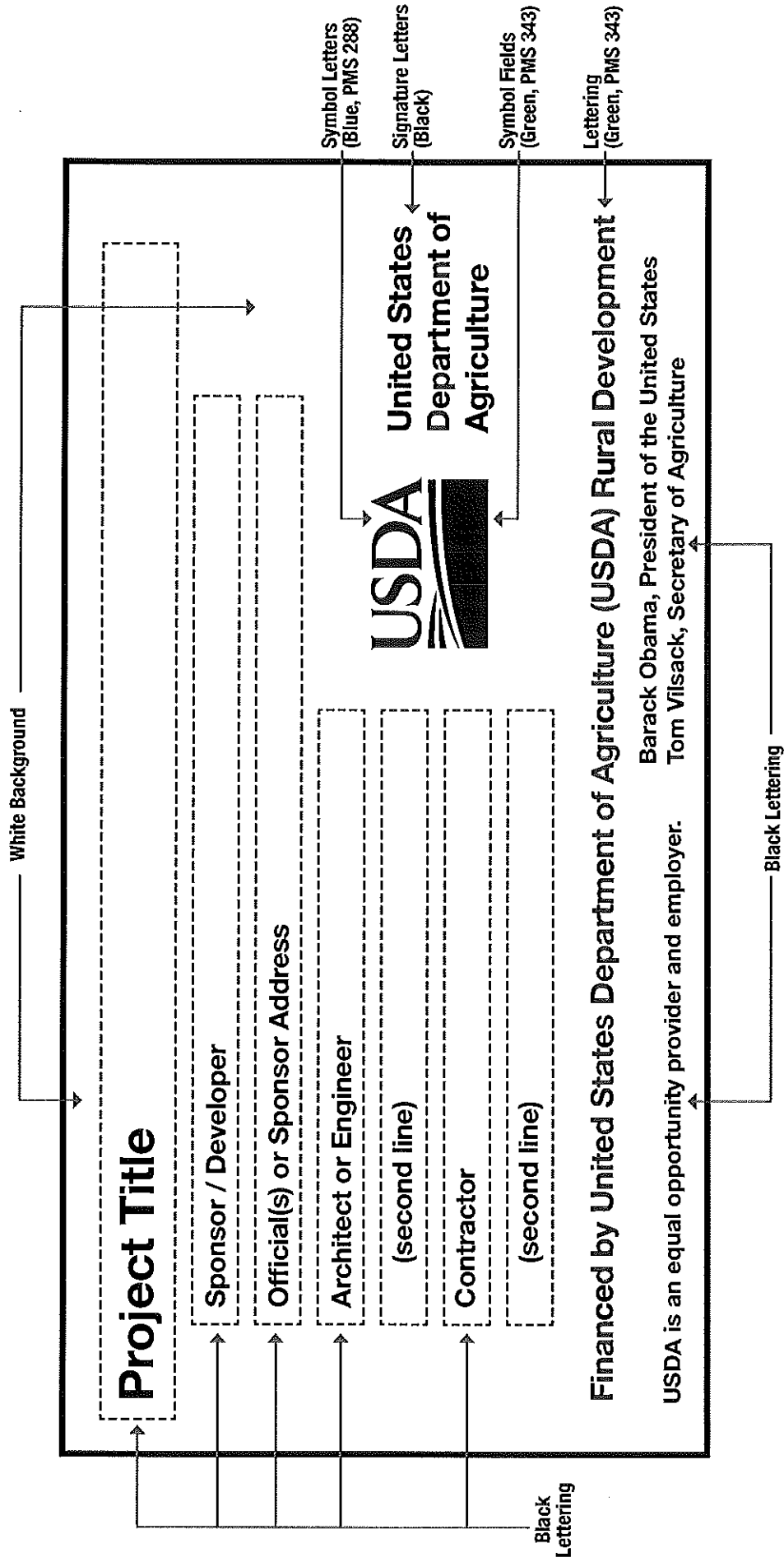
Signature(s)

Date

Instructions for Certification

1. By signing and submitting this form, the prospective lower tier participant is providing the certification set out on the reverse side in accordance with these instructions.
2. The certification in this clause is a material representation of fact upon which reliance was placed when this transaction was entered into. If it is later determined that the prospective lower tier participant knowingly rendered an erroneous certification, in addition to other remedies available to the Federal Government, the department or agency with which this transaction originated may pursue available remedies, including suspension and/or debarment.
3. The prospective lower tier participant shall provide immediate written notice to the person to which this proposal is submitted if at any time the prospective lower tier participant learns that its certification was erroneous when submitted or has become erroneous by reason of changed circumstances.
4. The terms "covered transaction," "debarred," "suspended," "ineligible," "lower tier covered transaction," "participant," "person," "primary covered transaction," "principal," "proposal," and "voluntarily excluded," as used in this clause, have the meanings set out in the Definitions and Coverage sections of rules implementing Executive Order 12549. You may contact the person to which this proposal is submitted for assistance in obtaining a copy of those regulations.
5. The prospective lower tier participant agrees by submitting this form that, should the proposed covered transaction be entered into, it shall not knowingly enter into any lower tier covered transaction with a person who is debarred, suspended, declared ineligible, or voluntarily excluded from participation in this covered transaction, unless authorized by the department or agency with which this transaction originated.
6. The prospective lower tier participant further agrees by submitting this form that it will include this clause titled "Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion - Lower Tier Covered Transactions," without modification, in all lower tier covered transactions and in all solicitations for lower tier covered transactions.
7. A participant in a covered transaction may rely upon a certification of a prospective participant in a lower tier covered transaction that it is not debarred, suspended, ineligible, or voluntarily excluded from the covered transaction, unless it knows that the certification is erroneous. A participant may decide the method and frequency by which it determines the eligibility of its principals. Each participant may, but is not required to, check the Nonprocurement List.
8. Nothing contained in the foregoing shall be construed to require establishment of a system of records in order to render in good faith the certification required by this clause. The knowledge and information of a participant is not required to exceed that which is normally possessed by a prudent person in the ordinary course of business dealings.
9. Except for transactions authorized under paragraph 5 of these instructions, if a participant in a covered transaction knowingly enters into a lower tier covered transaction with a person who is suspended, debarred, ineligible, or voluntarily excluded from participation in this transaction, in addition to other remedies available to the Federal Government, the department or agency with which this transaction originated may pursue available remedies, including suspension and/or debarment.

TEMPORARY CONSTRUCTION SIGN FOR RURAL DEVELOPMENT PROJECTS



SIGN DIMENSIONS: 1200 mm x 2400 mm x 19 mm (approx. 4' x 8' x 3/4")
PLYWOOD PANEL (APA RATED A-B GRADE--EXTERIOR)

WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
SPECIAL PROVISION
FOR
WEST VIRGINIA JOBS ACT

This special provision shall not apply to any project in which federal funds are used, in whole or in part, for its construction.

If the Contract Bid Amount is equal to or greater than \$500,000 the West Virginia Jobs Act (Chapter 21 Article 1C of the West Virginia Code) and the following shall apply.

The Prime Contractor and all Subcontractors are required to hire at least 75% of the workers for the project from the local labor market.. The local labor market as defined by the Act includes all counties in West Virginia and any county outside of West Virginia if any portion of that county is within fifty (50) miles of the West Virginia border. Each employer is permitted to have two workers from outside the local labor market. If workers are not available from inside the local labor market, the contractor shall obtain an employment waiver certificate from the local office of the West Virginia Job Service.

The Prime Contractor and all Subcontractors who work onsite shall provide to the Division of Highways' District Office a certified payroll and all employment waiver certificates for each week worked. The certified payroll must contain the County and State of residence for each employee.

All subcontracts shall contain provisions conforming to the requirements of this Act.

Any contractor or subcontractor found to be in violation of any provision of the Act will be subject to a civil penalty of one hundred dollars per day of violation. The West Virginia Division of Labor is responsible for establishing procedures for the collection of civil penalties.

PROMPT PAYMENT ACT OF 1990 (W. VA. CODE §5A-3-54)

INSTITUTION'S RESPONSIBILITY: According to the Prompt Payment Act of 1990 (West Virginia Code §5A-3-54), any properly registered and qualified vendor who supplies services or commodities to an institution is entitled to Prompt payment upon presentation to the institution of a legitimate uncontested invoice. The institution's accounts payable function shall establish institutional procedures to ensure that vendors are paid promptly.

An Institution receiving a legitimate uncontested invoice shall process the invoice within ten working days from its receipt. This means that invoices shall be processed at the institution and forwarded to the State Auditor within ten days of receipt of the vendor's legitimate and uncontested invoice. An invoice shall be deemed to have been received on the date it is marked received by the institution, or three days after the date of the postmark made by the United States Postal Service as evidenced on the envelope in which the invoice was mailed, whichever is earlier. If the invoice is received prior to delivery and acceptance of the goods and services, the invoice shall be deemed to be received on the date the goods are delivered and accepted or the services fully performed and accepted.

VENDOR'S RESPONSIBILITY: In order to receive timely payment, vendors have an obligation and responsibility to present invoices that are timely and accurate. An original of a vendor's invoice is needed for payment. The invoice must also contain identical information as shown on the purchase order or contract, such as:

- a. Vendor's name and address;
- b. Federal Employer's Identification Number(FEIN);
- c. Purchase order number;
- d. Invoice should be mailed to the proper address at the institution;
- e. Item description and number;
- f. Quantity, unit of measure and/or unit price, and extension of each item;
- g. Invoice total;
- h. Dates of order and shipment;
- i. Back orders, if any;
- j. Cancellations, if any;
- k. Credit memo, if the credit is not part of the invoice; and
- l. Invoices for services rendered must include the dates of service and be prepared according to the payment terms in the contract or purchase order.

INTEREST ON LATE PAYMENT: The Prompt Payment Act of 1990 (West Virginia Code §5A-3-54) entitles a vendor to interest on legitimate and uncontested invoices that have not been paid from the 61st day after the invoice was received until the date when the check was mailed to the vendor. The Act considers an invoice uncontested when it accurately covers the goods and services received. If the invoice is received prior to delivery and acceptance of the goods and services, the invoice shall be deemed to be received on the date the goods are delivered and accepted or the services fully performed and accepted. In order to receive payment for interest if entitled, a vendor must make a request in writing to the State Auditor and provide proof that the vendor received a check for payment of the invoice after the 60 day time limit. If the vendor is entitled to interest, the State Auditor's Office will calculate the interest and pay any amounts due.



CERTIFICATE OF LIABILITY INSURANCE

CHAR-11

OP ID: LJ

DATE (MM/DD/YYYY)

10/06/2014

THIS CERTIFICATE IS ISSUED AS A MATTER OF INFORMATION ONLY AND CONFERS NO RIGHTS UPON THE CERTIFICATE HOLDER. THIS CERTIFICATE DOES NOT AFFIRMATIVELY OR NEGATIVELY AMEND, EXTEND OR ALTER THE COVERAGE AFFORDED BY THE POLICIES BELOW. THIS CERTIFICATE OF INSURANCE DOES NOT CONSTITUTE A CONTRACT BETWEEN THE ISSUING INSURER(S), AUTHORIZED REPRESENTATIVE OR PRODUCER, AND THE CERTIFICATE HOLDER.

IMPORTANT: If the certificate holder is an ADDITIONAL INSURED, the policy(ies) must be endorsed. If SUBROGATION IS WAIVED, subject to the terms and conditions of the policy, certain policies may require an endorsement. A statement on this certificate does not confer rights to the certificate holder in lieu of such endorsement(s).

| | | |
|-------------------------------|-----------------------|----------------|
| PRODUCER | CONTACT NAME: | |
| | PHONE (A/C, No, Ext): | FAX (A/C, No): |
| E-MAIL ADDRESS: | | |
| INSURER(S) AFFORDING COVERAGE | | NAIC # |
| INSURED | NAME OF INSURED | |
| | INSURER A: | |
| | INSURER B: | |
| | INSURER C: | |
| | INSURER D: | |
| | INSURER E: | |

COVERAGES**CERTIFICATE NUMBER:****REVISION NUMBER:**

THIS IS TO CERTIFY THAT THE POLICIES OF INSURANCE LISTED BELOW HAVE BEEN ISSUED TO THE INSURED NAMED ABOVE FOR THE POLICY PERIOD INDICATED. NOTWITHSTANDING ANY REQUIREMENT, TERM OR CONDITION OF ANY CONTRACT OR OTHER DOCUMENT WITH RESPECT TO WHICH THIS CERTIFICATE MAY BE ISSUED OR MAY PERTAIN, THE INSURANCE AFFORDED BY THE POLICIES DESCRIBED HEREIN IS SUBJECT TO ALL THE TERMS, EXCLUSIONS AND CONDITIONS OF SUCH POLICIES. LIMITS SHOWN MAY HAVE BEEN REDUCED BY PAID CLAIMS.

| INSR LTR | TYPE OF INSURANCE | ADDL INSD | SUBR WVD | POLICY NUMBER | POLICY EFF (MM/DD/YYYY) | POLICY EXP (MM/DD/YYYY) | LIMITS |
|-------------------------------------|--|-----------|----------|-----------------------------------|-------------------------|-------------------------|---|
| <input checked="" type="checkbox"/> | COMMERCIAL GENERAL LIABILITY CLAIMS-MADE <input checked="" type="checkbox"/> OCCUR | | | POLICY NUMBER | | | EACH OCCURRENCE \$ 1,000,000 DAMAGE TO RENTED PREMISES (Ea occurrence) \$ 500,000 MED EXP (Any one person) \$ N/A PERSONAL & ADV INJURY \$ 1,000,000 GENERAL AGGREGATE \$ 5,000,000 PRODUCTS - COMP/OP AGG \$ 5,000,000 Emp Ben. \$ 1,000,000 |
| | GEN'L AGGREGATE LIMIT APPLIES PER: <input checked="" type="checkbox"/> POLICY <input type="checkbox"/> PROJECT <input type="checkbox"/> LOC OTHER: | | | | | | COMBINED SINGLE LIMIT (Ea accident) \$ 1,000,000 BODILY INJURY (Per person) \$ BODILY INJURY (Per accident) \$ PROPERTY DAMAGE (Per accident) \$ |
| <input checked="" type="checkbox"/> | AUTOMOBILE LIABILITY ANY OWNED AUTOS HIRE AUTOS <input checked="" type="checkbox"/> SCHEDULED AUTOS NON-OWNED AUTOS | | | POLICY NUMBER | | | |
| <input checked="" type="checkbox"/> | UMBRELLA LIAB <input checked="" type="checkbox"/> OCCUR EXCESS LIAB <input type="checkbox"/> CLAIMS-MADE DED. <input checked="" type="checkbox"/> RETENTIONS 0 | | | POLICY NUMBER | | | EACH OCCURRENCE \$ 2,000,000 AGGREGATE \$ 2,000,000 |
| | WORKERS COMPENSATION AND EMPLOYERS' LIABILITY ANY PROPRIETOR/PARTNER/EXECUTIVE OFFICER/MEMBER EXCLUDED? (Mandatory in NH) If yes, describe under DESCRIPTION OF OPERATIONS below | Y/N | N/A | POLICY NUMBER WV EL BROAD FORM | | | <input checked="" type="checkbox"/> PER STATUTE <input type="checkbox"/> OTHER EL EACH ACCIDENT \$ 1,000,000 EL DISEASE - EA EMPLOYEE \$ 1,000,000 EL DISEASE - POLICY LIMIT \$ 1,000,000 |
| | Builders Risk | | | POLICY NUMBER | | | Bid Risk - Value of Contract |

FOR BID USE ONLY
DESCRIPTION OF OPERATIONS / LOCATIONS / VEHICLES (ACORD 101, Additional Remarks Schedule, may be attached if more space is required)

Contractor Must Name City of Charles Town as Additional Insured

CERTIFICATE HOLDER**CANCELLATION**

City of Charles Town
David Mills, City Manager
P.O. Box 14
Charles Town, WV 25414

SHOULD ANY OF THE ABOVE DESCRIBED POLICIES BE CANCELLED BEFORE THE EXPIRATION DATE THEREOF, NOTICE WILL BE DELIVERED IN ACCORDANCE WITH THE POLICY PROVISIONS.

AUTHORIZED REPRESENTATIVE

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FILED

WEST VIRGINIA DIVISION OF LABOR
Building Construction Wage Rates

2014 JAN -3 P 1:13

Jefferson County
2014

OFFICE WEST VIRGINIA
STATE OF STATE
CLASSIFICATION

| CLASSIFICATION | BASIC HOURLY RATE | FRINGE BENEFITS |
|--------------------------------------|-------------------|-----------------|
| ASBESTOS & LEAD ABATEMENT WORKER | 20.86 | 5.73 |
| ASBESTOS/FIRE STOP TECHNICIAN | 26.06 | 6.17 |
| BOILERMAKER | 37.38 | 22.67 |
| BRICKLAYER | 26.88 | 17.85 |
| BRICKLAYER - POINTER/CAULKER/CLEANER | 26.88 | 17.85 |
| CARPENTER | 26.15 | 14.25 |
| CARPET LAYER | 26.15 | 14.25 |
| CEMENT MASON | 25.53 | 13.58 |
| DRYWALL HANGER | 26.15 | 14.25 |
| ELECTRICIAN | 30.00 | 15.95 |
| ELEVATOR HELPER | 27.97 | 28.69 |
| ELEVATOR MECHANIC | 39.96 | 28.69 |
| GLAZIER | 29.50 | 7.85 |
| INSULATOR | 33.13 | 13.72 |
| IRON WORKER BUCKER-UP * | 28.58 | 15.27 |
| IRON WORKER ERECTOR * | 28.33 | 15.27 |
| IRON WORKER FENCE ERECTOR * | 28.33 | 15.27 |
| IRON WORKER JOURNEYMAN * | 28.33 | 15.27 |
| IRON WORKER REINFORCING * | 28.33 | 15.27 |
| IRON WORKER SHEETER * | 28.58 | 15.27 |
| IRON WORKER STRUCTURAL * | 28.33 | 15.27 |
| LABORER CLASS I * | 21.62 | 14.65 |
| LABORER CLASS II * | 21.19 | 14.65 |
| LABORER CLASS III * | 20.83 | 14.65 |
| LABORER FLAGMAN | 18.48 | 14.65 |
| LATHER | 26.15 | 14.25 |
| MARBLE FINISHER | 21.98 | 16.51 |
| MARBLE SETTER | 26.88 | 17.85 |
| MILLWRIGHT | 26.75 | 14.25 |
| OPERATING ENGINEER I * | 34.76 | 18.83 |
| OPERATING ENGINEER II * | 34.41 | 18.83 |
| OPERATING ENGINEER III * | 33.41 | 18.83 |
| OPERATING ENGINEER IV * | 22.91 | 18.83 |
| PAINTER | 24.57 | 13.98 |
| PILEDRIVER | 26.66 | 14.25 |
| PLASTERER | 25.53 | 13.40 |
| PLUMBER/FITTER | 36.50 | 17.13 |
| ROOFER/HEATED COAL TAR PRODUCTS | 26.00 | 9.15 |
| ROOFER/WATER DAMP PROOFER | 26.00 | 9.15 |
| SHEET METAL WORKER | 27.23 | 18.28 |
| SOFT FLOOR LAYER | 26.15 | 14.25 |
| SPRINKLER FITTER | 30.77 | 18.62 |
| STONE MASON | 26.88 | 17.85 |
| TEAMSTER CLASS 1 | 20.53 | 16.06 |

WEST VIRGINIA DIVISION OF LABOR
Building Construction Wage Rates

Jefferson County
2014

| CLASSIFICATION | BASIC HOURLY RATE | FRINGE BENEFITS |
|--------------------------|-------------------|-----------------|
| TEAMSTER CLASS 2 | 20.76 | 16.06 |
| TEAMSTER CLASS 3 | 21.04 | 16.06 |
| TEAMSTER CLASS 4 | 21.29 | 16.06 |
| TEAMSTER CLASS 5 | 21.64 | 16.06 |
| TEAMSTER CLASS 6 | 21.99 | 16.06 |
| TEAMSTER CLASS 7 | 22.36 | 16.06 |
| TERRAZZO - TILE FINISHER | 21.98 | 16.51 |
| TERRAZZO - TILE SETTER | 26.88 | 17.85 |

APPRENTICE SCHEDULE

Jefferson County
2014

| CRAFT | INTERVAL | 1st | 2nd | 3rd | 4th | 5th | 6th | 7th | 8th | 9th | 10th |
|----------------------|------------|---------|---------|---------|---------|------|------|------|-----|-----|------|
| ASBESTOS WORKER * | Yearly | 50 | 55 | 60 | 70 | | | | | | |
| ASBESTOS/FIRESTOP ** | 2000 hours | \$12.33 | \$13.50 | \$15.84 | \$17.99 | | | | | | |
| BOILERMAKER | 6 months | 70 | 75 | 80 | 85 | 87.5 | 90 | 92.5 | 95 | | |
| BRICKLAYER | 6 months | 50 | 60 | 70 | 80 | 90 | 90 | | | | |
| CARPENTER | 6 months | 40 | 47.5 | 55 | 62.5 | 70 | 85 | | | | |
| CEMENT MASON | 1200 hrs | 50 | 60 | 70 | 80 | 90 | | | | | |
| ELECTRICIAN ** | Percent | 40 | 45 | 55 | 65 | 75 | 85 | | | | |
| ELECTRICIAN | Hours to | 1000 | 2000 | 3500 | 5000 | 6500 | 8000 | | | | |
| ELEVATOR MECHANIC | 6 months | 50 | 55 | 65 | 70 | 80 | | | | | |
| GLAZIER ** | 1000 hrs | 50 | 55 | 60 | 70 | 80 | 90 | | | | |
| INSULATOR | Yearly | 50 | 55 | 60 | 70 | | | | | | |
| IRONWORKER | 1000 hrs | 60 | 70 | 75 | 80 | 85 | 90 | | | | |
| LABORER | 1000 hrs | 60 | 70 | 80 | 90 | | | | | | |
| MARBLE SETTER | 6 months | 50 | 60 | 70 | 80 | 90 | 90 | | | | |
| MILLWRIGHT | 6 months | 40 | 47.5 | 55 | 62.5 | 70 | 85 | | | | |
| OPERATING ENGINEER | Yearly | 75 | 80 | 85 | | | | | | | |
| PAINTER ** | 1000 hrs | 50 | 55 | 60 | 70 | 80 | 90 | | | | |
| PILEDRIVER | 6 months | 40 | 47.5 | 55 | 62.5 | 70 | 85 | | | | |
| PLASTERER | 1200 hrs | 50 | 60 | 70 | 80 | 90 | | | | | |
| PLUMBER & FITTER ** | Yearly | 40 | 50 | 60 | 70 | | | | | | |
| SHEET METAL WKR. ** | 6 months | 45 | 50 | 55 | 60 | 65 | 70 | 75 | 80 | | |
| SPRINKLER FITTER ** | 6 months | 50 | 50 | 55 | 60 | 65 | 70 | 75 | 80 | 85 | 90 |
| STONE MASON | 6 months | 50 | 60 | 70 | 80 | 90 | 90 | | | | |
| TERRAZZO SETTER | 6 months | 50 | 60 | 70 | 80 | 90 | 90 | | | | |
| TILE SETTER | 6 months | 50 | 60 | 70 | 80 | 90 | 90 | | | | |

** For appropriate apprentice fringe rates, see Apprentice Fringe Rate Sheets

NOTE: For Carpet Layer, Drywall Hanger, Soft Floor Layer and Lather use Carpenter Schedule

APPRENTICE RATIO: Contact Federal Bureau of Apprenticeship and Training at (304) 347-5794.

SECTION 01 00 00 - GENERAL REQUIREMENTS

1.1 GENERAL INTENTION

- A. Contractor shall completely prepare site for building operations, including demolition and removal of existing structures, and furnish labor and materials and perform work for the renovation as required by drawings and specifications.
- B. Visits to the site by Bidders may be made only by appointment with the Owner or Architect.
- C. Offices of Grove & Dall'Olio Architects PLLC, as Architect-Engineers, will render certain technical services during construction. Such services shall be considered as advisory to the Owner and shall not be construed as expressing or implying a contractual act of the Owner without affirmations by Contracting Officer or the duly authorized representative.
- D. Before placement and installation of work subject to tests by testing laboratory retained by the Contractor, the Contractor shall notify the ARCHITECT in sufficient time to enable testing laboratory personnel to be present at the site in time for proper taking and testing of specimens and field inspection. Such prior notice shall be not less than three work days unless otherwise designated by the ARCHITECT.
- E. Prior to commencing work, general contractor shall provide proof that a OSHA certified "competent person" (CP) (29 CFR 1926.20(b)(2)) will maintain a presence at the work site whenever the general or subcontractors are present.

1.2 STATEMENT OF BID ITEM(S)

- A. ITEM I, GENERAL CONSTRUCTION: Work includes general construction, hazardous material abatement, alterations, mechanical and electrical work, utility systems, necessary removal of existing construction and certain other items.
- B. ADD ALTERNATE NO.1: Replace metal roofing on main and rear section of building as indicated on the drawings.
- C. ADD ALTERNATE NO.2: Replace south wall foundations with new as noted on the drawings.

1.3 SPECIFICATIONS AND DRAWINGS FOR CONTRACTOR

- A. AFTER AWARD OF CONTRACT, the Owner will provide the Contractor with up to 6 sets of updated specifications and drawings based on addenda issued during the bidding period.
- B. Additional sets of drawings may be made by the Contractor, at Contractor's expense, from electronic files furnished by the Architect.

1.4 CONSTRUCTION SECURITY REQUIREMENTS

- A. Security Plan:
 - 1. The security plan defines both physical and administrative security procedures that will remain effective for the entire duration of the project.

2. The General Contractor is responsible for assuring that all sub-contractors working on the project and their employees also comply with these regulations.
- B. Security Procedures:
1. General Contractor shall submit a plan to secure the site and will provide the Owner and Architect with keys to access the site.
 2. For working outside the "regular hours" as defined in the contract, The General Contractor shall give 3 days notice to the .
- C. Key Control:
1. The General Contractor shall provide duplicate keys and lock combinations to the CITY for the purpose of security inspections of every area of project including tool boxes and parked machines and take any emergency action.
 2. The General Contractor shall turn over all permanent lock cylinders to the CITY locksmith for permanent installation. See Section 08 71 00, DOOR HARDWARE and coordinate.

1.5 FIRE SAFETY

- A. Applicable Publications: Publications listed below form part of this Article to extent referenced. Publications are referenced in text by basic designations only.
1. American Society for Testing and Materials (ASTM):
 - E84-2009..... Surface Burning Characteristics of Building Materials
 2. National Fire Protection Association (NFPA):
 - 10-2010 Standard for Portable Fire Extinguishers
 - 30-2008 Flammable and Combustible Liquids Code
 - 51B-2009..... Standard for Fire Prevention During Welding, Cutting and Other Hot Work
 - 70-2011 National Electrical Code
 - 241-2009 Standard for Safeguarding Construction, Alteration, and Demolition Operations
 3. Occupational Safety and Health Administration (OSHA):
 - 29 CFR 1926 Safety and Health Regulations for Construction
- B. Fire Safety Plan: Establish and maintain a fire protection program in accordance with 29 CFR 1926. Prior to start of work, prepare a plan detailing project-specific fire safety measures, including periodic status reports, and submit to ARCHITECT for review for compliance with contract requirements in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES Prior to any worker for the contractor or subcontractors beginning work, they shall undergo a safety briefing provided by the general contractor's competent person per OSHA requirements.
- C. Site and Building Access: Maintain free and unobstructed access to facility emergency services and for fire, police and other emergency response forces in accordance with NFPA 241.

- D. Separate temporary facilities, such as trailers, storage sheds, and dumpsters, from existing buildings and new construction by distances in accordance with NFPA 241. For small facilities with less than 6 m (20 feet) exposing overall length, separate by 3m (10 feet).
- E. Temporary Construction Partitions:
 - 1. Install and maintain temporary construction partitions to provide smoke-tight separations between construction areas and adjoining areas.
- F. Temporary Heating and Electrical: Temporary heat shall be provided by the Contractor. The Contractor may use existing electrical service to the building for temporary power.
- G. Means of Egress: Do not block exiting for occupied buildings, including paths from exits to roads. Minimize disruptions and coordinate with THE CITY OF CHARLES TOWN.
- H. Egress Routes for Construction Workers: Maintain free and unobstructed egress. Inspect daily. Report findings and corrective actions weekly to ARCHITECT.
- I. Fire Extinguishers: Provide and maintain extinguishers in construction areas and temporary storage areas.
- J. Flammable and Combustible Liquids: Store, dispense and use liquids in accordance with 29 CFR 1926, NFPA 241 and NFPA 30.
- K. Smoking: Smoking is prohibited in and adjacent to construction areas inside existing buildings and additions under construction. In separate and detached buildings under construction, smoking is prohibited except in designated smoking rest areas.

1.6 OPERATIONS AND STORAGE AREAS

- A. The Contractor shall confine all operations (including storage of materials) on Owner premises to areas authorized or approved by the City. The Contractor shall hold and save the Owner, its officers and agents, free and harmless from liability of any nature occasioned by the Contractor's performance.
- B. Temporary buildings (e.g., storage sheds, shops, offices) and utilities may be erected by the Contractor only with the approval of the Owner and shall be built with labor and materials furnished by the Contractor without expense to the Owner. The temporary buildings and utilities shall remain the property of the Contractor and shall be removed by the Contractor at its expense upon completion of the work.
- C. The Contractor shall, under regulations prescribed by the Contracting Officer, use only established roadways, or use temporary roadways constructed by the Contractor when and as authorized by the Contracting Officer. When materials are transported in prosecuting the work, vehicles shall not be loaded beyond the loading capacity recommended by the manufacturer of the vehicle or prescribed by any Federal, State, or local law or regulation. When it is necessary to cross curbs or sidewalks, the Contractor shall protect them from damage. The Contractor shall repair or pay for the repair of any damaged curbs, sidewalks, or roads.
- D. Working space and space available for storing materials shall be as determined by the City.

- E. Construction Fence: Contractor shall provide construction fence along public right-of-ways to protect pedestrians.
- F. Utilities Services: Maintain existing utility services for Rouse Building at all times.
- G. Abandoned Lines: All service lines such as wires, cables, conduits, ducts, pipes and the like, and their hangers or supports, which are to be abandoned but are not required to be entirely removed, shall be removed.
- H. To minimize interference of construction activities with flow of traffic, comply with the following:
 - 1. Keep roads, walks and entrances to grounds, to parking and to occupied areas of buildings clear of construction materials, debris and standing construction equipment and vehicles.
- I. Coordinate the work for this contract with other construction operations as directed by ARCHITECT. This includes the scheduling of traffic and the use of roadways.

1.7 ALTERATIONS

- A. Survey: Before any work is started, the Contractor shall make a thorough survey of the building and inform the ARCHITECT of any conditions that are not addressed in the construction documents that would require additional work on the part of the Contractor to complete.
- B. Any items required by drawings to be either reused or relocated or both, found during this survey to be nonexistent, or in opinion of ARCHITECT to be in such condition that their use is impossible or impractical, shall be furnished and/or replaced by Contractor with new items in accordance with specifications which will be furnished by Owner.
- C. Protection: Provide the following protective measures:
 - 1. Wherever existing roof surfaces are disturbed they shall be protected against water infiltration. In case of leaks, they shall be repaired immediately upon discovery.
 - 2. Temporary protection against damage for portions of existing structures and grounds where work is to be done, materials handled and equipment moved and/or relocated.
 - 3. Protection of interior of existing structures at all times, from damage, dust and weather inclemency. Wherever work is performed, floor surfaces that are to remain in place shall be adequately protected prior to starting work, and this protection shall be maintained intact until all work in the area is completed.

1.8 DELETED

1.9 DISPOSAL AND RETENTION

- A. Materials and equipment accruing from work removed and from demolition of buildings or structures, or parts thereof, shall be disposed of as follows:
 - 1. Reserved items which are to remain property of the Owner are identified by attached tags as items to be stored. Items that remain property of the Owner shall be removed or dislodged from present locations in such a manner as to prevent damage which would be detrimental to re-installation and reuse. Store such items where directed by ARCHITECT.

2. Items not reserved shall become property of the Contractor and be removed by Contractor from site.
3. Items of portable equipment and furnishings located in rooms and spaces in which work is to be done under this contract shall remain the property of the Owner.

1.10 PROTECTION OF EXISTING VEGETATION, STRUCTURES, EQUIPMENT, UTILITIES, AND IMPROVEMENTS

- A. The Contractor shall preserve and protect all structures, equipment, and vegetation (such as trees, shrubs, and grass) on or adjacent to the work site, which are not to be removed and which do not unreasonably interfere with the work required under this contract. The Contractor shall only remove trees when specifically authorized to do so, and shall avoid damaging vegetation that will remain in place. If any limbs or branches of trees are broken during contract performance, or by the careless operation of equipment, or by workmen, the Contractor shall trim those limbs or branches with a clean cut and paint the cut with a tree-pruning compound as directed by the Contracting Officer.
- B. The Contractor shall protect from damage all existing improvements and utilities at or near the work site and on adjacent property of a third party, the locations of which are made known to or should be known by the Contractor. The Contractor shall repair any damage to those facilities, including those that are the property of a third party, resulting from failure to comply with the requirements of this contract or failure to exercise reasonable care in performing the work. If the Contractor fails or refuses to repair the damage promptly, the Owner may have the necessary work performed and charge the cost to the Contractor.

1.11 RESTORATION

- A. Remove, cut, alter, replace, patch and repair existing work as necessary to install new work. Except as otherwise shown or specified, do not cut, alter or remove any structural work, and do not disturb any ducts, plumbing, steam, gas, or electric work without approval of the ARCHITECT. Existing work to be altered or extended and that is found to be defective in any way, shall be reported to the ARCHITECT before it is disturbed. Materials and workmanship used in restoring work, shall conform in type and quality to that of original existing construction, except as otherwise shown or specified.
- B. Upon completion of contract, deliver work complete and undamaged. Existing work (walls, ceilings, partitions, floors, mechanical and electrical work, lawns, paving, roads, walks, etc.) disturbed or removed as a result of performing required new work, shall be patched, repaired, reinstalled, or replaced with new work, and refinished and left in as good condition as existed before commencing work.
- C. At Contractor's own expense, Contractor shall immediately restore service and repair any damage caused by Contractor's workmen to existing piping and conduits, wires, cables, etc., of

utility services or of fire protection systems and communications systems which are indicated on drawings and which are not scheduled for discontinuance or abandonment.

1.12 PHYSICAL DATA - SECTION DELETED

1.13 PROFESSIONAL SURVEYING SERVICES - SECTION DELETED

1.14 LAYOUT OF WORK - SECTION DELETED

1.15 AS-BUILT DRAWINGS

- A. The contractor shall maintain two full size sets of as-built drawings which will be kept current during construction of the project, to include all contract changes, modifications and clarifications.
- B. All variations shall be shown in the same general detail as used in the contract drawings. To insure compliance, as-built drawings shall be made available for the ARCHITECT's review, as often as requested.
- C. Contractor shall deliver two approved completed sets of as-built drawings to the ARCHITECT within 15 calendar days after each completed phase and after the acceptance of the project by the ARCHITECT.
- D. Paragraphs A, B, & C shall also apply to all shop drawings.

1.16 USE OF ROADWAYS

- A. For hauling, use only established public roads, unless authorized by the Owner, in the performance of contract work.

1.17 ARCHITECT'S FIELD OFFICE - SECTION DELETED

1.18 TEMPORARY USE OF MECHANICAL AND ELECTRICAL EQUIPMENT

- A. Use of new installed mechanical and electrical equipment to provide heat, ventilation, plumbing, light and power will be permitted subject to compliance with the following provisions:
 - 1. Permission to use each unit or system must be given by ARCHITECT. If the equipment is not installed and maintained in accordance with the following provisions, the ARCHITECT will withdraw permission for use of the equipment.
 - 2. Electrical installations used by the equipment shall be completed in accordance with the drawings and specifications to prevent damage to the equipment and the electrical systems, i.e. transformers, relays, circuit breakers, fuses, conductors, motor controllers and their overload elements shall be properly sized, coordinated and adjusted. Voltage supplied to each item of equipment shall be verified to be correct and it shall be determined that motors are not overloaded. The electrical equipment shall be thoroughly cleaned before using it and again immediately before final inspection including vacuum cleaning and wiping clean interior and exterior surfaces.
 - 3. Units shall be properly lubricated, balanced, and aligned. Vibrations must be eliminated.
 - 4. Automatic temperature control systems for preheat coils shall function properly and all safety controls shall function to prevent coil freeze-up damage.

5. The air filtering system utilized shall be that which is designed for the system when complete, and all filter elements shall be replaced at completion of construction and prior to testing and balancing of system.
 6. All components of heat production and distribution system, metering equipment, condensate returns, and other auxiliary facilities used in temporary service shall be cleaned prior to use; maintained to prevent corrosion internally and externally during use; and cleaned, maintained and inspected prior to acceptance by the Owner.
- B. Prior to final inspection, the equipment or parts used which show wear and tear beyond normal, shall be replaced with identical replacements, at no additional cost to the Owner.

1.19 TEMPORARY USE OF EXISTING ELEVATORS

- A. EXISTING ELEVATOR IN ROUSE BUILDING IS NOT AVAILABLE FOR USE TO CONTRACTOR OR SUBCONTRACTORS DURING CONSTRUCTION.

1.20 TEMPORARY USE OF NEW ELEVATORS – DELETED.

1.21 TEMPORARY TOILETS

- A. Contractor shall provide temporary toilets for workmen on site.

1.22 AVAILABILITY AND USE OF UTILITY SERVICES

- A. Heat: Existing systems are called for demolition. Heat must be provided during construction by the Contractor.
- B. Electricity (for Construction and Testing): Furnish all temporary electric services.
1. Obtain electricity by existing service
- C. Water (for Construction and Testing): Furnish temporary water service.
1. Obtain water by existing on site service.
 2. Maintain connections, pipe, fittings and fixtures and conserve water-use so none is wasted.

1.23 NEW TELEPHONE EQUIPMENT

The contractor shall coordinate with the work of installation of telephone equipment by others. This work shall be completed before the building is turned over to the City.

1.24 TESTS

- A. Pre-test mechanical and electrical equipment and systems and make corrections required for proper operation of such systems before requesting final tests. Final test will not be conducted unless pre-tested.
- B. Conduct final tests required in various sections of specifications in presence of an authorized representative of the Contracting Officer. Contractor shall furnish all labor, materials, equipment, instruments, and forms, to conduct and record such tests.

- C. Mechanical and electrical systems shall be balanced, controlled and coordinated. A system is defined as the entire complex which must be coordinated to work together during normal operation to produce results for which the system is designed.
- D. All related components as defined above shall be functioning when any system component is tested. Tests shall be completed within a reasonably short period of time during which operating and environmental conditions remain reasonably constant.
- E. Individual test result of any component, where required, will only be accepted when submitted with the test results of related components and of the entire system.

1.25 INSTRUCTIONS

- A. Contractor shall furnish Maintenance and Operating manuals and verbal instructions when required by the various sections of the specifications and as hereinafter specified.
- B. Manuals: Maintenance and operating manuals (two copies each) for each separate piece of equipment shall be delivered to the ARCHITECT. Manuals shall be complete, detailed guides for the maintenance and operation of equipment. They shall include complete information necessary for starting, adjusting, maintaining in continuous operation for long periods of time and dismantling and reassembling of the complete units and sub-assembly components. Manuals shall include an index covering all component parts clearly cross-referenced to diagrams and illustrations. Illustrations shall include "exploded" views showing and identifying each separate item. Emphasis shall be placed on the use of special tools and instruments. The function of each piece of equipment, component, accessory and control shall be clearly and thoroughly explained. All necessary precautions for the operation of the equipment and the reason for each precaution shall be clearly set forth. Manuals must reference the exact model, style and size of the piece of equipment and system being furnished. Manuals referencing equipment similar to but of a different model, style, and size than that furnished will not be accepted.
- C. Instructions: Contractor shall provide qualified, factory-trained manufacturers' representatives to give detailed instructions to assigned Owner personnel in the operation and complete maintenance for each piece of equipment. All such training will be at the job site. These requirements are more specifically detailed in the various technical sections. Instructions for different items of equipment that are component parts of a complete system, shall be given in an integrated, progressive manner. All instructors for every piece of component equipment in a system shall be available until instructions for all items included in the system have been completed. This is to assure proper instruction in the operation of inter-related systems. All instruction periods shall be at such times as scheduled by the Owner and shall be considered concluded only when the Owner is satisfied in regard to complete and thorough coverage.

--- E N D ---

SECTION 01 32 16 - PROJECT SCHEDULES

PART 1- GENERAL

1.1 DESCRIPTION:

- A. The Contractor shall develop a Critical Path Method (CPM) plan and schedule demonstrating fulfillment of the contract requirements (Project Schedule), and shall keep the Project Schedule up-to-date in accordance with the requirements of this section and shall utilize the plan for scheduling, coordinating and monitoring work under this contract (including all activities of subcontractors, equipment vendors and suppliers). Conventional Critical Path Method (CPM) technique shall be utilized to satisfy both time and cost applications.

1.2 CONTRACTOR'S REPRESENTATIVE:

- A. The Contractor shall designate an authorized representative responsible for the Project Schedule including preparation, review and progress reporting with and to the Architect.
- B. The Contractor's representative shall have direct project control and complete authority to act on behalf of the Contractor in fulfilling the requirements of this specification section.
- C. The Contractor's representative shall have the option of developing the project schedule within their organization or to engage the services of an outside consultant

1.3 COMPUTER PRODUCED SCHEDULES

- A. The contractor shall provide monthly, to the Architect and Owner, all computer-produced time/cost schedules and reports generated from monthly project updates.

1.4 THE COMPLETE PROJECT SCHEDULE SUBMITTAL

- A. Within 45 calendar days after receipt of Notice to Proceed, the Contractor shall submit for the Architect's review; 3 copies of the interim schedule and an electronic file in the previously approved CPM schedule program. The submittal shall also include three copies of a computer-produced schedule showing project duration; phase completion dates; and other data, including event cost. The complete working schedule shall reflect the Contractor's approach to scheduling the complete project. **The final Project Schedule in its original form shall contain no contract changes or delays which may have been incurred during the final network diagram development period and shall reflect the entire contract duration as defined in the bid documents.** These changes/delays shall be entered at the first update after the final Project Schedule has been approved. The Contractor should provide their requests for time and supporting time extension analysis for contract time as a result of contract changes/delays, after this update, and in accordance with Article, ADJUSTMENT OF CONTRACT COMPLETION.
- B. Within 30 calendar days after receipt of the complete project interim Project Schedule and the complete final Project Schedule, the Architect, will do one or both of the following:
 - 1. Notify the Contractor concerning his actions, opinions, and objections.

2. A meeting with the Contractor at or near the job site for joint review, correction or adjustment of the proposed plan will be scheduled if required. Within 14 calendar days after the joint review, the Contractor shall revise and shall submit three blue line copies of the revised Project Schedule, three copies of the revised computer-produced activity/event ID schedule and a revised electronic file as specified by the Architect. The revised submission will be reviewed by the Architect and, if found to be as previously agreed upon, will be approved.
- C. The approved baseline schedule and the computer-produced schedule(s) generated there from shall constitute the approved baseline schedule until subsequently revised in accordance with the requirements of this section.

1.5 PROJECT SCHEDULE REQUIREMENTS

- A. Show on the project schedule the sequence of work activities/events required for complete performance of all items of work. The Contractor Shall:
 1. Show activities/events as:
 - a. Contractor's time required for submittal of shop drawings, templates, fabrication, delivery and similar pre-construction work.
 - b. Owner's representative's and Architect-Engineer's review and approval of shop drawings, equipment schedules, samples, template, or similar items.
 - c. Interruption of utilities, delivery of OWNER furnished equipment, and rough-in drawings, project phasing and any other specification requirements.
 - d. Test, balance and adjust various systems and pieces of equipment, maintenance and operation manuals, instructions and preventive maintenance tasks.
 2. Show not only the activities/events for actual construction work for each trade category of the project, but also trade relationships to indicate the movement of trades from one area, floor, or building, to another area, floor, or building, for at least five trades who are performing major work under this contract.
 3. Break up the work into activities/events of a duration no longer than 20 work days each or one reporting period, except as to non-construction activities/events (i.e., procurement of materials, delivery of equipment, concrete and asphalt curing) and any other activities/events for which the ARCHITECT may approve the showing of a longer duration. The duration for approval of any required submittal, shop drawing, or other submittals will not be less than 10 work days.
 4. Describe work activities/events clearly, so the work is readily identifiable for assessment of completion. Activities/events labeled "start," "continue," or "completion," are not specific and will not be allowed. Lead and lag time activities will not be acceptable.
 5. The schedule shall be generally numbered in such a way to reflect either discipline, phase or location of the work.

- B. The Contractor shall submit the following supporting data in addition to the project schedule:
1. The appropriate project calendar including working days and holidays.
 2. The planned number of shifts per day.
 3. The number of hours per shift.
- Failure of the Contractor to include this data shall delay the review of the submittal until the Owner's representative is in receipt of the missing data.
- C. To the extent that the Project Schedule or any revised Project Schedule shows anything not jointly agreed upon, it shall not be deemed to have been approved by the Architect. Failure to include any element of work required for the performance of this contract shall not excuse the Contractor from completing all work required within any applicable completion date regardless of the ARCHITECT's approval of the Project Schedule.

1.6 PAYMENT TO THE CONTRACTOR:

- A. Monthly, the contractor shall submit the AIA application and certificate for payment documents G702 & G703 to the Architect for certification. The Contractor shall be entitled to a monthly progress payment upon approval of estimates as determined from the currently approved updated project schedule. Monthly payment requests shall include: a listing of all agreed upon project schedule changes and associated data; and an electronic file (s) of the resulting monthly updated schedule.
- B. Approval of the Contractor's monthly Application for Payment shall be contingent, among other factors, on the submittal of a satisfactory monthly update of the project schedule.

1.7 PAYMENT AND PROGRESS REPORTING

- A. Monthly schedule update meetings will be held on dates mutually agreed to by the Owner, Architect and Contractor. Contractor shall attend all monthly schedule update meetings. The Contractor shall accurately update the Project Schedule and all other data required and provide this information to the Architect three work days in advance of the schedule update meeting. Job progress will be reviewed to verify:
1. Actual start and/or finish dates for updated/completed activities/events.
 2. Remaining duration for each activity/event started, or scheduled to start, but not completed.
 3. Logic, time and cost data for change orders, and supplemental agreements that are to be incorporated into the Project Schedule.
 4. Changes in activity/event sequence and/or duration which have been made, pursuant to the provisions of following Article, ADJUSTMENT OF CONTRACT COMPLETION.
 5. Completion percentage for all completed and partially completed activities/events.

1.8 RESPONSIBILITY FOR COMPLETION

- A. If it becomes apparent from the current revised monthly progress schedule that phasing or contract completion dates will not be met, the Contractor shall execute some or all of the following remedial actions:

1. Increase construction manpower in such quantities and crafts as necessary to eliminate the backlog of work.
 2. Increase the number of working hours per shift, shifts per working day, working days per week, the amount of construction equipment, or any combination of the foregoing to eliminate the backlog of work.
 3. Reschedule the work in conformance with the specification requirements.
- B. Prior to proceeding with any of the above actions, the Contractor shall notify and obtain approval from the ARCHITECT for the proposed schedule changes. If such actions are approved, the representative schedule revisions shall be incorporated by the Contractor into the Project Schedule before the next update, at no additional cost to the Owner.

1.9 CHANGES TO THE SCHEDULE

- A. Within 30 calendar days after Owner acceptance and approval of any updated project schedule, the Contractor shall submit a revised electronic file (s) and a list of any activity/event changes including predecessors and successors for any of the following reasons:
1. Delay in completion of any activity/event or group of activities/events, which may be involved with contract changes, strikes, unusual weather, and other delays will not relieve the Contractor from the requirements specified unless the conditions are shown on the CPM as the direct cause for delaying the project beyond the acceptable limits.
 2. Delays in submittals, or deliveries, or work stoppage are encountered which make rescheduling of the work necessary.
 3. The schedule does not represent the actual prosecution and progress of the project.
 4. When there is, or has been, a substantial revision to the activity/event costs regardless of the cause for these revisions.
- B. The cost of revisions to the Project Schedule not resulting from contract changes is the responsibility of the Contractor.

1.10 ADJUSTMENT OF CONTRACT COMPLETION

- A. The Contractor shall submit each request for a change in the contract completion date to the Owner's representative in accordance with the AIA Document A201-2007, General Conditions of the Contract for Construction and the USDA Attachment to the former. The Contractor shall include, as a part of each change order proposal, a sketch showing all CPM logic revisions, duration (in work days) changes, and cost changes, for work in question and its relationship to other activities on the approved network diagram.
- D. All delays due to non-work activities/events such as RFI's, WEATHER, STRIKES, and similar non-work activities/events shall be analyzed on a month by month basis.

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SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES

- 1.1 Refer to AIA Document A201-2007, General Conditions of the Contract for Construction and the USDA Attachment to the AIA Document A201-2007, General Conditions.
- 1.2 For the purposes of this contract, samples (including laboratory samples to be tested), test reports, certificates, and manufacturers' literature and data shall also be subject to the previously referenced requirements. The following text refers to all items collectively as SUBMITTALS.
- 1.3 Submit for approval, all of the items specifically mentioned under the separate sections of the specification, with information sufficient to evidence full compliance with contract requirements. Materials, fabricated articles and the like to be installed in permanent work shall equal those of approved submittals. After an item has been approved, no change in brand or make will be permitted unless:
 - A. Satisfactory written evidence is presented to, and approved by Owner, that manufacturer cannot make scheduled delivery of approved item or;
 - B. Item delivered has been rejected and substitution of a suitable item is an urgent necessity or;
 - C. Other conditions become apparent which indicates approval of such substitute item to be in best interest of the Owner.
- 1.4 Forward submittals in sufficient time to permit proper consideration and approval action by Owner. Time submission to assure adequate lead time for procurement of contract - required items. Delays attributable to untimely and rejected submittals (including any laboratory samples to be tested) will not serve as a basis for extending contract time for completion.
- 1.5 Submittals will be reviewed for compliance with contract requirements by Architect-Engineer, and action thereon will be taken by ARCHITECT on behalf of the Owner.
- 1.6 Upon receipt of submittals, Architect-Engineer will assign a file number thereto. Contractor, in any subsequent correspondence, shall refer to this file and identification number to expedite replies relative to previously approved or disapproved submittals.
- 1.7 The Owner reserves the right to require additional submittals, whether or not particularly mentioned in this contract. If additional submittals beyond those required by the contract are furnished pursuant to request therefore by Owner, adjustment in contract price and time will be made in accordance with the GENERAL CONDITIONS of the contract.
- 1.8 Schedules called for in specifications and shown on shop drawings shall be submitted for use and information of the Owner and Architect-Engineer. However, the Contractor shall assume responsibility for coordinating and verifying schedules.

- 1.9 Submittals must be submitted by Contractor only and shipped prepaid. The Architect or Owner assumes no responsibility for checking quantities or exact numbers included in such submittals.
- A. Submit samples in triplicate if requested by the Architect. Submit other samples in single units unless otherwise specified. Submit shop drawings, schedules, manufacturers' literature and data, and certificates in quadruplicate, except where a greater number is specified.
 - B. Submittals will receive consideration only when covered by a transmittal letter signed by Contractor. Letter shall be sent via first class mail and shall contain the list of items, name of the Owner, name of Contractor, contract number, applicable specification paragraph numbers, applicable drawing numbers (and other information required for exact identification of location for each item), manufacturer and brand, ASTM or Federal Specification Number (if any) and such additional information as may be required by specifications for particular item being furnished. In addition, catalogs shall be marked to indicate specific items submitted for approval.
 - 1. A copy of letter must be enclosed with items, and any items received without identification letter will be considered "unclaimed goods" and held for a limited time only.
 - 2. Each sample, certificate, manufacturers' literature and data shall be labeled to indicate the name and location of the Owner, name of Contractor, manufacturer, brand, and location(s) on project.
 - 3. Required certificates shall be signed by an authorized representative of manufacturer or supplier of material, and by Contractor.
 - C. In addition to complying with the applicable requirements specified in preceding Article 1.9, samples which are required to have Laboratory Tests (those preceded by symbol "LT" under the separate sections of the specification shall be tested, at the expense of Contractor, in a commercial laboratory approved by Owner.
 - 1. Laboratory shall furnish Owner with a certificate stating that it is fully equipped and qualified to perform intended work, is fully acquainted with specification requirements and intended use of materials and is an independent establishment in no way connected with organization of Contractor or with manufacturer or supplier of materials to be tested.
 - 2. Certificates shall also set forth a list of comparable projects upon which laboratory has performed similar functions during past five years.
 - 3. Samples and laboratory tests shall be sent directly to approved commercial testing laboratory.
 - 4. Contractor shall forward a copy of transmittal letter to ARCHITECT simultaneously with submission to a commercial testing laboratory.
 - 5. Laboratory test reports shall be sent directly to ARCHITECT for appropriate action.

6. Laboratory reports shall list contract specification test requirements and a comparative list of the laboratory test results. When tests show that the material meets specification requirements, the laboratory shall so certify on test report.
 7. Laboratory test reports shall also include a recommendation for approval or disapproval of tested item.
- D. If submittal samples have been disapproved, resubmit new samples as soon as possible after notification of disapproval. Such new samples shall be marked "Resubmitted Sample" in addition to containing other previously specified information required on label and in transmittal letter.
 - E. Approved samples will be kept on file by the ARCHITECT at the site until completion of contract, at which time such samples will be delivered to Contractor as Contractor's property. Where noted in technical sections of specifications, approved samples in good condition may be used in their proper locations in contract work. At completion of contract, samples that are not approved will be returned to Contractor only upon request and at Contractor's expense. Such request should be made prior to completion of the contract. Disapproved samples that are not requested for return by Contractor will be discarded after completion of contract.
 - F. Submittal drawings (shop, erection or setting drawings) and schedules, required for work of various trades, shall be checked before submission by technically qualified employees of Contractor for accuracy, completeness and compliance with contract requirements. These drawings and schedules shall be stamped and signed by Contractor certifying to such check.
 1. For each drawing required, submit three copies plus the number required by the Contractor.
 2. Drawings shall be full size.
 3. Each drawing shall have marked thereon, proper descriptive title, including Medical Center location, project number, manufacturer's number, reference to contract drawing number, detail Section Number, and Specification Section Number.
 4. A space 120 mm by 125 mm (4-3/4 by 5 inches) shall be reserved on each drawing to accommodate approval or disapproval stamp.
 5. Submit drawings, ROLLED WITHIN A MAILING TUBE, fully protected for shipment.
 6. Two prints of approved or disapproved shop drawings will be forwarded to Contractor.
 7. When work is directly related and involves more than one trade, shop drawings shall be submitted to Architect-Engineer under one cover.
- 1.10 Samples, shop drawings, test reports, certificates and manufacturers' literature and data, shall be submitted for approval to
- Grove & Dall'Olio Architects PLLC
- 220 West King Street
- Martinsburg, WV, 25401.

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SECTION 02 42 93 - SELECTIVE REMOVAL AND PRESERVATION/STORAGE FOR REINSTALLATION

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes

1. Document with drawings and photographs keyed to drawings and label elements and materials designated for removal and preservation/storage for reinstallation.
2. Perform removals with little or no damage to historic materials including visible fasteners and adjoining trim.
3. Provide temporary shoring as required to ensure stability of building elements and fabric to remain.
4. Provide protection as required to prevent damage to, deterioration of, and other alteration to both elements and materials to be removed and stored for reinstallation and elements and materials to remain.
5. Selectively remove the following elements:
 - a. Second floor demising wall studs and historic/original framing.
 - b. Interior architectural trim, including baseboard, window and door trim.
 - c. Windows
 - d. Doors
 - e. Flooring.
 - f. Wall brick-face and interior
 - g. Exterior architectural trim.
 - h. Sidewalk pavers.
 - i. Gutters and downspouts
 - j. Other elements as indicated on Drawings
6. Remove and store the following elements without damage for restoration and/or reinstallation:
 - a. Windows.
 - b. Doors.
 - c. Interior architectural trim, including baseboard, window and door trim.
 - d. Exterior architectural trim.
 - e. Wall brick-face and interior (face brick shall be separated for all other brick for replacement)
 - f. Sidewalk pavers.
 - g. Other elements as indicated on Drawings.
 - h. Antique Framing Lumber for window/door restoration
 - 1) Trim
 - 2) Framing and Blocking
7. Remove the following elements to be turned over to Owner:
 - a. Elements indicated on Drawings.
8. Deliver items to be restored and reinstalled to locations indicated or designated for restoration or storage.
9. Deliver items to be turned over to Owner to location designated by Owner.
10. Dispose of elements and materials not to be reinstalled or returned to Owner offsite in a legal manner.
11. No historic building finish materials are to be installed in locations where they were not originally found, and no historic materials from other buildings are to be used in carrying out this project, without approval by architect.

B. Related Requirements

1. Section 06 20 00 – Finish Carpentry
2. Section 08 50 00 – Wood Window and Door Restoration
3. Section 09 20 00 - Wall and Ceiling Plaster Restoration
4. Section 09 30 00 – Tiling
5. Section 09 90 00 – Painting and Coating

1.2 QUALITY ASSURANCE

A. Removal and Storage Specialist: Award the selective removal and storage work to a firm that is regularly engaged in dismantling and storing elements and materials from historic buildings similar to those required to be removed and stored as work of this Section and that can demonstrate to Owner's satisfaction that, within previous five years, it has successfully performed and completed in a timely manner at least three projects similar in scope and type to work required on this Project involving selective removal and reinstallation, building material conservation, or repairs in keeping with the *Secretary of the Interior's Standards* as evaluated by a State Historic Preservation office for buildings listed in the National Register of Historic Places, or buildings listed in a State Register of Historic Places, or under the direction of preservation authorities for buildings designated as Landmarks by local governmental authorities.

1. Foreman: Selective removal and storage shall be directly supervised by a full-time foreman with experience equal to or greater than that required of Removal and Storage Specialist. Foreman shall read and speak English fluently. Foreman shall be on site daily for duration of work of this Section. Same foreman shall remain on Project throughout work unless his performance is deemed unacceptable.
2. Mechanics: Selective removal and storage shall be carried out by skilled mechanics who are thoroughly experienced in the removal, storage, and reinstallation of historic building materials from historic buildings and have a minimum of three years' experience with work on historic buildings similar to that required by this Section. In acceptance or rejection of work of this Section, no allowance will be made for workers' inattention, incompetence, or lack of skill.

B. Laws, Codes, and Regulations: Work of this Section shall comply with all applicable federal, state, and local laws, codes, and regulations.

C. Referenced Standards: Work of this Section shall comply with applicable requirements and recommendations of latest editions of the documents listed herein, except as modified by more stringent requirements of the Contract Documents and of applicable laws, codes, and regulations of authorities having jurisdiction. Where the language in any of the documents referred to herein is in the form of a recommendation or suggestion, such recommendations or suggestions shall be deemed to be mandatory under this Contract unless specifically indicated otherwise in Contract Documents. Provide a reference copy of each of the following standards at Project site during all periods when work of this Section is being performed. In each case in which there is a conflict between requirements of referenced standards; requirements of laws, codes, and regulations; and requirements of this Section, the most stringent or restrictive requirement shall govern.

1. ANSI/NFPD 241, *Building Construction and Demolition Operations*.
2. National Fire Protection Association, Standard No. 241, *Safeguarding Building Construction and Demolition Operations*.
3. *The Secretary of the Interior's Standards for the Treatment of Historic Properties*

(Standards for Rehabilitation and/or Standards for Restoration).

- D. Shoring and Bracing: Contractor shall provide all shoring and bracing required to prevent harm to all persons, whether or not involved with the Work, and to prevent damage to and deterioration of existing building elements, materials, and finishes indicated to remain and indicated to be removed and stored for reinstallation or other preservation. Contractor shall provide all temporary shoring, bracing, and other support that may be required to ensure that building elements and materials to be removed are not damaged during removal and that building elements and materials to remain are not damaged, deteriorated, displaced, allowed to move from existing position in any plane, subjected to stresses that might adversely affect them, or otherwise adversely affected as a result of selective removal, storage, and reinstallation work.
- E. Responsibility for Damage to Historic Material Resulting from Selective Removal and Storage Work: Restore and/or replace in kind all building elements, materials, and finishes (including the elements, materials, and finishes to be removed and stored and in some cases reinstalled and the elements, materials, and finishes to remain) damaged or deteriorated as a result of work of this Section.
1. Restoration and replacement shall be made using materials and methods as directed by the Architect and shall be performed by firms and personnel skilled and experienced in the restoration and replacement of these elements, materials, and finishes to the Architect's satisfaction.
 2. Removal of material shall be tagged with metal or plastic tags for replacement in the same location, including door and window trim and architectural woodwork, doors, and windows.
 3. All replacement work shall meet the *Secretary of the Interior's Standards*.
 4. Restored and replaced elements, materials, and finishes that do not result in elements, materials, and finishes equal in every way to the existing elements before work began will be rejected, and Owner shall have the right to have rejected elements, materials, and finishes restored or replaced to match original elements before work began at no additional cost.
- F. Knowledge of Site and Project Conditions: Before submitting bid, Bidders shall make themselves thoroughly familiar with the Drawings and Specifications, with the scope of this Project, and with all conditions at the Project site relating to requirements of this Section and limitations under which the work will be performed and shall determine or verify dimensions and quantities. Submission of a bid shall be considered conclusive evidence that Contractor is thoroughly familiar with Project requirements and site conditions and limitations.

1.3 SUBMITTALS

- A. General: Submit the following in compliance with the requirements of the Contract Documents. Revise and resubmit each item as required to obtain Architect's approval.
- B. Qualification Data: Qualification data for firms and personnel specified in "Quality Assurance" Article that demonstrates that both firms and personnel have capabilities and experience complying with requirements specified. For firm and foreman, provide a list of at least three completed projects similar in size and scope to the work required on this Project. For each project list project name, address, architect, conservator, supervising preservation agency, scope of contractor's work, and other relevant information. Submit this information with the bid.

- C. Selective Removal and Storage Program: Detailed description of methods and procedures, equipment, tools, and materials proposed for use in removal and storage operations including, but not limited to, the following:
 - 1. Documenting and identifying elements and materials to be removed.
 - 2. Procedures for controlling noise and dust.
 - 3. Releasing or freeing materials and elements from existing construction.
 - 4. Protection for elements to be removed and for elements to remain.
 - 5. Handling and transporting materials and elements removed.
 - 6. Packaging elements removed.
 - 7. Storage locations.

- D. Documentation (Do Not Begin Work Onsite before Acceptance): Before beginning selective removal and storage, document characteristics and condition of all elements and materials to be removed and stored for reinstallation or other preservation and of all elements and materials adjacent to those elements and materials indicated to be removed and those elements and materials indicated to be removed and stored with photographs showing overall elements and detail photographs showing all surfaces of elements and materials as required in Article "Documentation," below. Submit documentation as digital color prints on archival quality disks, per current archival documentation standards. Identify each print with permanent archival label on rear surface. Ensure that label does not bleed through or otherwise damage photograph.

1.4 PROJECT CONDITIONS

- A. Condition of Site: Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical. Owner assumes no responsibility for condition of elements to be selectively removed and/or stored.

- B. Protection of Building and Property: Provide all protection and procedures necessary to protect adjacent elements and materials from damage and from deterioration during work of this Section.
 - 1. Protection from Rain and Other Precipitation: Protect building elements and finishes from damage and from deterioration caused by precipitation and other weather-related causes resulting from work of this Section.
 - 2. Protection from Fire: Take all necessary precautions to prevent fire and spread of fire.
 - 3. Protection from Water and Other Products Used in the Work: Provide all necessary protection to prevent damage and deterioration of building elements and materials to remain caused or resulting from products and procedures used in executing work of this Section.
 - 4. Protection from Dust: Take all precautions necessary to keep dust resulting from work of this Section at an absolute minimum.

- C. Debris Removal
 - 1. Remove debris using suitable containers and conveyances.
 - 2. Keep premises clean by removing accumulation of waste materials, rubbish, and debris from site daily.

- D. Security: Secure materials and elements to remain in place and materials and elements to be removed and stored from loss, theft, defacement, damage, and deterioration.

- E. Discrepancies: Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective removal and stored work.
- F. Disposal: Dispose of all items not to be reinstalled or turned over to Owner offsite in a legal manner. Storage or sale of removed items or materials onsite is not permitted.

1.5 LEAD-CONTAINING PAINT (LCP)

- A. General: Perform all work that disturbs lead-containing paint (LCP), handle all material that involves lead-containing paint, and transport and dispose of all lead-containing paint and residue in compliance with all applicable federal, state, and local laws and regulations for identification, removal, labeling, handling, containerization, transportation, and disposal of lead- containing material including, but not limited to, those referenced herein.
- B. U.S. Department of Labor OSHA Regulations: Including but not limited to: Title 29, Code of Federal Regulations (CFR) Section 1926.62: "Lead Exposure in Construction" and Title 29, CFR Section 1910.1200: "Hazard Communication Standard."
- C. U.S. Environmental Protection Agency (USEPA) Regulations: Including but not limited to: Title 40 CFR Part 262: "Standards Applicable to Generators of Hazardous Waste" and Part 263: "Standards Applicable to Transporters of Hazardous Waste."
- D. U.S. Department of Transportation (USDOT) Regulations: Including but not limited to: 49 CFR Parts 172, 173, 174, 175, 177, 178, 179, and 180.

PART 2 PRODUCTS

2.1 MATERIALS FOR PROTECTION OF REMOVED ELEMENTS AND MATERIALS (GENERAL)

- A. General: Provide materials for packaging and crating elements removed and stored for reinstallation, as suitable for use intended and approved by Architect.
- B. Resilient Materials: Paper, foam board, bubble wrap, mover's quilts, terry cloth, natural or synthetic batting, and other non-staining and non-abrasive materials that will not damage or deteriorate elements and materials to be removed and stored as approved by Architect.

2.2 MATERIALS FOR CRATING REMOVED ELEMENTS AND MATERIALS

- A. General: Provide materials as specified herein, except provide thicker, heavier materials as required to ensure sound, secure crates.
- B. Framing and Bracing: Dimensioned lumber, 2-inch nominal dimension by dimension required for container. Provide thicker lumber as required to ensure sound secure crate that will fully protect removed elements during handling, transportation, and storage.
- C. Enclosure: Plywood, minimum 1/2-inch CDX. Provide thicker plywood as required to ensure sound, secure crate. Reinforce crating materials as required to prevent damage from handling and transportation.
- D. Fasteners: Screws designed for fastening wood members to wood substrate of gauge and length required to ensure sound, secure crate.

PART 3 EXECUTION

3.1 DOCUMENTATION

- A. General: Before beginning general selective removal and stored work, document elements and materials to be removed and stored with drawings showing locations and photographs showing condition. Label or tag each element to be removed.
- B. Drawings: Identify areas of materials to be removed and stored and each individual element to be removed and stored on drawings. Assign each element a unique identification number.
- C. Identification: Label or tag each element to be removed with identification number matching number on drawings. Provide permanent identification on surfaces that will be concealed following reinstallation.
- D. Photographs: Document each element to be removed and stored for reinstallation with photographs (minimum 5 inch x 7 inch) showing overall element and details showing condition and areas of damage and deterioration.

3.2 PROTECTION

- A. General
 - 1. Protect against damage by water and fire, and injury to the public, workers, occupants and contents of existing building, damage to adjacent property, and portions of existing building not being selectively removed or removed and stored. Provide adequate protection to building, utilities, and equipment, including temporary supports, dust and other enclosures, etc., as required to protect elements from damage and from deterioration caused by work of this Section.
 - 2. Protect all persons from injury and all public and private property and building contents from damage due to the operations under this Section. Adequate protection of persons and property shall be provided at all times, including Saturdays, Sundays, and holidays, during time period in which work is being performed and after working hours.
- B. Debris Removal
 - 1. Do not drop or throw materials from any height. Remove debris using suitable containers or conveyances.
 - 2. Keep premises clean by removing accumulation of waste materials, rubbish, and debris from site daily. Dispose of waste, rubbish, and debris in a proper manner in accordance with all federal state, and local laws and regulations, to the satisfaction of all authorities having jurisdiction, and to the satisfaction of the Architect. Keep site and public rights of way clear. Take all precautions necessary to keep dust resulting from work of this Section at an absolute minimum.
 - 3. Do not store or permit excess debris to accumulate on site. If excess debris is not removed promptly, Architect reserves the right to cause same to be removed at no additional expense.
 - 4. Separate dumpsters are to be provided for the recycling of all non-pressure treated wood, cardboard, and scrap metal.

3.3 TEMPORARY SHORING AND BRACING

- A. Provide temporary shoring and bracing as required to maintain existing construction safely in position during removal and storage, abide by shoring and bracing notes on structural drawings.
- B. Perform shoring and bracing in such a manner as to prevent settlement and/or displacement of the existing building elements to remain and to prevent stresses on building elements to remain that might damage or deteriorate them. Before commencing with the work, thoroughly investigate the existing structure to verify its present condition.
- C. Execute shoring and bracing in best, substantial, workmanlike manner to avoid danger to workers and public and damage to the building.

3.4 SELECTIVE REMOVAL AND STORAGE, GENERAL

- A. Documentation: Do not begin selective removal and storage work until all documentation has been accepted by Architect.
- B. Support: Provide all shoring, bracing, reinforcement, and enclosures required to prevent damage and/or deterioration prior to beginning selective removal and storage work.
- C. Protection: Provide protection from dust, noise, and other conditions to be generated by work of this Section.
- D. Hoisting and Lowering: Where necessary because of size or weight, use appropriately sized hoisting devices and cribbing to accomplish all removal, lifting, and lowering.
- E. Selective Removal: Perform work of this Section in a careful, workmanlike manner.
 - 1. Remove existing construction only to extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as specified herein.
 - 2. Proceed with selective removal systematically. Complete selective removal operations in one location before proceeding to other locations.
 - 3. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping, to minimize disturbance of adjacent surfaces. Temporarily cover openings to remain.
 - 4. Locate selective removal equipment and remove debris and materials so as not to impose excessive loads on building elements.
- F. Storage for Reinstallation: Store elements as indicated.
 - 1. Protection: Wrap elements to be stored for reinstallation using appropriate materials that will protect elements from damage during handling, transportation, and storage and will not cause damage or deterioration to elements. Secure wrappings so that protection will not come loose during handling.
 - a. Label wrapping in a permanent manner, clearly identifying contents as to type and original location.

2. Crating: Crate elements that have been wrapped in crates of appropriate material and construction that will protect elements from damage and from deterioration.
 - a. Label crates in a permanent manner, clearly identifying contents.

END OF SECTION

SECTION 03 30 00 - 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 the work of this Section.

1.2 SUMMARY

- A. Section includes but is not limited to the following as shown on the drawings and as specified herein:
1. Foundation systems including footings, piers, and similar concrete.
 2. Slabs on grade.
 3. Furnishing and installing all required anchors and inserts.
 4. Placing in the forms all inserts, anchors, anchor bolts, bearing plates and the like furnished by other trades for casting into the concrete and cleaning of same after stripping of forms.
 5. Protection of all inserts, anchors, hangers, sleeves and supports furnished and set by others for the attachment of other work to the concrete, or required to permit the passage of other work through the concrete.
 6. Supply, fabricate and place all required reinforcing bars, mesh and other reinforcement for concrete where shown, called for, and/or required complete with proper supporting devices.
 7. Erection and removal of all formwork required to properly complete the work.
 8. Finishing of all concrete work as hereinafter specified.
 9. Curing and protection of all concrete work.
 10. Floor sealers and dust-proofing of all areas exposed and/or covered with carpet.
 11. Cutting, patching, grouting, repairing and pointing up as required.
 12. Vapor barrier system below slabs on grade.
 13. Under slab drainage course.
 14. Dewatering.
 15. Waterproofing.
 16. Grouting of all beam bearing plates and column base plates.
 17. Equipment pads as required.
 18. All other work and materials as may be reasonably inferred and needed to make the work of this section complete.
 19. Waste Management
- B. Related Requirements:
1. Section 02 42 93 – Selective Removal and Preservation/Storage for Reinstallation
 2. Section 04 22 00 – Concrete Unit Masonry
 3. Section 05 12 00 – Structural Steel
 4. Section 05 50 00 – Metal Fabrications
 5. Section 06 10 00 – Rough Carpentry
 6. Section 07 92 00 – Joint Sealants

1.3 SUBMITTALS

- A. Product Data: Submit data for proprietary materials and items, including the following:
1. Reinforcement and forming accessories
 2. Admixtures
 3. Patching compounds

4. Waterstops
 5. Joint systems
 6. Curing compounds
 7. Dry-shake finish materials
 8. Others items as requested by Architect.
- B. Shop Drawings; Reinforcement: Submit original shop drawings for fabrication, bending, and placement of concrete reinforcement. Comply with ACI 315 "Details and Detailing of Concrete Reinforcement" showing bar schedules, stirrup spacing, diagrams of bent bars, arrangement of concrete reinforcement. Include special reinforcement required for openings through concrete structures. The shop drawings shall be prepared only by competent detailers, checked by the contractor prior to submission.
1. The shop drawings shall show construction, contraction and isolation joint locations and the added reinforcement required at same.
 2. Obtain and coordinate information for sleeves and openings in concrete, which are required for the work of other trades. Make coordinated drawings showing size and location of openings and sleeves and incorporate this information on the reinforcing drawings.
 3. Only those splices indicated on the approved shop drawings will be permitted.
 4. Provide elevations of all foundation walls and other structural elements to a minimum 1/4" scale.
- C. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.
1. Location of construction joints is subject to approval of the Architect.
- D. Contraction Joint Layout: Indicate proposed contraction joints required per applicable codes and drawings.
1. Location of contraction joints is subject to approval of the Architect.
- E. Samples: Submit samples of materials as requested by Architect, including names, sources and descriptions.
- F. Laboratory Test Reports: Submit laboratory test reports for concrete materials, mix design test and microwave test.
- G. Material Certificates: Provide materials certificates in lieu of materials laboratory test reports when permitted by Architect. Manufacturer and Contractor, certifying that each material item complies with, or exceeds, specified requirements shall sign material certificates. Provide certification from admixture manufacturers that chloride content complies with specification requirements.
- H. Cold Weather and Hot Weather Concreting Procedures: Submit written descriptions of contractor's proposed cold weather and hot weather concreting procedures, when applicable.
- I. Certification that pozzolanic materials conforms to ASTM C 618-01 (noting class C or class F), ASTM C 989 or ASTM C1240.
- J. Certified recycled steel content. Provide cut sheets clearly indicating whether the rebar used meets the minimums for post-consumer OR post-industrial recycled contents. Or, if cut sheets are not available, obtain a written affidavit from the manufacturer stating the recycled content percentage and if the recycled content is post-consumer or post-industrial.

- K. Formwork: Specify whether reusable, permanent, salvaged or new wood forms are to be used.
- L. Recycled Aggregate: Provide laboratory reports indicating that aggregate conforms to ASTM C33 for structural concrete or ASTM D1241-00 for sub-base material. Provide cut sheets clearly indicating the source, total weight and volume of the recycled aggregate. If aggregate provided is a mix of virgin and recycled aggregates obtain a written affidavit from the manufacturer stating the recycled content percentage
- M. VOC content for curing compounds, sealants and release agents: Provide a cut sheet and a Material Safety Data Sheet (MSDS) for each curing compound, sealant, hardener and release agent used highlighting VOC contents. VOC content must be less than or equal to limits stated under "PRODUCTS".

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer who employs on Project personnel qualified as ACI- certified Flatwork Technician and Finisher and a supervisor who is an ACI- certified Concrete Flatwork Technician.
- B. 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.
- C. Codes and Standards: Comply with provisions of following codes, specifications, and standards, except where more stringent requirements are shown or specified:
 1. International Existing Building Code, 2008, as modified by the State of West Virginia.
 2. ACI 117 "Standard Specifications for Tolerances for Concrete Construction and Materials and Commentary."
 3. ACI 211.1 "Standard Practice for Selecting Proportions for Normal, Heavyweight and mass concrete."
 4. ACI 214R, "Evaluation of Strength Test Results of Concrete."
 5. ACI 232.2R, "Use of Fly Ash in Concrete."
 6. ACI 233R, "Guide to Use of Slag Cement in Concrete and Mortar."
 7. ACI 234, "Guide for the Use of Silica Fume in Concrete."
 8. ACI 301 "Specifications for Structural Concrete."
 9. ACI 302.1R "Guide for Concrete Floor and Slab Construction."
 10. ACI 304R, "Guide for Measuring, Mixing, Transporting and Placing Concrete."
 11. ACI 305R "Hot Weather Concreting."
 12. ACI 306.1-90 "Standard Specification for Cold Weather Concreting."
 13. ACI 308.1 "Standard Specification for Curing Concrete."
 14. ACI 309R, "Guide for Consolidation of Concrete."
 15. ACI 311.4R, "Guide for Concrete Inspections."
 16. ACI 315, "Details and Detailing of Concrete Reinforcement."
 17. ACI 318 "Building Code Requirements for Structural Concrete and Commentary."
 18. ACI 347 "Guide to Formwork of Concrete."
 19. Concrete Reinforcing Steel Institute, (CRSI) "Manual of Standard Practice."
 20. CRSI-WCRSI, "Placing Reinforcing Bars."
 21. AWS D1.4, "Structural Welding Code Reinforcing Steel."
 22. The ACI Field Reference Manual, SP-15 shall be kept at the job site, and the practices set forth therein shall be strictly adhered to.
 23. ASTM Standards as applicable in the building code of the local jurisdiction and as noted in this specification.

- D. Concrete Testing Service: Owner will engage a testing laboratory acceptable to Architect and Engineer of Record to perform material evaluation tests and to design concrete mixes.
- E. Materials and installed work may require testing and retesting at any time during progress of work. Tests, including retesting of rejected materials for installed work, shall be done at Contractor's expense.
- F. Preconstruction Meeting:
 - 1. At least 35 days prior to the start of the concrete construction schedule, the Contractor shall conduct a meeting to review the proposed mix designs and to discuss the required methods and procedures to achieve the required concrete construction. The Contractor shall send a pre-concrete conference agenda to all attendees 20 days prior to the scheduled date of the conference.
 - 2. The Contractor shall require responsible representatives of every party who is concerned with the concrete work to attend the conference, including but not limited to the following:
 - a. Contractor's superintendent
 - b. Laboratory responsible for the concrete design mix
 - c. Laboratory responsible for field quality control
 - d. Concrete subcontractor
 - e. Ready-mix concrete producer
 - f. Admixture manufacturer(s)
 - g. Concrete pumping equipment manufacturer.
 - 3. Minutes of the meeting shall be recorded, typed and printed by the contractor and distributed by him to all parties concerned within 5 days of the meeting. One copy of the minutes shall also be transmitted to the following for information purposes: Owner or owner's representative, Architect, and Engineer of Record.
 - 4. The minutes shall include a statement by the concrete contractor indicating that the proposed mix design and placing can produce the concrete quality required by these specifications.
 - 5. A minimum of a 4 cubic yard trial mixture containing all required admixtures shall be placed at the job site using the accepted methods of placing, finishing and curing. All applicable tests including slump, strength, air content, permeability, and air content will be performed. This shall occur at least four weeks before actual concreting operations with particular admixture begins. The admixture manufacturer(s) and inspectors shall be present. The same testing should be done in the laboratory at the same time for comparison. A test sample should be done for each condition that is to be placed.
 - 6. The Engineer of Record will be present at the conference. The Contractor shall notify the Engineer of Record at least 10 days prior to the scheduled date of the conference.

1.5 PROJECT CONDITIONS

- A. The Contractor, before commencing work, shall examine all adjoining work on which this work is in any way dependent for proper installation and workmanship according to the intent of this specification, and shall report to the Architect or Engineer of Record any condition which prevents this contractor from performing first class work.

- B. Protection of Footings Against Freezing: Cover completed work at footing level with sufficient temporary or permanent cover as required to protect footings and adjacent subgrade against possibility of freezing; maintain cover for time period as necessary.
- C. Protect adjacent finish materials against spatter during concrete placement.
- D. Provide all barricades and safeguards at all pits, holes, shaft and stairway openings, etc., to prevent injury to workmen and others within and about the premises. Also provide all safeguards as required by the Building Code, OSHA, or any other departments having jurisdiction. Take full responsibility for all safety precautions and methods.
- E. Procedure of Work: The contractor shall keep himself constantly informed as to the progress of the work in the field, materials and men ready to start work immediately when conditions of preceding work are available or ready, wholly or in part, so as not to delay the progress of building work or to interfere with the progress of work of other contractors, and in any event he shall, within 24 hours after notice from the Owner, proceed with such work as directed to maintain the uninterrupted progress of the work.

1.6 DELIVERY, STORAGE, AND HANDLING

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

PART 2 – PRODUCTS

2.1 FORM MATERIALS

- A. Forms for Exposed Finish Concrete: Unless otherwise indicated, construct of plywood, metal, metal-framed plywood faced, or other acceptable panel-type materials, to provide continuous, straight, smooth, exposed surfaces. Furnish in largest practicable sizes to minimize number of joints and to conform to joint system shown on drawings. Provide form material with sufficient strength and thickness to withstand pressure of newly placed concrete without bow or deflection.
 - 1. Use plywood complying with U.S. Product Standard PS-1 “B-B (Concrete Form) Plywood”, Class I, Exterior Grade or better mill oiled and edge-sealed, with each piece bearing legible inspection trademark.
- B. Forms for Unexposed Finish Concrete: Plywood, lumber, metal, or other acceptable material. Preference shall go to salvaged or re-used Dimensional Lumber. Provide lumber dressed on at least 2 edges and one side for tight fit.
- C. Form Coatings: Provide VOC compliant commercial formulation form- coating compounds that will not bond with, stain nor adversely affect concrete surfaces, and will not impair subsequent treatments of concrete surfaces. Use biodegradable form release agent listed below or equivalent made from soy or rapeseed oil.
 - 1. “Bio-Release EF”
 - 2. “Soy Form Away”
 - 3. “Bio-Form”
 - 4. “Duogard II”
 - 5. “Atlas Bio-Guard”

- D. Void Forms: Biodegradable paper surface, treated for moisture resistance, structurally sufficient to support weight of plastic concrete and other superimposed loads.
- E. Form Ties: Form ties and spreaders: prefabricated assemblies by Richmond; Superior, Dayton or approved equal. Wire ties shall not be used. Ties for foundation work shall be of snap design with removal cones and water seal washer.
 - 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 REINFORCING MATERIALS

- A. Steel anchors, reinforcing welded wire fabric and other metal members required by the work of this section shall contain a minimum of 50% (combined) pre-consumer/post-consumer recycled content.
- B. Reinforcing Bars: ASTM A 615, Grade 60.
- C. Steel Wire: ASTM A 82, plain, cold-drawn steel.
- D. Welded Wire Fabric: ASTM A 185, welded steel wire fabric, Galvanized.
- E. Welded Deformed Steel Wire Fabric: ASTM A 497, Galvanized.
- F. Joint Dowel Bars: ASTM A 615/A 615M, Grade 60, plain-steel bars, cut true to length with ends square and free of burrs.
- G. Zinc Repair Material: ASTM A 780, zinc-based solder, paint containing zinc dust, or sprayed zinc.
- H. Supports for Reinforcement: Bolsters, chairs, spacers and other devices for spacing, supporting and fastening reinforcing bars and welded wire fabric in place. Use wire bar type supports complying with CRSI specifications.
 - 1. For exposed-to-view concrete surfaces, where legs of supports are in contact with forms, provide supports with legs which are plastic protected (CRSI, Class I) or stainless steel protected (CRSI, Class 2), at a spacing not to exceed 4'-0" on center in either direction.

2.3 CONCRETE MATERIALS

- A. Portland cement: ASTM C 150, Type I. Total percentage of Portland Cement is NOT to exceed 75% of the cementitious mix. Use one brand of cement throughout project, unless otherwise acceptable to Architect.
 - 1. Fly Ash: Cast-in-place concrete shall incorporate fly ash as a replacement for at least 25% (by weight) of the Portland cement. All design mixes must be reviewed and approved by the Engineer of Record.
 - 2. Ground Granulated Blast Furnace Slag (GGBF): Cast-in-place concrete shall incorporate GGBF as a replacement for at least 40% (by weight) of the Portland cement. All design mixes must be reviewed and approved by the Engineer of Record.

3. Pozzolans and Slags: These must be completely accounted for in the design mix. Mix design must meet minimum design requirements set in the contract documents. Additional admixtures may be required to meet early strength requirements and alternative cementitious material goals. If a "blended cement" is used which already contains a certain percentage of Pozzolans or Slags this content may offset or entirely satisfy the minimum percentage required.
 - a. Coal Fly Ash: ASTM C 618 (Class C or Class F): ASTM C 618 (Note: Class F fly Ash will require higher amounts or air entraining ad-mixtures than class C).
 - b. Blast Furnace Slag: ASTM C989
 - c. Silica Fume: ASTM C 1240
 - d. Rice Hull (or "husk") Ash: ASTM C 618 Blended hydraulic cement, as defined by ASTM C 595 or ASTM C 1157

- B. Normal Weight Aggregates: ASTM C 33, and as herein specified. Provide aggregates from a single source for exposed concrete.
 1. Local aggregates not complying with ASTM C 33 but which have shown by special test or actual service to produce concrete of adequate strength and durability may be used when acceptable to Architect.
 2. Normal weight Fine Aggregate: washed, inert, natural or manufactured or combination thereof, sand conforming ASTM C33 gradation.
 3. Normal weight Coarse Aggregate: well graded crushed stone or washed gravel conforming to ASTM C33, sizes 57 for foundations and 67 for slabs and structure.
 - a. Recycled crushed concrete aggregate in concrete mixes is only to be used with approval of Engineer of Record. Recycled aggregate shall be used only as a substitute for coarse aggregate and must also be washed and well-graded, conforming to ASTM C33.
 - b. For sub-base, slabs on grade and non-structural applications and Recycled Aggregate Materials are NOT required to meet the ASTM C 33 standard. In addition to concrete rubble, glass, porcelain, and tire chips can be used as filler material. Any inert material conforming to ASTM D1241 is acceptable for the applications described in this paragraph.

- C. Lightweight Aggregates: Well-graded crushed expanded shale produced by rotary kiln method. Solite or equal, conforming to ASTM C330.

- D. Water: Free from oils, acids, alkali, organic matter and other deleterious material to conform to ASTM C94. ASTM C94 for gray water use in the production of ready mixed concrete per approval by the Engineer of Record.

- E. Air-Entraining Admixture: Any material proposed for use as an air-entraining admixture should be tested in conformance with ASTM C 260.
 1. Liquid air-entrainment: Use only agents derived from salts of wood resins. Select from products listed below or approved equal conforming to ASTM C-260.
 - a. "Airmix" Euclid Chemical
 - b. "Darex AEA" W. R. Grace
 - c. "MB-VR" Master Builders

- F. Water-Reducing Admixture: ASTM C 494.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. "Polyheed 997" Master Builders
 - b. "Euclid MR" Euclid Chemical
 - c. "WRDA 64" W. R. Grace

- G. High-Range Water-Reducing Admixture (Superplasticizer): ASTM C 494, Type F or Type G and containing not more than 0.05 percent chloride ions.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. "Eucon 37, 1037 or Plastol 5000" Euclid Chemical Co.
 - b. "Rheobuild 1000" Master Builders
 - c. "Sikament 300": Sika Chemical Corp.
- H. Water Reducing, Non-Corrosive Accelerating Admixture: The admixture shall conform to ASTM C 494, Type C or E, and not contain more chloride ions than are present in municipal drinking water. The admixture manufacturer must have long-term non-corrosive test data from an independent testing laboratory (of at least a year's duration) using an acceptable accelerated corrosion test method such as that using electrical potential measures. Accelerating admixtures are not to be used as antifreeze agents. Accelerating admixtures are permitted only upon review by Engineer of Record.
1. Products: Subject to compliance with requirements, provide the following:
 - a. "Accelguard 80" Euclid Chemical Co.
 - b. "Daraset" W.R. Grace
 - c. "Pozzutec 20" Master Builders
- I. Water-Reducing, Retarding Admixture: ASTM C 494, Type D, and contain not more than 0.05 percent chloride ions.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. "Eucon Retarder 75" Euclid Chemical Co.
 - b. "Pozzolith 100XR" Master Builders
 - c. "Plastiment" Sika Chemical Co.
 - d. "Daratard" W.R. Grace
- J. Microsilica Admixture shall be dry densified or slurry formed. Microsilica shall come from the same source throughout the project. If a single source cannot be maintained, laboratory testing of each new source shall be required before acceptance by the Engineer of Record at no cost to the owner.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. "Emsac F 100" Elkem Chemical, Inc.
 - b. "Eucon MSA" Euclid Chemical Co.
 - c. "Force 10,000" W. R. Grace
- K. Prohibited Admixtures: Calcium chloride, thiocyanates or admixtures containing more than 0.05 percent chloride ions are not permitted.
- L. Certification: Written conformance to the above-mentioned requirements and the chloride ion content of admixtures will be required from the admixture manufacturer prior to mix design review by the Engineer of Record.

2.4 WATERSTOPS

- A. Self-Expanding Butyl Strip Waterstops: Manufactured rectangular or trapezoidal strip, butyl rubber with sodium bentonite or other hydrophilic polymers, for adhesive bonding to concrete, 3/4 by 1 inch (19 by 25 mm). of the following available products that may be incorporated into the Work include, but are not limited to, the following:
1. Carlisle Coatings & Waterproofing, Inc.; MiraSTOP
 2. CETCO; Volclay Waterstop-RX
 3. Concrete Sealants Inc.; Conseal CS-231
 4. Greenstreak; Swellstop

5. Henry Company, Sealants Division; Hydro-Flex
6. JP Specialties, Inc.; Earth Shield Type 20

2.5 GROUT

- A. Non-Shrink, Non-Metallic Grout: The non-shrink grout shall be a factory pre-mixed grout and shall conform to ASTM C1107, "Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Non-Shrink)." In addition, the grout manufacturer shall furnish test data from an independent laboratory indicating that the grout when placed at a fluid consistency shall achieve 95% bearing under a 4' x 4' base plate.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. "Euco-NS" Euclid Chemical Co.
 - b. "Five Stare Grout" U.S. Grout Corp.
 - c. "Masterflow 713" BASF
- B. High Flow Grout: Where high fluidity and/or increased placing time is required, use high flow grout. The factory pre-mixed grout shall conform to ASTM C1107, "Standard Specification for Packages Dry, Hydraulic-Cement Grout (Non-shrink)." In addition, the grout manufacturer shall furnish test data from an independent laboratory indicating that the grout when placed at a fluid consistency shall achieve 95% bearing under an 18" x 36" base plate.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. "Euco Hi-Flow Grout" Euclid Chemical Co.
 - b. "Masterflow 928" BASF
 - c. "Five Star Fluid Grout 100" Five Star

2.6 RELATED MATERIALS

- A. Granular Fill: Clean mixture of crushed stone or crushed or uncrushed gravel; ASTM D 1241, Size 57, with 100 percent passing a 1-1/2 inch sieve and 0 to 5 percent passing a No. 8 sieve.
- B. Fine-Graded Granular Material: Clean mixture of crushed stone, crushed gravel, and manufactured or natural sand; ASTM D 1241, 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.
- C. Non-slip Aggregate Finish: Provide fused aluminum oxide grits, or crushed emery, as abrasive aggregate for non-slip finish with emery aggregate containing not less than 40% aluminum oxide and not less than 25% ferric oxide. Use material that is factory-graded, packaged, rustproof and non-glazing, and is unaffected by freezing, moisture, and cleaning materials.
- D. Absorptive Cover: Burlap cloth made from jute or kenaf, weighing approximately 9 oz. per sq. yd., complying with AASHTO M 182, Class 2.
- E. Moisture-Retaining Cover: One of the following, complying with ASTM C 171.
 1. Waterproof paper
 2. Polyethylene film
 3. Polyethylene-coated burlap
- F. Curing Compounds: The compound shall conform to ASTM C 309. Limit VOC content to 130 g/L. Use water based curing compound listed below or approved equivalent. For surfaces receiving both a curing compound and additional flooring, verify that the curing

compound and additional flooring are compatible.

1. SealTight 1100 by W.R. Meadows
 2. Kurez W VOX by Euclid Chemical Co.
 3. Luster Seal WB STD by Euclid Chemical Co.
 4. VOCOMP-25 by W.R. Meadows
- G. Curing & Sealing Compounds: Only specify for slabs that will remain exposed, i.e. will not receive additional flooring. The compound shall conform to ASTM C1315. Limit VOC content to 130 g/L. Use water based curing compound listed below or approved equivalent.
1. Luster Seal WB STD by Euclid Chemical Co.
 2. VOCOMP-25 by W.R. Meadows
- H. Sealers/Hardeners: For use on concrete surfaces that will remain exposed. Slabs that will receive additional flooring do not require sealing or hardening. Sealers and hardeners must conform to ASTM D1546, not yellow under ultra violet light after 500 hours of test in accordance with and have a maximum moisture loss of 0.039 grams per sq. cm. when applied at a coverage rate of 250 sq. ft. per gallon. Limit VOC content to 130 g/L. Use water or vegetable-based product, those listed below or approved equal.
1. Kure-N-Harden by BASF
- I. For concrete floors subjected to heavy vehicular traffic use a Liquid Sealer/Densifier: The product must be a high performance, deeply penetrating concrete densifier conforming to ASTM C836; odorless, colorless, VOC - compliant, non-yellowing silicate based solution designed to harden, dustproof and protect and to resist black rubber tire marks on concrete surfaces. The compound must contain a minimum of 20% solids content of which 50% is silicate
- J. Evaporation Retardant:
1. Products Subject to compliance with requirements, provide one of the following:
 - a. "Eucohar"
 - b. "Confilm"
- K. Certify that all curing compounds, sealers and hardeners are compatible with all adhesive products intended for attaching co-lateral floor material. In conformance with ASTM F 710, coordination with flooring manufacturer is required to insure concrete coatings will not obstruct the bond between the concrete and the adhesive. Insure coatings and adhesives are "benignly compatible" -- in other words, do not combine substances whose constituents are reactive. Reactivity releases VOCs and /or other toxic fumes.
- L. Crack Sealer: Elastomeric liquid crack sealer resistant to water, gasoline, oil and salts.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. "Plasti-seal"
- M. Underlayment Compound: Free flowing, self-leveling, pumpable cementitious base compound.
1. Products: Subject to compliance with requirements, provide the following:
 - a. "Flo-Top 90 or Super Flo-Top" Euclid Chemical Co.
 - b. "Ardex" Ardex Co.
 - c. "Underlayment 110" Master Builders

- N. Bonding Admixture: The compound shall be a latex, non-rewettable type.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. "Flex-Con" Euclid Chemical Co.
 - b. "Daraweld C" W.R. Grace
 - c. "SBR Latex" Euclid Chemical Co.
- O. High Strength Polymer Repair Mortar: For form and pouring or large horizontal repairs, provide the flowable on-part, high strength repair mortar.
1. Products: subject to compliance with requirements, provide the following:
 - a. "Eucocrete" The Euclid Chemical Co.
 - b. "Euco Speed MP" (Cold Weather) The Euclid Chemical Co.
 - c. "Emaco R" Master Builders.
- P. Bonding Agent: ASTM C 1059/C 1059M, Type II, non-redispersible, acrylic emulsion or styrene butadiene.
- Q. Epoxy Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade to suit requirements, and as follows:
1. Type IV for bonding hardened concrete to hardened concrete, and Type V for bonding freshly mixed concrete to hardened concrete.
- R. 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.
- S. Vapor Barrier: Provide vapor barrier which conforms to ASTM E 1745, Class A or B. The membrane shall have a water-vapor permeance rate no greater than 0.012 perms when tested in accordance with ASTM E 154, Section 7. The vapor barrier shall be placed over prepared base material where indicated below slabs on grade. Vapor barrier shall be no less than 10 mil thick in accordance with ACI 302.1R. Preferred vapor barriers will be manufactured from post- consumer recycled polymers.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. "Stego Wrap (15 mil) Vapor Barrier" Stego Industries LLC
 - b. "Griffolyn Vaporguard" Reef Industries
 - c. "Premoulded Membrane with Plastmatic Core" W.R. Meadows.
 - d. W.R. Meadows
- T. Water: Potable.

2.7 PROPORTIONING AND DESIGN OF MIXES

- A. Preparation of Design Mixes
1. All mix designs shall be proportioned in accordance with Section 5.3, "Proportioning on the Basis of Field Experience and/or Trial Mixtures" of ACI 318 and prepared by a licensed testing laboratory approved by the owner, but paid for by the contractor. Submit mix designs on each class of concrete for review.
 2. If previously used mixes are submitted, all materials shall be from the same sources and with the same brand names as the previously utilized mix.
 3. If trial batches are used, the mix design shall be prepared by an independent testing laboratory and shall achieve an average compressive strength 1200 psi higher than the specified strength. This over-design shall be increased to 1400 psi when concrete strengths of 5000 or more are used.

4. The proposed mix designs shall be accompanied by complete standard deviation analysis or trial mixture test data.
- B. Submit each proposed mix on the mix design submittal form (included at the end of this specification) to the Architect and Structural Engineer for review at least 5 days prior to the pre- concrete conference. Do not begin concrete production until Architect and Engineer of Record has reviewed and approved mixes.
1. Submit Test reports for any pozzolans or slags indicating compliance with ASTM C 618 or ASTM C 989, respectively.
 2. Provide cut sheets clearly indicating the percentages of pozzolans or slags used in the mix design as replacement for Portland cement. Or, if cut sheets are not available, obtain a written affidavit from the manufacturer stating the percentage.
 3. Test reports for recycled aggregate indicating compliance with ASTM C 33. Provide cut sheets clearly indicating the percentage of aggregates used that are recycled. Or, if cut sheets are not available, obtain a written affidavit from the manufacturer stating the recycled content percentage and source or sources of the material.
 4. Provide cut sheets clearly indicating the percentage of sub-base and filler aggregate materials that are recycled. Or, if cut sheets are not available, obtain a written affidavit from the manufacturer stating the recycled content percentage and source or sources of the material.
- C. Design mixes to provide concrete with strength as indicated on drawings and schedules.
- D. Adjustment to Concrete Mixes: Mix design adjustments may be requested by Contractor when characteristics of materials, job conditions, weather, test results, or other circumstances warrant; at no additional cost to Owner and as accepted by Architect and Engineer of Record. Laboratory test data for revised mix design and strength results must be submitted to and accepted by Architect and Engineer of Record before using in work.
- E. Admixtures:
1. Use water-reducing admixture or high range water-reducing admixture (superplasticizer) in all concrete as required for placement and workability.
 2. Use non-corrosive, non-chloride accelerating admixture in concrete slabs placed at ambient temperatures below 50[°]F (10[°]C).
 3. Use high-range water-reducing admixture in pumped concrete, architectural concrete, concrete required to be watertight, concrete with ultimate strength of 5,000 psi or more, and concrete with water/cement ratios below 0.50.
 4. Use air-entraining admixture in exterior exposed concrete, unless otherwise indicated. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having total air content with a tolerance of plus-or-minus 1-1/2 percent within following limits:
 - a. Concrete structures and slabs exposed to freezing and thawing or deicer chemicals.
 - 1) 4.5 percent (moderate exposure); 5.5 percent (severe exposure) 1-1/2" max. aggregate 4.5 percent (moderate exposure); 6.0 percent (severe exposure) 1" max. aggregate.
 - 2) 5.0 percent (moderate exposure); 6.0 percent (severe exposure) 3/4" max. aggregate.
 - 3) 5.5 percent (moderate exposure); 7.0 percent (severe exposure) 1/2" max. aggregate.
 - b. Other Concrete: (not exposed to freezing, thawing, or hydraulic pressure): 2 percent to 4 percent air.

5. Use admixtures for water-reducing and set-control in strict compliance with manufacturer's directions.
- F. Water-Cement Ratio: Provide concrete for following conditions with maximum water-cement (W/C) ratios as follows:
1. Concrete for poured in place slabs, columns and walls, on ground or exposed to weather: W/C 0.40.
 2. "Quick Dry" Concrete: 0.40.
 3. Subjected to freezing and thawing; W/C 0.50.
 4. Subjected to deicers/watertight: W/C 0.45.
 5. Reinforced concrete subjected to brackish water, salt spray or deicers; W/C 0.40.
- G. Slump Limits: Proportion and design mixes to result in concrete slump at point of placement as follows:
1. Ramp slabs and sloping surfaces: Not more than 3".
 2. Reinforced foundation systems: Not less than 1" and not more than 3".
 3. Concrete containing HRWR admixture (superplasticizer): Not more than 9" unless otherwise approved by the architect. The concrete shall arrive at the job site at a slump of 2" to 3" (3" to 4" for concrete receiving a "shake-on" hardener or lightweight concrete), be verified, then the high-range water-reducing admixture added to increase the slump to the approved level.
 4. Other Concrete: Not less than 1" or more than 4".
- H. Chloride Ion Level: Chloride ion content of aggregate shall be tested by the laboratory making the trial mixes. The total chloride ion content of the mix including all constituents shall not exceed the limitations set forth in Table 4.4.1 of ACI 318 for concrete subjected to deicers or exposed to chloride in service (0.15% chloride ions by weight of cement).

2.8 CONCRETE MIXING

- A. Ready-Mix Concrete: Comply with requirements of ASTM C 94, and as herein specified.
- B. Provide batch ticket for each batch discharged and used in work, indicating project identification name and number, date, mix type, mix time, quantity, and amount of water introduced.
- C. During hot weather, or under conditions contributing to rapid setting of concrete, a shorter mixing time than specified in ASTM C 94 may be required. When air temperature is between 85°F (30°C) and 90°F (32°C), reduce maximum mixing and delivery time from 1-1/2 hours to 75 minutes, and when air temperature is above 90°F (32°C), reduce maximum mixing and delivery time to 60 minutes.
- D. No water shall be added after mixing to concrete containing HRWR (Superplasticizer). If loss of slump occurs, the concrete treated with HRWR may be redosed as long as a "flash set" has not occurred. Redosage procedures must be discussed and approved by the Engineer of Record and the manufacturer.

PART 3 - EXECUTION

3.1 GENERAL

- A. Coordinate the installation of joint materials and vapor retarders with placement of forms and reinforcing steel.

3.2 INSPECTION

- A. Examine all work prepared by others to receive work of this section and report any defects affecting installation to the Contractor for correction. Commencement of work will be construed as complete acceptance of preparatory work by others.

3.3 CONCRETE

- A. Concrete shall develop the minimum compressive strengths shown on drawings at 28 days when sampled and tested in accordance with ASTM C 31 and C 39 with the maximum slump in accordance with the approved mix design.
- B. Concrete shall be in accordance with the requirements and specifications of "Building Code Requirements for Structural Concrete" as modified by the building code noted above.
- C. Fly Ash Concrete & Slag Concrete: Concrete mixes containing high volumes of fly ash or Slag have slower set times and may take up to 56 days to reach full strength. The Engineer of Record, agency responsible for concrete mix design, the architect and the concrete subcontractor must coordinate to ensure that the form stripping schedule is consistent with the ability of the structure to support itself and all imposed construction loads.

3.4 FORMS

- A. Design formwork to maximize its reusability, reduce resources devoted to formwork construction and minimize waste generated. Where appropriate choose alternative formwork systems (refer to sections listed above).
- B. Design, erect, support, brace and maintain formwork to support vertical and lateral, static, and dynamic loads that might be applied until such loads can be supported by concrete structure. Construct formwork so concrete members and structures are of correct size, shapes, alignment, elevation and position. Maintain formwork construction tolerances complying with ACI 347. Provide Class A tolerances for concrete exposed to view. Provide Class C tolerances for other concrete surfaces.
- C. Design formwork to be readily removable without impact, shocks or damage to cast-in-place concrete surfaces and adjacent materials.
- D. Construct forms to size shapes, lines and dimensions shown, and to obtain accurate alignment, location, grades, level and plumb work in finished structures. Provide for openings, offsets, sinkages, keyways, recesses, moldings, rustications, reglets, chamfers, blocking, screeds, bulkheads, anchorages and inserts, and other features required in work. Use selected materials to obtain required finishes. Solidly butt joints and provide back- up at joints to prevent leakage of cement paste.
- E. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush plates or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces where slope is too steep to place concrete with bottom forms only. Kerf wood inserts for forming keyways, recesses, and the like, to prevent swelling and for easy removal.
- F. Provide temporary openings where interior area of formwork is inaccessible for cleanout, for inspection before concrete placement, and for placement of concrete. Securely brace temporary openings and set tightly to forms to prevent loss of concrete mortar. Locate temporary openings on forms at inconspicuous locations.

- G. Chamfer exposed corners and edges as indicated, using wood, metal, PVC or rubber chamfer strips fabricated to produce uniform smooth lines and tight edge joints.
- H. Provisions for Other Trades: Provide openings in concrete formwork to accommodate work of other trades. Determine size and location of openings, recesses and chases from trades providing such items. Accurately place and securely support items built into forms.
- I. Cleaning and Tightening: Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt or other debris just before concrete is placed. Retightening forms and bracing after concrete placement is required to eliminate mortar leaks and maintain proper alignment.

3.5 VAPOR BARRIER INSTALLATION

- A. Examine the condition of porous fill and remedy any unsatisfactory portions prior to installing vapor barriers.
- B. Sub-base material to be per above sections.
- C. Following leveling and tamping of sub-base for slabs on grade, place vapor barrier sheeting with longest dimension parallel with direction of pour.
- D. Lap joints 6" and seal with appropriate tape.
- E. After placement of moisture barrier, cover with granular material and compact to depth as shown on drawings.
- F. Avoid cutting or puncturing vapor barrier during reinforcement placement and concreting operations.

3.6 PLACING REINFORCEMENT

- A. Comply with Concrete Reinforcing Steel Institute's recommended practice for "Placing Reinforcing Bars", for details and methods of reinforcement placement and supports, and as herein specified.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, and other materials, which reduce or destroy bond with concrete.
- C. Accurately position, support and secure reinforcement against displacement by formwork, construction, or concrete placement operations. Locate and support reinforcing by metal chairs, runners, bolsters, spacers, and hangers, as required.
- D. Place reinforcement to obtain at least minimum coverage's for concrete protection. Arrange, space and securely tie bars and bar supports to hold reinforcement in position during concrete placement operations. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces.
- E. Install welded wire fabric in as long lengths as practicable. Lap adjoining pieces at least one full mesh and lace splices with wire. Offset end laps in adjacent widths to prevent continuous laps in either direction.

3.7 JOINTS

- A. Construction Joints: Locate and install construction joints as indicated, or if not indicated, locate so as not to impair strength and appearance of the structure, as acceptable to Architect.

- B. Provide keyways at least 1-1/2" deep in construction joints in walls, slabs and between walls and footings; accepted bulkheads designed for this purpose may be used for slabs.
- C. Place construction joints perpendicular to main reinforcement. Continue reinforcement across construction joints, except as otherwise indicated.
- D. Waterstops: Provide waterstops in construction joints as indicated. Install waterstops to form continuous diaphragm in each joint. Make provisions to support and protect exposed waterstops during progress of work. Fabricate field joints in waterstops in accordance with manufacturer's printed instructions, using manufacturer's specified welding irons.
- E. Isolation Joints in Slabs-on-Ground: Construct isolation joints in slabs-on-ground at points of contact between slabs-on-ground and vertical surfaces, such as column pedestals and elsewhere as indicated.
 - 1. Joint filler and sealant materials are specified in the section for "Related Materials"
- F. Contraction (Control) Joints in Slabs-on-Ground: Maximum joint spacing shall be 36 times the slab thickness unless otherwise noted on the drawings. The dry cut saw shall be used immediately after final finishing and to a depth of 1-1/4". A conventional saw shall be used as soon as possible without dislodging aggregate and to a depth of 1/4 slab thickness.
 - 1. Joint sealant material is specified in the section for "Related Materials".

3.8 INSTALLATION OF EMBEDDED ITEMS

- A. General: Set and build into work anchorage devices and other embedded items required for other work that is attached to, or supported by, cast-in-place concrete. Use setting drawings, diagrams, instructions and directions provided by suppliers of items to be attached thereto.
- B. Edge Forms and Screed Strips for Slabs: Set edge forms or bulkheads and intermediate screed strips for slabs to obtain required elevations and contours in finished slab surface. Provide and secure units sufficiently strong to support types of screed strips by use of strike-off templates or accepted compacting type screeds.

3.9 PREPARATION OF FORM SURFACES

- A. Clean re-used forms of concrete matrix residue, repair and patch as required to return forms to acceptable surface condition.
- B. If form-release compound is required, coat contact surfaces of forms with a form-coating compound *before* reinforcement is placed.
- C. Thin form-coating compounds only with thinning agent of type, and amount, and under conditions of form-coating compound manufacturer's directions. Do not allow excess form-coating material to accumulate in forms or to come into contact with in-place concrete surfaces against which fresh concrete will be placed. Apply in compliance with manufacturer's instructions.
- D. Coat steel forms with a non-staining, rust-preventative form oil or otherwise protect against rusting. Rust-stained steel formwork is not acceptable.

3.10 CONCRETE PLACEMENT

- A. Ready-mix concrete shall comply with the requirements of ASTM C 94 and ACI 304. All plant and transporting equipment shall comply with the concrete plant standards and truck mixer and agitator standards of the National Ready Mix Concrete Association.
- B. Cold weather mixing procedures shall be submitted to the architect for approval.
- C. Notify Architect and Owner's Inspector at least 36 hours (1 1/2 regular working days) before each pour so that forms and reinforcing may be examined. Do not place concrete until inspection has been made or waived.
- D. Preplacement Inspection: Before placing concrete, inspect and complete formwork installation, reinforcing steel, and items to be embedded or cast-in. Notify other crafts to permit installation of their work; cooperate with other trades in setting such work. Moisten wood forms immediately before placing concrete where form coatings are not used.
 - 1. Apply temporary protective covering to lower 2' of finished walls adjacent to poured floor slabs and similar conditions, and guard against spattering during placement.
- E. General: Comply with ACI 304 "Recommended Practice for Measuring, Mixing, Transporting, and Placing Concrete," and as herein specified.
 - 1. Deposit concrete continuously or in layers of such thickness that no concrete will be placed on concrete which has hardened sufficiently to cause the formation of seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as herein specified. Deposit concrete as nearly as practicable to its final location to avoid segregation.
- F. Placing Concrete in Forms: Deposit concrete in forms in horizontal layers not deeper than 18" and in a manner to avoid inclined construction joints. Where placement consists of several layers, place each layer while preceding layer is still plastic to avoid cold joints. Use internal vibrators penetrating both the top and preceding layers.
- G. Consolidate placed concrete by mechanical vibrating equipment supplemented by hand-spading, rodding or tamping. Use equipment and procedures for consolidation of concrete in accordance with ACI recommended practices.
- H. Use and type of vibrators shall conform to ACI 309 "Recommended Practice for Consolidation of Concrete." Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations not farther than visible effectiveness of machine. Place vibrators to rapidly penetrate placed layer and at least 6" into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to set. At each insertion limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing segregation of mix.
- I. Placing Concrete Slabs: Deposit and consolidate concrete slabs in a continuous operation, within limits of construction joints, until the placing of a panel or section is completed.
- J. Consolidate concrete during placing operations so that concrete is thoroughly worked around reinforcement and other embedded items and into corners.

- K. Slabs: Bring slab surfaces to correct level with straightedge and strikeoff. Use highway straightedge, bull floats or darbies to smooth surface free of humps or hollows. Do not disturb slab surfaces prior to beginning finishing operations. See also "MONOLITHIC SLAB FINISHES" below.
- L. Maintain reinforcing in proper position during concrete placement operations.
- M. Cold Weather Placing: Protect concrete work from physical damage or reduced strength which could be caused by frost, freezing actions, or low temperatures, in compliance with ACI 306 and as herein specified.
 - 1. When air temperature has fallen to or is expected to fall below 40°F (4°C), uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50°F (10°C), and not more than 80°F (27°C) at point of placement.
 - 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. Use only a non-corrosive, non-chloride accelerator. Calcium chloride, thiocyanates or admixtures containing more than 0.05% chloride ions are NOT permitted.
 - 4. Care must be taken to store water-based curing and sealing compounds where they will not freeze. In most cases, they cannot be reconstituted after thawing.
- N. Hot Weather Placing: When hot weather conditions exist that would seriously impair quality and strength of concrete, place concrete in compliance with ACI 305 and as herein specified.
 - 1. Cool ingredients before mixing to maintain concrete temperature at time of placement below 90°F (32°C). Mixing water may be chilled, or chopped ice may be used to control temperature provided water equivalent of ice is calculated to total amount of mixing water. Use of liquid nitrogen to cool concrete is Contractor's option.
 - 2. Cover reinforcing steel with water-soaked burlap if it becomes too hot, so that steel temperature will not exceed the ambient air temperature immediately before embedment in concrete.
 - 3. Fog spray forms, reinforcing steel and subgrade just before concrete is placed.

3.11 FINISH OF FORMED SURFACES

- A. Concrete mixes containing pozzolans or slags do not set at the same rate or with the same bleed water characteristic as plain Portland cement. Therefore attention must be directed to the proper procedures. Refer to ACI 232.2R and ACI 301.
- B. Rough Form Finish: For formed concrete surface not exposed-to-view in the finish work or by other construction, unless otherwise indicated. This is the concrete surface having texture imparted by form facing material used, with tie holes and defective areas repaired and patched and fins and other projections exceeding 1/4" in height rubbed down or chipped off.
- C. Smooth Form Finish: For formed concrete surfaces exposed-to-view, or that are to be covered with a coating material applied directly to concrete, or a covering material applied directly to concrete, such as waterproofing, damp-proofing, painting or other similar system. This is as-cast concrete surface obtained with selected form facing material, arranged orderly and symmetrically with a minimum of seams. Repair and patch defective areas with fins or other projections completely removed and smoothed. Follow all requirements in ACI 301, Chapter 10 for smooth form finish. Surface

preparation for surfaces receiving waterproofing must be approved by the waterproofing manufacturer prior to construction.

3.12 MONOLITHIC SLAB FINISHES

- A. Float Finish: Apply float finish to slabs at crawl spaces, unless otherwise noted.
- B. After screeding, consolidating, and leveling concrete slabs, do not work surface until ready for floating. Begin floating when surface water has disappeared or when concrete has stiffened sufficiently to permit operation of power-driven floats, or both. Consolidate surface with power-driven floats, or by hand-floating if area is small or inaccessible to power units. Cut down high spots and fill low spots. Uniformly slope surfaces to drains. Immediately after leveling, refloat surface to a uniform, smooth, granular texture. Surface shall achieve an FF 20 - FL 17 tolerance.
- C. Trowel Finish: Apply trowel finish to monolithic slab surfaces to be exposed-to-view, and slab surfaces to be covered with resilient flooring, carpet, ceramic or quarry tile, paint, or other thin film finish coating system, unless otherwise noted.
- D. After floating, begin first trowel finish operation using a power-driven trowel. Begin final troweling when surface produces a ringing sound as trowel is moved over surface. Consolidate concrete surface by final hand-troweling operation, free of trowel marks, uniform in texture and appearance and with a surface leveled to an FF 25/ FL 20 tolerance (FL17 for elevated slabs). Grind smooth surface defects, which would telegraph through applied floor covering system.
- E. Trowel and Fine Broom Finish: Where ceramic or quarry tile is to be installed with thin-set mortar, and slab surfaces which are to be covered with membrane or elastic waterproofing, or sand-bed terrazzo, and as otherwise indicated, apply single trowel finish as specified, then immediately follow with slightly scarifying surface by fine brooming. Surface preparation for surfaces receiving waterproofing must be approved by the waterproofing manufacturer prior to construction
- F. Sealers, Hardeners and Liquid Densifiers: Apply a coat of the specified compound to all EXPOSED interior concrete floors where indicated on the drawings. This surface must be continuously moist cured by a method satisfactory to the Architect. Apply and mechanically scrub compound into the floor in strict accordance with the manufacturer's printed instructions.

3.13 CONCRETE CURING AND PROTECTION

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.
 - 1. Start initial curing as soon as free water has disappeared from concrete surface after placing and finishing. Weather permitting, keep continuously moist for not less than 7 days.
 - 2. Begin final curing procedures immediately following initial curing and before concrete has dried. Continue final curing for at least 7 days in accordance with ACI 301 procedures. Avoid rapid drying at end of final curing period.
 - 3. In order to avoid plastic or drying shrinkage cracks during warm, dry or windy weather, ACI 302 and ACI 308 shall be followed using wind breaks and sun shades when recommended. Evaporation retardant shall be as specified in Section 2.04.
 - 4. Care must be taken to store water based curing and sealing compounds where they will not freeze. In most cases, they cannot be reconstituted after thawing.

- B. Curing Methods: Perform curing of concrete by moisture curing, moisture-retaining cover curing, curing and sealing compound, and by combinations thereof, as herein specified.
1. Provide moisture curing by following methods.
 - a. Keep concrete surface continuously wet by covering with water.
 - b. Continuous water-fog spray.
 - c. Covering concrete surface with specified absorptive cover, thoroughly saturating cover with water and keeping continuously wet. Place absorptive cover to provide coverage of concrete surfaces and edges, with 4" lap over adjacent absorptive covers.
 2. Provide moisture-retaining cover curing as follows:
 - a. Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width with sides and ends lapped at least 3" and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
 3. Provide curing and sealing compound to exposed interior slabs not receiving additional flooring. A clear curing and sealing compound shall be used on exterior slabs, sidewalks and curbs not receiving a penetrating sealer.
 4. Use the specified curing compound on surfaces to be covered with finish or coating material applied directly to concrete, such as liquid densifier/sealer, waterproofing, dampproofing, membrane roofing, flooring, painting, and other coatings and finish materials. Apply compound in accordance with manufacturer's direction.
- C. Curing Formed Surfaces: Cure formed concrete surfaces, including undersides of beams, supported slabs and other similar surfaces by moist curing with forms in place for full curing period or until forms are removed. If forms are removed, continue curing by methods specified above, as applicable.
- D. Curing Unformed Surfaces: Cure unformed surfaces, such as slabs, floor topping, and other flat surfaces by application of the specified curing compound or a continuous moist curing method approved by the architect.
- E. Certify that all curing compounds, sealers and hardeners are compatible with all adhesive products intended for attaching co-lateral floor material. In conformance with ASTM F710, coordination with flooring manufacturer is required to insure concrete coatings will not obstruct the bond between the concrete and the adhesive. In addition, insure coatings and adhesives are "benignly compatible" -- in other words, do not combine substances whose constituents are reactive.
- F. Sealer and Dustproofer: Apply a second coat of the specified curing and sealing compound to exposed interior slabs not subjected to vehicular traffic, noted on the drawings. These slabs must have received an initial coat of the curing and sealing compound.

3.14 REMOVAL OF FORMS

- A. Formwork not supporting weight of concrete, such as sides of beams, walls, columns, and similar parts of the work, may be removed after cumulatively curing at not less than 50°F (10°C) for 12 hours after placing concrete, provided concrete is sufficiently hard to not be damaged by form removal operations, and provided curing and protection operations are maintained.
- B. Formwork supporting weight of concrete, such as beam soffits, joints, slabs and other structural elements, may not be removed in less than 14 days and until concrete has attained design minimum compressive strength at 28-days. Determine potential

compressive strength of in- place concrete by testing field-cured specimens representative of concrete location or members.

- C. Form facing material may be removed 4 days after placement, only if shores and other vertical supports have been arranged to permit removal of form facing material without loosening or disturbing shores and supports.

3.15 RE-USE OF FORMS

- A. Clean and repair surfaces of forms to be re-used in work. Split, frayed, delaminated or otherwise damaged form facing material will not be acceptable for exposed surfaces. Apply new form coating compound as specified for new formwork.
- B. When forms are intended for successive concrete placement, thoroughly clean surfaces, remove fins and laitance, and tighten forms to close joints. Align and secure joint to avoid offsets. Do not use "patched" forms for exposed concrete surfaces, except as acceptable to Architect.

3.16 MISCELLANEOUS CONCRETE ITEMS

- A. Filling-In: Fill-in holes and openings left in concrete structures for passage of work by other trades, unless otherwise shown or directed, after work of other trades is in place. Mix, place and cure concrete as herein specified, to blend with in- place construction. Provide other miscellaneous concrete filling shown or required to complete work.
- B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and 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 to template at correct elevations, complying with certified diagrams or templates of manufacturer furnishing machines and equipment.
- D. Grout base plates and foundations as indicated using specified free-flowing non-shrink grout. Use non-metallic grout for exposed conditions, unless otherwise indicated.
- E. Where high fluidity and/or increased placing time is required use the specified high flow grout. This grout shall be used for all base plates larger than 10 square feet.
- F. Reinforced Masonry: Provide concrete grout for reinforced masonry lintels and bond beams where indicated on drawings and as scheduled. Maintain accurate location of reinforcing steel during concrete placement.

3.17 CONCRETE SURFACE REPAIRS

- A. Prior to all repairs, an as-built condition sketch and method of repair must be submitted to the Architect and Engineer of Record for review and approval.
- B. Patching Defective Areas: Repair and patch defective areas with cement mortar immediately after removal of forms, when acceptable to Architect.
- C. Cut out honeycomb, rock pockets, voids over 1/4" in any dimension, and holes left by tie rods and bolts, down to solid concrete but, in no case to a depth of less than 1". Make edges of cuts perpendicular to the concrete surface. Thoroughly clean, dampen with water, and brush-coat the area to be patched with a bonding grout containing the specified bonding admixture. Place patching mortar after while bonding grout is still tacky.

- D. For exposed-to-view surfaces, blend white Portland cement and standard Portland cement so that, when dry, patching mortar will match color surrounding. Provide test areas at inconspicuous location to verify mixture and color match before proceeding with patching. Compact mortar in place and strike-off slightly higher than surrounding surface.
- E. Repair of Formed Surfaces: Remove and replace concrete having defective surfaces if defects cannot be repaired to satisfaction of Architect. Surface defects, as such, include color and texture irregularities, cracks, spalls, air bubbles, honeycomb, rock pockets; fins and other projections on surface; and stains and other discoloration's that cannot be removed by cleaning. Flush out form tie holes, fill with dry pack mortar, or pre-cast cement cone plugs secured in place with bonding agent.
- F. Repair concealed formed surfaces, where possible, that contain defects that affect the durability of concrete. If defects cannot be repaired, remove and replace concrete.
- G. Repair of Unformed Surfaces: Test unformed surfaces, such as monolithic slabs, for smoothness and verify surface plane to tolerances specified for each surface and finish. Correct low and high areas as herein specified. Test unformed surfaces sloped to drain for tureens of slope, in addition to smoothness, using a template having required slope.
- H. Repair finished unformed surfaces that contain defects, which affect durability of concrete. Surface defects, as such, include crazing, cracks in excess of 0.01" wide or which penetrate to reinforcement or completely through non-reinforced sections regardless of width, spalling, pop- outs, honeycomb, rock pockets, and other objectionable conditions.
- I. Correct high areas in unformed surfaces by grinding, after concrete has cured at least 14 days, except at hydrostatic slabs.
- J. Correct low areas in unformed surfaces during or immediately after completion of surface finishing operations by cutting out low areas and replacing with fresh concrete. Finish repaired areas to blend into adjacent concrete. The specified underlayment compound or repair topping may be used when acceptable to Architect.
- K. Repair defective areas, except random cracks and single holes not exceeding 1" diameter, by cutting out and replacing with fresh concrete. Remove defective areas to sound concrete with clean, square cuts and expose reinforcing steel with at least 3/4" clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding compound. Mix patching concrete of same materials to provide concrete of same type or class as original concrete. Place, compact and finish to blend with adjacent finished concrete. Cure in the same manner as adjacent concrete.
- L. Repair isolated random cracks and single holes not over 1" in diameter by dry-pack method. Groove top of cracks and cutout holes to sound concrete and clean of dust, dirt and loose particles. Dampen cleaned concrete surfaces and apply bonding compound. Mix dry-pack, consisting of one part Portland cement to 2-1/2 parts fine aggregate passing a No. 16 mesh sieve, using only enough water as required for handling and placing. Place dry-pack after bonding compound has dried. Compact dry-pack mixture in place and finish to match adjacent concrete. Keep patched area continuously moist for not less than 72 hours.
- M. Structural Repair: All structural repairs shall be made with prior approval of the Engineer of Record as to method and procedure, using the specified polymer repair mortar and/or specified epoxy adhesive. Where epoxy injection procedures must be used, an approved low viscosity epoxy made by the manufacturers previously specified shall be used. In addition, all cracks Record. All garage slabs shall be repaired prior to the slab being treated with the specified penetrating anti-spalling sealer.

- N. Underlayment Application: Leveling of floors for subsequent finishes may be achieved by use of specified underlayment material. Underlayment application shall achieve the tolerances specified in "MONOLITHIC SLAB FINISHES" above.
- O. Specified Polymer Horizontal Repair Mortar: All exposed floors shall be leveled, where required, with the specified self-leveling repair topping.
- P. Repair Methods not specified above may be used, subject to acceptance of Architect.

3.18 FOUNDATION WALLS

- A. The contractor shall form and leave openings in walls as shown on drawings and approved shop drawings for work of other contractors. These openings shall be temporarily closed and when so directed, the contractor shall point up in solid and neat manner with waterproofed cement.

3.19 WORK IN CONNECTION WITH OTHER TRADES AND CONTRACTS

- A. Sleeves, pockets, openings, etc., shall be set in the concrete walls and arches as required for the mechanical trades as shown on approved shop drawings; these shall be encased or built into the concrete work and shall be properly placed and secured in position in the forms before concrete is placed.
- B. Provide all chases, pipe slots, etc., required for the mechanical trades (see mechanical drawings), constructed as shown on the approved shop drawings.
- C. Leave temporary access panels where required to install mechanical equipment as required by trade affected. Panels shall be formed with construction joints as specified. Details for such panels shall be submitted to Architect for approval.
- D. Coordinate all penetrations, cutting, and patching with waterproofing contractor.

3.20 CUTTING AND PATCHING

- A. Contractor for concrete work shall be responsible for all cutting, removing and patching work where concrete surfaces are not installed within the limits shown on the drawings or specified herein. All such work shall meet with the approval of the Architect or Engineer of Record.
- B. Where cutting and patching is required to accommodate the work of other subcontractors, such cutting shall be done at the expense of said subcontractors but shall be performed by the contractor for concrete work. meet with the approval of the Architect or Engineer of Record.

3.21 QUALITY CONTROL TESTING DURING CONSTRUCTION

- A. The Owner will employ a testing laboratory to perform tests and to submit test reports.
- B. Sampling and testing for quality control during placement of concrete may include the following, as directed by Architect.
 - 1. Sampling Fresh Concrete: ASTM C 172, except modified for slump to comply with ASTM C 94.
 - 2. Slump: ASTM C 143; one test at point of discharge for each truck; additional tests when concrete consistency seems to have changed.
 - 3. Air Content: ASTM C 173, volumetric method for lightweight or normal weight concrete; ASTM C 231 pressure method for normal weight concrete; one for

each truck of air- entrained concrete.

4. Concrete Temperature: Test hourly when air temperature is 40°F (4°C) and below, and when 80°F (27°C) and above; and each time a set of compression test specimens made.
5. Compression Test Specimen: ASTM C 31; one set of 5 standard cylinders for each compressive strength test, unless otherwise directed. Mold and store cylinders for laboratory cured test specimens except when field-cure test specimens are required.
6. Compressive Strength Tests: ASTM C 39; one set for each day's pour exceeding 25 cu. yds. plus additional sets for each 50 cu. yds. over and above the first 25 cu. yds. of each concrete class placed in any one day; one specimens tested at 7 days, three specimens tested at 28 days, and one specimens retained in reserve for later testing if required.
 - a. When frequency of testing will provide less than 5 strength tests for a given class of concrete, conduct testing from at least 5 randomly selected batches or from each batch if fewer than 5 are used.
 - b. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, evaluate current operations and provide corrective procedures for protecting and curing the in-place concrete.
 - c. Strength level of concrete will be considered satisfactory if averages of sets of three consecutive strength test results equal or exceed specified compressive strength, and no individual strength test result falls below specified compressive strength by more than 500 psi.
7. Water Cement Ratio Test: Check water content of concrete in accordance with 'Standard Method of Test for Water Content of Freshly Mixed Concrete Using Microwave Oven Drying, AASHTO DESIGNATION: TP 23, SHRP DESIGNATION: 2027' for testing procedure.
8. Test results will be reported in writing to Architect, Engineer of Record, and Contractor within 24 hours after tests. Reports of compressive strength tests shall contain the project identification name and number, date of concrete placement, name of concrete testing service, concrete type and class, location of concrete batch in structure, design compressive strength at 28 days, concrete mix proportions and materials; compressive breaking strength and type of break for both 7-day tests and 28-day tests.
 - a. Non Compliance: All test reports indicating non-compliance shall be faxed immediately to all parties on the test report distribution list and the hard copies submitted on different colored paper.
 - b. Nondestructive Testing: Windsor probes, sonoscope, or other non-destructive device may be permitted but shall not be used as the sole basis for acceptance or rejection.
9. Additional Tests: The testing service will make additional tests of in-place concrete when test results indicate specified concrete strengths and other characteristics have not been attained in the structure, as directed by Architect. Testing service may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42, or by other methods as directed. Contractor shall pay for such tests when unacceptable concrete is verified.

3.22 WASTE MANAGEMENT

- A. Separate and recycle waste materials in accordance with the Section 01 74 19 Construction Waste Management and Disposal and to the maximum extent feasible.
- B. Collect cut off steel and discarded reinforcement steel and place in area for recycling.
- C. Place materials defined as hazardous or toxic waste in designated containers.

- D. Use trigger operated spray nozzles for water hoses and closed loop system to reduce water consumption.
- E. Reusable forms should be cleaned immediately after removal and non-reusable forms recycled to the maximum extent economically feasible.
- F. Incorporate crushed concrete or masonry materials in sub-base to the maximum extent feasible in accordance with sub-base specifications.
- G. Before concrete pours, designate location or uses for excess concrete. Options include:
 - 1. Additional paving
 - 2. Post footing anchorage
 - 3. Landscaping -- site concrete features
 - 4. Flowable fill
- H. To avoid contamination of the local landscape, before concrete pours, designate a location for cleaning out concrete trucks where run-off can be contained, reused or incorporated. Options include:
 - 1. Company owned site for that purpose
 - 2. On-site area to be paved later in project

END OF SECTION

SECTION 04 22 00 – CONCRETE UNIT MASONRY

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Concrete Unit Masonry/Concrete Block

1.2 RELATED SECTIONS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to the work of this Section.
- B. Section 03 30 00 – Cast in Place Concrete
Section 04 22 00 - Concrete Unit Masonry

1.3 REFERENCES

- A. Reference written specification as described on Structural Sheet S.1 – General Notes.

1.4 SUBMITTALS

- A. Submit under provisions of Division 1.

PART 2 – PRODUCTS

- A. Reference written specification as described on Structural Sheet S.1 – General Notes.

PART 3 – EXECUTION

- A. Reference written specification as described on Structural Sheet S.1 – General Notes.

END OF SECTION

SECTION 04 23 00 - GLASS UNIT MASONRY

PART 1 – GENERAL

1.1 SECTION INCLUDES

- A. Glass Block Units, hollow.
- B. Integral Joint Reinforcement
- C. Mortar

1.2 RELATED SECTIONS

- A. Sills, lintels, jambs
- B. Sealant (caulk)
- C. Packing Material

1.3 REFERENCES

- A. ASTM A82—Spec. for Cold Drawn Steel Wire
- B. ASTM A153—Class B-2, Spec. for Zinc Coating (Hot dip) on Iron and Steel Hardware (Canada same)
- C. ASTM A167, Spec. for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet and Strip
- D. ASTM A580, Spec. for Stainless Steel Wire
- E. ASTM C144, Spec. for Aggregate for Masonry (Canada – A179-94)
- F. ASTM C150, Spec. for Portland Cement (Canada – CAN/CSA-A5-93)
- G. ASTM E2010 and NFPA 257, Fire Test of Window Assemblies (equivalent to UL® 9 and CAN 4-S106-M80)
- H. ASTM C207, Spec. for Hydrated Lime for Masonry Purposes (Canada same)
- I. ASTM C270, Spec. for Mortar for Unit Masonry (Canada – A179-94)
- J. ASTM D1187, Type II—Spec. for Asphalt-Base Emulsions (For Metal Surfaces)
- K. K. ASTM D1227, Type III—Spec. for Emulsified Asphalt (For Porous Surfaces)

1.4 SYSTEM DESCRIPTION

- A. Knowledge of the following basic information is essential for proper installation of Pittsburgh Corning Glass Block units:
 - 1. Glass block panels shall not be designed to support structural loads.
 - 2. Maximum deflection of structural members supporting glass block panels shall not exceed L/600.

3. Sills of all panels must be painted with a heavy coat of asphalt emulsion and must cure for two hours before first mortar bed is placed.
4. Provision for expansion, movement and isolation of the glass units from the surrounding frame must be made at jambs and heads of all panels. Mortar must not bridge expansion spaces.
5. Mortar should be mixed and applied in accordance with the recommendations of Pittsburgh Corning Corporation. See Mortar Materials. Because glass block will not absorb water, mortar must be considerably stiffer than mortar for ordinary masonry. The consistency can be described as "mashed potatoes" or "peanut butter" and be clay-like. The joints must be full and struck smooth, not sponged.
6. Design and installation of glass block projects should be done by whole units since cutting glass block is not recommended.

1.5 SUBMITTALS

A. Product Data

1. Submit two (2) copies of manufacturer's literature and two (2) copies of manufacturer's installation instructions.

B. Samples

1. Submit two (2) glass block units of each type specified, showing size, design and pattern of faces.
2. Submit representative samples of (panel reinforcing), (panel anchors), (expansion strips), and (sealant).

C. Test Reports —Fire Tests

Submit documents verifying glass block units are classified for a 1 hour fire exposure according to ASTM E2010, Underwriters Laboratories of Canada CAN 4-S106-M80, UL® 9, or NFPA 257 "Fire Tests of Window Assemblies." All such glass block unit cartons shall carry appropriate UL® labels.

1.6 STORAGE AND PROTECTION

- A. Store unopened cartons of glass block in a clean, cool, dry area.
- B. Protect opened cartons of glass block against windblown rain or water run-off with tarpaulins or plastic covering.

1.7 PROJECT/SITE CONDITIONS

- A. Do not install glass block units when temperature is 40°F (4°C) and falling. Maintain the temperature of glass unit masonry above 40°F (4°C) for the first 48 hours after construction.

1.8 WARRANTY

- A. Pittsburgh Corning Corporation offers a limited 5-year warranty on Pittsburgh Corning Glass Block units.

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. The drawings and specifications are based on catalog data, specifications and products of Pittsburgh Corning Corporation and designate the type and quality of work intended under

this section.

1. Substitutions: The Architect will consider products of comparable manufacturers as a substitution, pending the contractor's submission of adequate documentation of the substitution in accordance with procedures in Division 1 of the Project Manual. Supporting technical data, samples, published specifications and the like must be submitted for comparison.
2. Contractor shall warrant that proposed substitutions, if accepted, will provide performance equivalent to the materials specified herein.
3. These specifications have been developed by Pittsburgh Corning Corporation based on extensive tests of panels composed of Pittsburgh Corning Premiere Series Glass Block masonry units as manufactured by Pittsburgh Corning Corporation. These specifications do not apply to panels made from glass block masonry units produced by any other manufacturer.

2.2 GLASS BLOCK UNITS

- A. Thick faced glass block units, nominally 8 inch x 8 inch x 4 inch thick shall be partially evacuated hollow units made of clear, colorless glass with a polyvinyl butyral edge coating. Pattern type: THICKSET® 60 Vue.

2.3 ACCESSORIES

- A. Panel Reinforcing: two parallel 9 gauge wires either 1⁵/₈ inch or 2 inch on center with electrically butt-welded crosswires spaced at regular intervals, hot dipped galvanized after welding or Type 304 stainless steel, by Pittsburgh Corning Corporation.
- B. Panel Anchors: 20 gauge perforated steel strips 24 inches long by 1³/₄ inches wide, hot dipped galvanized after perforation or 22 gauge by 16 inches long by 1³/₄ inches wide of Type 304 stainless steel, by Pittsburgh Corning Corporation.
- C. Expansion Strips: made of polyethylene foam with a thickness of 3/8 inch, by Pittsburgh Corning Corporation.
- D. Asphalt Emulsion: a water-based asphalt emulsion, by Karnak Chemical Corp. (Karnak 100, 1-800-526-4236), or equal.
- E. Sealant (caulk): non-staining, waterproof mastic type. Below is a list of the toll-free telephone numbers of the Technical Departments of the following sealant manufacturers:
 1. Dow Corning Corporation, 1-800-248-2481 in Midland, MI.
 2. General Electric, 1-800-255-8886, in Waterford, NY
 3. Sonneborn Building Products, 1-800-243-6739 in Minneapolis, MN
 4. Tremco Incorporated, 1-800-321-7906 in Beachwood, OH. Below is information on the fire retardant sealant used on glass block fire tests:
 5. Fyre-Sil Silicone Sealant (for fire-rated construction), by Tremco, Inc. (1-800-321-7906)
- F. Packing (Backer Rods): polyethylene foam, neoprene, fibrous glass or equal as approved by sealant manufacturer.

2.4 MORTAR MATERIALS

- A. Mortar: Limit cementitious materials in mortar to Portland Cement and lime. Type S in accordance with ASTM C270. Mortar shall be 1 part Portland Cement, 1/2 part lime, and

sand equal to 2¼ to 3 times the amount of cementitious material (cement plus lime), all measured by volume. (For exterior glass block panels, an integral type waterproofer should be added to the mortar mix.) No antifreeze compounds or accelerators allowed.

- B. Portland Cement: Type I in accordance with ASTM C150. If a waterproof Portland Cement is used, the integral type waterproofer shall be omitted. (Masonry Cement is not recommended.) Color as selected by Architect.
- C. Lime: Shall be a dolomitic pressure-hydrated lime, special hydrate, Type S, in accordance with ASTM C207.
- D. Sand: A clean, white quartzite or silica type, essentially free of iron compounds, in accordance with ASTM C144, not less than 100% passing a No. 8 sieve.
- E. Integral Type Water-repellent: Stearate type by The Euclid Chemical Company (Integral Waterpeller® Powder, Not Liquid, 1-800-321-7628), or approved equal. Note: Add Integral Waterpeller® powder to dry mortar mix. Do not add powder to wet mortar mix.
- F. External Type Water Proofer: Water based silane sealer type by BASF Corporation (HYDROZO ENVIROSEAL™ 40, 1-800-243-6739). Note: Remove excess sealer from glass surfaces soon after application.

PART 3 – EXECUTION

3.1 PREPARATION

- A. Verify that panel anchors have been provided at head and jambs for the purpose of providing panel anchorage within the opening.
- B. Mix all mortar components to a consistency that is drier than mortar for ordinary masonry. (See Section 1.4, Item 5.) Retempering the mortar after it has taken its initial set shall not be permitted. Do not use antifreeze compounds or accelerators.
- C. *Freshly mixed mortar may create skin irritation. Avoid direct contact where possible and wash exposed skin areas promptly with water. If any mortar gets into the eyes, rinse immediately with water and get prompt medical attention.*

3.2 INSTALLATION

- A. Cover sill area with a heavy coat of asphalt emulsion. Allow emulsion to cure at least 2 hours before placing mortar.
- B. Where panel anchors are used at jambs and heads, install panel anchors in the same joints (16 inches o.c. maximum starting after first course) where panel reinforcing will be laid. Panel anchors are to be embedded a minimum of 12 inches into the mortar joints.
- C. Place or adhere expansion strips to jambs and head. Make certain expansion strip extends to sill and covers leg of panel anchor that is attached to jambs and head.
- D. Set a full mortar bed joint, applied to sill.
- E. Set lower course of block. Maintain a uniform joint width of ¼ to 3/8 inch plus or minus 1/8 inch. All mortar joints must be full and not furrowed. Steel tools must not be used to tap blocks into position. (Place a rubber crutch tip on end of trowel to tap block into position.) Do not realign, tap or otherwise move block after initial placement. For

- F. Install panel reinforcing every 16 inches o.c. maximum (starting after the first course) in the horizontal mortar joints. Run reinforcing continuously from end to end of panels. Lap reinforcing not less than 6 inches whenever it is necessary to use more than one length. Install reinforcing as follows:
 - 1. Place lower half of mortar in bed joint. Do not furrow.
 - 2. Press panel reinforcing into place.
 - 3. Cover panel reinforcing with upper half of mortar bed and trowel smooth. Do not furrow.
- G. Place full mortar bed for joints not requiring panel reinforcing – do not furrow. Maintain uniform joint width.
- H. Set succeeding courses of block. Spaces at head of panel and jambs must remain free of mortar for caulking with sealant.
- I. Use only wooden or rubber tipped tools when tapping glass blocks into place.
- J. Strike joints smooth while mortar is still plastic and before final set. Remove surplus mortar from faces of glass blocks and wipe dry. (See Section 3.3.). Tool joints smooth and concave before mortar takes final set. At this time, remove and clean out all excess mortar from jambs, head and other locations.
- K. After final mortar set (approximately 24 hours), install packing tightly between glass block panel and jamb and head locations. Leave space for sealant.
- L. Apply sealant evenly to the full depth of recesses as indicated on the drawings and in accordance with the manufacturers' published application manual and instructions.
- M. *All exterior glass block panels shall be well sealed to prevent water entry.*

3.3 CLEANING

- A. Remove surplus mortar from the faces of the glass block at the time joints are struck or tooled. Mortar should be removed while it is still plastic using a clean, wet sponge or an ordinary household scrub brush with stiff bristles.
- B. Do not use harsh cleaners, acids (of any strength), abrasives or alkaline materials while cleaning glass block. Never use a wire brush to remove mortar from glass block surfaces.
- C. Final mortar removal is accomplished with a clean, wet sponge or cloth. Rinse sponge or cloth frequently in clean water to remove abrasive particles that could scratch glass surfaces. Allow any remaining film on the block to dry to a powder.
- D. After all sealants, caulking, etc., have been applied, remove excess caulking materials with commercial solvents such as xylene, toluene, mineral spirits or naphtha and follow with normal wash and rinse. Be careful not to damage caulking by overgenerous application of strong solvents. Comply with solvent manufacturers' printed directions on label for toxicity and flammability warnings.
- E. Final cleaning of glass block panels is accomplished after they are completely installed. Wait until panels are not exposed to direct sunlight. Start at the top of the panel and wash with generous amounts of clean water. Dry all water from the glass block surface. Change cloth frequently to eliminate dried mortar particles or aggregate that could scratch the glass surface. To remove the dry powder from the glass surfaces,

use a clean, dry, soft cloth. For stubborn or hard to remove powder or stains, the use of an "extra fine" steel wool (grades 000 or 0000) is suggested. Try this first in an unobtrusive area.

END OF SECTION

SECTION 04 50 00 - MASONRY RESTORATION

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Work of this Section shall be governed by the Contract Documents. Provide materials, labor, equipment and services necessary to furnish, deliver and install all work of this Section and as shown on the drawings, as specified herein and as required by job conditions.

Work of this Section shall include but not be limited to the following:

1. Reconstruct portions of brick masonry wall. See structural drawings.
2. Rake out loose mortar and repoint masonry joints.
3. Replace damaged or missing bricks to provide a finished and restored masonry wall condition on all subject buildings.
4. Protect all doors, windows, eaves and other adjacent surfaces during this work.
5. Remove excess mortar and debris from the face of masonry after pointing and repair work is complete.
8. Complete all work around masonry openings prior to pointing.

1.2 QUALITY ASSURANCE

- A. Subcontractor for this phase of the work shall have 10 successful years of experience with the restoration of brick masonry on historic landmarks and shall have successfully completed 5 similar projects.
- B. Field Examples:
Repointing: Prior to performing any Work of this Section, complete repointing test area a minimum of 4 ft. by 4 ft. Do not proceed further with the Work until the sample has been approved by the Architect. Approved samples will be used as quality standards.
- C. Masonry Cleaning: Test a minimum 4 ft. by 4 ft. area with each cleaning product. Use manufacturer's application instructions. Let the test panel dry 3 to 7 days before inspection. After inspection evaluate (together with the architect) which product best suites the onsite conditions. Keep test panels available for comparison throughout the cleaning project.
- D. Material Container Labels
Material containers shall bear the manufacturer's label indicating manufacturer's name, trade name of product, lot number, shelf life of product, and mix ratio (if applicable).

1.3 DELIVERY, STORAGE, AND HANDLING

- A. Packaged Products
1. Deliver materials to the site in manufacturer's original, sealed containers. Do not deliver materials which have exceeded shelf life limitation set forth by manufacturer.
 2. Comply with manufacturer's printed instructions for storing and protecting materials.
- B. Bulk Aggregate:
1. Store in a manner which will keep aggregate clean and protected from the weather elements.

1.4 PROJECT CONDITIONS

A. Environmental Requirements

1. For factory packaged products, comply with the manufacturer's printed limitations and instructions.
2. Repoint only when wall temperatures are forecast to between 40 and 90 degrees F during work and 24 hours thereafter.
3. Maintain mortar temperature between 40 degrees F. and 90 degrees F. unless otherwise recommended by the material manufacturer. If necessary, heat mixing water and sand to produce the required results.
4. Maintain restored masonry at temperatures above 40 degrees F for not less than 24 hours using auxiliary heat or insulating blankets.
5. Do not lower freezing point of mortar by use of antifreeze, calcium chloride, or other additives. Do not use chemical or bonding agents.
6. Do not use frozen materials or materials coated with ice or frost.

1.5 SUBMITTALS

A. Product Data

1. Packaged Products: Manufacturer's specifications and application instructions for the following:
 - a. Lime mortar mix
2. Masonry cleaners and sealers.

B. Samples: Deliver to the Site for comparison with existing masonry:

1. Mortar for Exposed Joints and Cracks: Each required type, minimum 12" long by full thickness, showing finish and color.

C. Procedures

1. Indicate tools, means, methods, equipment and techniques to be used including removal of lead based paint and paint removal materials.

1.6 REFERENCES

A. American Society for Testing and Materials (ASTM)

PART 2 - PRODUCTS

2.1 MATERIALS

A. Mortar Type:

1. Mortar pre-mixed, including lime mortar and sand, for above grade as follows: LimeWorks.US Ecologic Mix & Go Type F.
2. Mortar pre-mixed, including lime mortar and sand, for below grade as follows: LimeWorks.US Ecologic Mix & Go Type G.

B. Masonry Units: brick masonry shall be new handmade units as manufactured by Redland Brick in Williamsport, MD and salvaged units from the south façade. Distinguish between face brick and non face brick for reuse. Broken brick may be used only in interior wythes. Broken brick may NOT be used as headers.

- C. Water: Potable, clean and free of salts, acids, alkalis or large amounts of organic material, 1.2 gallons per one 67 lb. bag of mix & go.
- D. Masonry Cleaners/Coatings:
1. Enviro Klean® Safety Peel 1 and 3 by ProSoCo, Inc. or approved equal. ProSoCo, Inc. 3741 Greenway Circle, Lawrence, KS 66046. Phone: (800) 255-4255; Fax: (785) 830-9797. E-mail: Customer Care@prosoco.com Enviro Klean® Safety Peel 1 and 3 are solvent pastes with no methylene chloride or methanol. Designed for removal of paint, graffiti and clear coatings, Safety Peel 1 and 3 are "slow-working" paint removers.
 2. Sure Klean Restoration Cleaner by ProSoCo, Inc. or approved equal. Sure Klean® Restoration Cleaner is a concentrated compound formulated as a "carbon solubilizer." Used properly, it cleans brick surfaces. Application to masonry surfaces loosens and dissolves dirt, carbon buildup and other atmospheric pollutants. A simple cold-water rinse then removes these unsightly stains.
 3. Sure Klean® Vana Trol® is a concentrated acidic cleaner for new masonry surfaces that are subject to vanadium, manganese and other metallic stains. Vana Trol® is designed to simplify rinsing and reduces potential for efflorescence.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Protection: Protect adjacent surfaces not being restored. Protect sills, ledges, doors, windows, eaves, projections and all surfaces not designated for cleaning from contact with the Pre-Wash and Cleaning materials. Keep these same surfaces free from material droppings and moisture penetration during cleanings. Install 10 mil polyethelene basin to collect lead based paint and paint stripper.
- B. Surface Preparation:
1. Prepare surfaces to be restored in compliance with product manufacturer's printed instructions and as specified.
 2. Joints need repointing if they conform the following criteria:
 - a. Open joints: the mortar is deeply eroded (more than 1/3" from the face of the masonry) or has fallen out.
 - b. Cracked Joints: cracks (hairline width or larger) have formed in the mortar.
 - c. Separated Joints: the mortar and the masonry do not adhere, resulting in a crack or gap between the two, or the mortar is sitting loosely in the joint.
 3. If joints require repointing, hand rake joints using a small-headed chisel (no wider than half the width of the joint). The joint must be raked to a depth equal to between 2 and 2 1/2 times the width of the vertical joint (usually 1/2 to 3/4 inch deep with brick and 1 to 2 inches with stonework). Remove any loose and deteriorated mortar beyond this minimum depth. Upon completion of proper raking, the masonry must be left with square corners and a flat surface at the back of the cut.
 4. Before filling joints, reset any bricks that are loose.
 5. Clean out the joints by gently flushing with water or compressed air to remove all loose particles and dust.
 6. Remove miscellaneous metal prior to cleaning and repointing.

3.2 CLEANING & PAINT REMOVAL

- A. After removing all miscellaneous metal from the walls and having placed the polyethylene trough at the base of the subject walls, make ready all equipment necessary to recover water and/or remove the waste from the trough.
- B. After completing the cleaning containment preparation, prewet the surface with clean water using low pressure water no greater than 300 psi.
- C. Fast Acting Stripper for tar and paint removal:
 - 1. Preparation – Before applying, follow the ‘Preparation’ section in the Manufacturer’s Product Data Sheet for Enviro Klean ® Safety Peel 1 and 3.
 - 2. Application – Follow application and safety guidelines as defined on the Manufacturer’s Product Data Sheet for Enviro Klean ® Safety Peel 1 and 3.
- D. Upon completing the metal, tar and paint removal work, wash down the masonry and apply restoration cleaner product as per the manufacturer’s recommendations. Before applying, read “Protect” and “Precautionary Measures” sections in the Manufacturer’s Product Data Sheet for Restoration Cleaner. Use Restoration Cleaner in concentrate or dilute with 1-3 parts water. Refer to Product Data Sheet for recommended dilution for intended use. Apply recommended neutralizer to walls once the cleaning has be completed.
 - 1. After protecting all non masonry surfaces, thoroughly prewet the area to be cleaned with fresh water.
 - 2. Apply the cleaning solution liberally using low-pressure spray (50 psi), roller or densely filled (tampico) masonry washing brush.
 - 3. Leave the cleaning solution on the surface for 3-5 minutes. Reapply. Light scrubbing improves cleaning results especially if high-pressure rinsing equipment isn’t available. Keep people away from treated surfaces.
 - 4. Water rinse with low-pressure; flood rinse to remove initial acidic residue with minimum risk of wind drift. Then rinse the treated area thoroughly with high-pressure spray. Rinse from the bottom to the top. Flush each section of the surface with a concentrated stream of water. Keep the wall below wet and rinsed free of cleaner and residues to avoid streaks.
 - 5. Use fan tipped sprayer at least three feet away from masonry. Due to the condition of these buildings, allow the Masonry Restoration cleaner and brushes to do the work of cleaning the brick and mortar. Do not use the water sprayers to ‘pressure clean’ the brick. Sprayers shall be used to ‘rinse’ the masonry surfaces. Test patches may dictate that a lower pressure must be used to prevent unnecessary erosion of mortar joints.
- E. As the Work proceeds and after completion of Work, remove excess mortar, droppings, smears, stains, and other soiling substances resulting from the Work of this Section.
 - 1. Bits of mortar that fall off the trowel or are forced from joint edges by tooling are to be removed with a stiff dry or lightly dampened brush after the mortar has initially set, but before it is hardened. Should hardened mortar need to be removed, a wooden paddle may only be used. Remove misplaced materials from surfaces immediately.
 - 2. Smears on the wall must be cleaned up after a day or two, after the mortar has developed some resistance. This may be done using a stiff, natural bristle brush and water. Acetic acid may also be applied with a small brush and flushed with water. Muriatic acid may not be used.
 - 3. Remove all mortar material from the face of masonry units and adjacent protective coverings from doors, windows and other misc. surfaces.

- F. The Contractor shall be responsible to remove all garbage and debris associated with their work or their subcontractor's work from the site and legally dispose of it.

3.3 REPLACING MASONRY UNITS

- A. Provide temporary shoring or other supports as required to prevent displacement of existing masonry which is to remain. Perform the removal work with such care as may be required to prevent damage to adjoining masonry which is to remain.
- B. Remove the deteriorated and damaged masonry units to their full depth, including the surrounding joint mortar. Leave square corners at adjoining masonry which is to remain. Clean joints and cavities by flushing with water or compressed air.
- C. Dampen contact surfaces slightly before application of mortar, making sure there is no free water. Install matching masonry units with specified mortar. Install units to match and align with existing masonry. Maintain bonding and coursing pattern of existing masonry. Use presoaked wood wedges where necessary to properly set the units and maintain uniform matching joints. Backpack and fill joints full of mortar. Finish joints to match existing adjoining joints.

3.4 REPOINTING JOINTS

- A. Materials Preparations
 - 1. Prepare mortar: Mix dry ingredients first before adding any water. Half the water should then be added, followed by mixing for five minutes. The remaining water should then be added in small portions until the desired consistency is reached. The proper consistency uses the minimum amount of water to allow the mortar to stick to a trowel held upside down. Mortar must be used before it begins to harden, retempering, or adding more water after the initial mix is prepared, may not be done.
- B. Backpack joints tightly out to a depth of 5/8" from the face of masonry with Type O pointing mortar. After backpacking mortar has attained initial set, re-dampen remaining 5/8" depth of joints, fill with Type O pointing mortar, and finish with a tooled joint to match existing.
 - 1. When back-packing mortar, lay in no more than 1/4" to 3/8" in depth per pass, allowing each pass time to set.

3.5 FINAL CLEANING

- A. Upon completing the repointing work, wash down the masonry as per the manufacturer's recommendations. Before applying, read "Protect" and "Precautionary Measures" sections in the Manufacturer's Product Data Sheet for Vana Trol. Dilute Vana Trol concentrate with 1-10 parts water. Refer to Product Data Sheet for recommended dilution for intended use. Apply recommended neutralizer to walls once the final cleaning has been completed.

END OF SECTION

SECTION 04 73 00 – MANUFACTURED STONE MASONRY

PART 1 - GENERAL

1.1 RELATED SECTIONS

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

1.2 SUMMARY

- A. Section includes but is not limited to the following as shown on the drawings and as specified herein:

- 1. Cast stone sill

- B. Related Requirements:

- 1. Division 04 - Masonry

1.3 MATERIALS

- A. Material shall be a highly refined architectural concrete stone product with a fine grain texture manufactured by means of the vibrant dry tamp (VDT) casting method and/or the machine casting method.

- B. Cast stone products shall be manufactured using the following standards:

- 1. ASTM C150 – Standard Specification for Portland Cement
 - 2. ASTM C1116 – Standard Specification for Fiber-Reinforced Concrete and Shotcrete
 - 3. ASTM C1364 – Standard Specification for Architectural Cast Stone
 - 4. Cast Stone Institute Standard Specification (www.caststone.org)

1.4 SUBMITTALS

- A. Submit under provisions of Division 01.
- B. Shop Drawings: Manufacturer's shop drawings shall include profiles, cross sections, reinforcement, exposed faces, arrangement of joints, anchoring methods, anchors, annotation of components, and their locations in project as indicated on the Drawings.
- C. Material sample shall be provided for approval.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A current producer member of Cast Stone Institute with a minimum of 10 years of experience in producing cast stone of types required for project.

PART 2 – PRODUCTS

2.1 MATERIALS

- A. Sill shall be as manufactured by Hanover Architectural Products, website: www.hanover-pavers.com or equivalent.
- B. Material color shall be selected by the Architect from manufacturer's submitted samples.

PART 3 - EXECUTION

3.1 GENERAL

- A. Coordinate the installation of sill material in conjunction with brick masonry repair and restoration in conjunction with 04 21 13 Brick.
- B. Installation shall include silane or siloxane water repellent treatment on all cast stone products in accordance with manufacturer's instructions.

3.2 INSPECTION

- A. Examine all work prepared by others to receive work of this section and report any defects affecting installation to the Contractor for correction. Commencement of work will be construed as complete acceptance of preparatory work by others.

3.3 CUTTING

- A. No material cutting shall be exposed unless finish is consistent with manufacturer's specified exterior finish.
- B. The location and extent of cutting in completed sill placement work shall meet with the approval of the Architect or Engineer of Record.

END OF SECTION

SECTION 05 12 00 - STRUCTURAL STEEL

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 but is not limited to the following as shown on the drawings and as specified herein:

1. Furnish and deliver for installation by others, anchor bolts, bearing plates and loose lintels with complete instructions and templates to facilitate installation.
2. Furnish and erect all struts, columns, bearing plates, beams, bracing, hangers and all related connections (bolted and welded).
3. Openings (unreinforced and reinforced) in structural steel to accommodate mechanical and electrical work.
4. Shop painting and field touch-up painting.
5. Erection bracing and supports, including steel wedges, shims or nuts required for leveling base plates.
6. Lintels and angles attached to structural steel as shown on drawings.
7. Unless specifically excluded, furnish and install all other items for structural steel work indicated on the drawings, specified, or obviously needed to make the work of this Section complete.
8. Waste Management

- B. Related Requirements:

1. Division 01 Section "Construction Waste and Disposal"
2. Division 03 Section "Cast in Place Concrete"
3. Division 04 Section "Unit Masonry"
4. Division 05 Section "Metal Fabrications."
5. Division 06 Section "Rough Carpentry."
6. Division 07 Section "Waterproofing."
7. Division 07 Section "Joint Sealants."
8. Division 31 Section "Dewatering."

- C. Related Work Specified Elsewhere

1. Installation of anchor bolts furnished under this section.
2. Grout under base and bearing plates.
3. Installation of loose lintels furnished under this section.
4. Miscellaneous metal work
5. Stair framing and hangers.
6. Field painting of structural steel, except as specified herein.
7. Fireproofing systems.

1.3 DEFINITIONS

- A. Structural Steel: Elements of structural-steel frame, as classified by AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."
- B. 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. Column base plates thicker than 2 inches .

1.4 PERFORMANCE REQUIREMENTS

- A. Connections: Provide details of all connections required by the drawings to be completed by structural steel fabricator (including comprehensive engineering analysis by a qualified professional engineer) to withstand loads indicated and comply with other information and restrictions indicated, unless noted otherwise.
1. Select and complete connections using schematic details indicated and AISC 360.
 2. Use design method indicated on structural drawings.
 3. Moment Connections: Fully restrained unless otherwise noted on drawings.

1.5 SUBMITTALS

- A. Product Data: Submit data for each type of product indicated in the contract documents.
- B. Shop Drawings: Submit shop drawings in accordance with the specifications as follows:
1. Show clearly all work, including relationship of structural steel to the adjacent work of other trades and to significant lines of finishes of other trades.
 2. Do not fabricate or deliver work to the site before drawings reviewed by the Architect and Engineer of Record have been returned.
 3. Before preparing steel shop drawings, submit proposed submittal schedule for review by Architect and Engineer of Record.
 4. Before preparing steel shop drawings, submit for review a set of job standards showing all necessary joint details with full particulars of connection pieces, shop and field welds, and holes for erection bolts and permanent bolts. These shall include any moment and shear connections. Appropriate marks for designating all types and sizes of joint details shall be included. After approval of these job standards, the erection plans are to be submitted and shall be marked to indicate unmistakably the type and size of joint to be used for every beam connection. Do not order steel in advance of approval of the job standards and the erection plans with joint marks, except at own risk
 5. Submit calculations for design of connections on job standards and all other connections such as moment and brace frames. Calculations shall be signed and sealed by a Professional Engineer licensed in the state in which the project is located.
 6. Prepare remainder of steel shop drawings after approval of job standards and erection plans. Drawings submitted prior to approval of job standards will be returned without review.
 7. Prepare shop drawings in conformance with the applicable procedures shown in "*Detailing for Steel Construction*," latest edition, published by AISC. Prepare shop drawings under the supervision of competent engineering personnel, licensed by the state in which the construction is to take place. During the preparation of shop drawings, and prior to submittal, coordinate and cross check all shop drawings, including those prepared by subcontractors, for compliance with the Contract Documents.
 8. Indicate clearly the size and grade of steel for each component. Identify rolled shapes, tubes and plates by using the standard designations used in "Steel Construction Manual" Latest Edition, by AISC.
 9. Indicate welds and nondestructive tests by using the symbols conforming to AWS A2.4 "Symbols for Welding and Nondestructive Testing." Where necessary for clarity, indicate welding procedure designations or other data in the tail of the

- welding symbol.
10. Show explicitly the type of connection used in each location, the grade, size, and number of bolts; the type, number, position, designation and orientation of each washer; and the size of each hole, whether slotted or round. Ensure that adequate wrench clearance for correct bolt tightening is provided and note special bolt tightening sequences where applicable and necessary.
 11. Show all camber dimensions in the shop drawings. Where specific camber is not shown in the drawings, note on each affected shop drawing that such members are to be fabricated with the natural camber up.
 12. Show holes required for securing work specified in other sections to structural steelwork, as well as all holes required for passage through structural steelwork of work of other trades. Provide field work drawings for all such holes not shown in shop or erection drawings. Addition of, or change in size or location of openings will not be permitted without prior approval.
 13. Use bolted connections wherever possible; avoid field welding unless otherwise noted on drawings.
 14. Make details in such a way as to avoid having steel, connections, bracing, bolts, etc., interfere with architectural details or in any way reduce the areas of shafts, openings, clearances, etc.
 15. Detail and schedule cleaning and painting data and requirements, including specific indication of "no-paint" areas.
 16. The use of the Architect's or Engineer of Record's electronic drawing files as a base for the erection shop drawings will be permitted at the request of the structural steel detailer upon completion and return of the waiver form. The use of the Architect's or Engineer of Record's electronic drawing files as a base for shop drawing details will be not be permitted. The structural steel detailer will be responsible for compatibility of the files with his hardware or software. The electronic files are not to be considered the contract documents, the design team makes no representation regarding the accuracy or completeness of the electronic files given to the structural steel detailer and their use will be at the structural steel detailer's sole risk and without liability to the design team. The structural steel detailer shall remove the project title box and all references to the structural drawings including drawing numbers and structural drawing sections and details. The structural steel detailer shall also remove all reference to work not included in the steel contract.
 17. Show clearly the size and location of each member and the erection mark assigned to each member. Show each field connection with all data and details necessary for assembling the structure. Direct special attention to the possible need for special guying, bracing, or shoring to prevent deformation of existing or new structure due to stresses caused by erection procedures and equipment, by construction loadings, and by forces of natural phenomena.
 18. Prepare, keep up-to-date, and submit a complete drawing index cross-referencing each assigned piece mark with the drawing number in which the piece is detailed. Detail drawings submitted without an up-to-date index and the applicable erection drawing(s) showing the location of each piece will be deemed an incomplete submission and will not be accepted as subject to any agreed shop drawing review schedule.
 19. Prepare anchor bolt and base plate erection drawings containing complete location and placing details, including details of all templates. Provide anchor bolt erection drawings to the concrete trade in advance of applicable concrete work and in coordination with concrete construction sequence.
 20. Submit, in writing, any proposed deviations from the Contract Documents, prior to the submission of shop drawings showing the proposed deviation. Submit requests for deviations on the steelwork subcontractor's letterhead. Deviations not identified, or identified only in letters of transmittal or in shop drawings or both, without the required written request, may not be accepted, and shall be sufficient

cause for the architect to return each shop drawing containing such deviations without further action. Acceptance of shop drawings containing deviations not detected by the architect during shop drawing review shall not relieve the steelwork subcontractor from responsibility to conform strictly to the Contract Documents.

21. Prior to resubmission of shop drawings with additions or corrections, circle or bubble and identify all changes. Drawings submitted without each change being clearly identified are subject to return for resubmission.
 22. Prior to making shop drawings for any portion of the work involving alterations to an existing structure, make all necessary field observations, measurements and surveys of existing conditions. If probes are required to accomplish such measurements, give timely notice where probes will be required.
- C. Submit certified copies of each survey conducted by a surveyor licensed by the state in which the construction is to take place and employed by the structural steel subcontractor. Survey shall show elevations and locations of base plates and anchor bolts to receive structural steel, and final elevations and locations for major members. Indicate discrepancies between actual installation and Contract Documents.
- D. Reports:
1. Submit certified copies of mill test reports for all steel furnished. Perform mechanical and chemical tests for all material regardless of thickness or use.
 2. Submit certification of recycled steel content. Certification shall clearly indicate post-consumer AND post-industrial recycled steel content for the particular member or members used.
 3. Submit mill and fabricator certification of compliance with ISO14001.
 4. Submit anchor bolt checking certification as required.
 5. Submit qualification certificates of all welders who will perform work on the project.
 6. Submit survey of erected steelwork as required.
- E. Submit verification of bio-degradable or low VOC, and low Hazardous Air Pollutants (HAPS) cleaning solutions. Provide a cut sheet for all cleaning solutions used in the surface preparation of steel components. Highlight VOC limits and chemical component limits.

1.6 QUALITY ASSURANCE

- A. Except as modified by this specification, comply with the applicable provisions and recommendations of the following codes and standards:
1. International Existing Building Code, Latest Edition, as modified by the State of West Virginia.
 2. AISC "Specification for the Design, Fabrication and Erection of Structural Steel for Buildings".
 3. AISC "Code of Standard Practice for Steel Buildings and Bridges" latest edition.
 4. AISC "Seismic Provisions for Structural Steel Buildings", latest edition.
 5. Industrial Fasteners Institute "Handbook of Bolt and Bolted Joints" latest edition.
 6. RCSC "Specifications for Structural Joints Using ASTM A 325 or A 490 Bolts."
 7. ASTM A 6 "General requirements for rolled steel plates, shapes, sheet piling and bars for structural use".
 8. AWS D1.1, "Structural Welding Code."
 9. AWS A5.18 & A5.28, Structural Welding Code for GMAW
 10. SSPC "Painting Manual, Volume 2, Systems and Specifications.", Latest edition.
- B. Qualifications for welding work shall be as follows:
1. Qualify welding procedures and welding operators in accordance with the AWS

"Standard Qualification Procedure."

- a. Include amended requirements of the building code as noted above.
2. Submit certification that all welders to be employed in work are AWS qualified. If re-certification of welders is required, retesting will be responsibility of structural steel subcontractor.
 - a. Include licensing requirements as per the building code noted above and local jurisdiction.

1.7 TESTING AND INSPECTION

- A. Special Inspection as required by the applicable Building Code of all structural steelwork in the shop and field will be performed by an inspection agency retained by the Owner at no expense to the Contractor. The inspection agency shall work under the direction of the Owner. Contractor shall provide the inspection agency with the following:
 1. Schedule of all work in both shop and field with at least ten days' written notice before commencement of either activity.
 2. A complete set of approved shop and erection drawings.
 3. Cutting lists, order sheets, material bills, shipping bills and mill test reports.
 4. Information as to time and place of all rollings and shipment of material to shops.
 5. Representative sample pieces as requested by the testing agency.
 6. Full and ample means and assistance for testing all material.
 7. Proper facilities, including scaffolding, temporary work platforms, etc., for inspection of the work in the mills, shop and field.
- B. Each person installing connections shall be assigned an identifying symbol or mark and all shop and field connections shall be so identified so that the inspector can refer back to the person making the connection.
- C. The following minimum criteria shall be adhered to in testing of welds and bolts:
 1. All welds and bolts shall be examined by visual means.
 2. 25% of all welds, selected randomly, shall be measured.
 3. 25% of all bolts, selected randomly, shall be checked with calibrated torque wrench.
 4. In addition, all welds subject to tensile stress shall be examined by the Ultrasonic Method for 100% of their length.
 5. 10% of all manual fillet welds shall be tested by the magnetic particle method.
 6. 1'-0" at each end of automatic fillet welds shall be tested by the magnetic particle method.
 7. 100% of groove welds shall be tested by the ultrasonic method.
- D. Shop inspection will include examination of steel for straightness and alignment, fissures, mill scale, and other defects and deformities, as described in ASTM A6, examination of fabricated pieces for conforming to approved shop drawings, testing of bolts and welds, and inspection of shop painting. All shop welds shall be visually inspected and spot tested using Ultrasonic Method ASTM E 114 and AWS, Chapter 6, Part C. All inspected welds shall be identified by the inspector.
- E. Field inspection will include examination of erected steel for welding, proper fitting and tensioning of bolts, alignment, trueness and plumbness, touching-up of shop coat, level of billets and base plates.
- F. Inspection of welding will be such as to assure that the work is within the quality requirements specified below and elsewhere in this section of the specifications and will include:

1. Ascertainment that the electrodes and flux used for the SAW, GMAW and FCAW welding processes conform to the requirements of this section of the specifications.
 2. Ascertainment that the approved welding procedures and sequence are followed without deviation, unless specific approval for change is obtained from the Engineer of Record.
 3. The testing agency shall be prepared to utilize the following approved methods of testing:
 - a. Liquid penetrant inspection: ASTM E 165.
 - b. Magnetic particle: ASTM A 709.
 - c. Radiographic inspection: ASTM E 94 and E 1032.
 - d. Ultrasonic inspection: ASTM E 114 and AWS, Chapter 6, Section C.
- G. When defects are revealed, additional inspection by whatever method is deemed necessary by the inspector, shall be performed to the extent necessary to assure that the full amount of defect has been located. No further work shall be done on the assembly or sub-assembly in question until all the necessary corrections have been made. Defects shall be repaired, using the same welding procedure that was used initially in making the weld, unless otherwise approved by the Engineer of Record. Inspection of the repaired weld shall be by the same method that was used to reveal the defect. A second repair of a defective area shall not be made without approval of the Engineer of Record.
- H. Apparatus and procedure for measuring torque and tension in high strength bolts and for calibrating wrenches shall be furnished and maintained by steel contractor, and shall be approved by the inspection agency. Wrenches shall be calibrated each day at the beginning of the work, each time the bolt size or length of pressure hose is changed, and at such other times as the inspection agency may direct. Periodic checks of high strength steel bolt connections will be made in the field by the inspection agency. The steel contractor shall maintain at all times during erection a manual torque wrench, and shall provide a laborer and scaffolding as required for the testing of connections by the inspection agency, and shall at his own expense, furnish such facilities and provide such assistance as may be required for proper inspection.
- I. A distinguishing mark will be placed on all work that has been inspected and approved. Material or work that is not acceptable will be designated by words such as "REJECT" or "REPAIR" marked directly on the material or work.
- J. Inspection of Shop Painting:
1. Visually evaluate surface preparation by comparison with pictorial standards in accordance with SSPC-Vis 1.
 2. Measure dry film thickness of each coat with a magnetic film thickness gauge in accordance with SSPC-PA 2.
 3. Visually inspect dried film for runs, sags, dry spray, overspray and missed areas.
 4. Repair defective or damaged areas in accordance with painting requirements specified. Architecturally exposed structural steel shall be free of runs and holidays. Make repairs to shop or field coat as directed.

1.8 DELIVERY, STORAGE AND HANDLING

- A. Deliver materials to site at such intervals to ensure uninterrupted progress of work. Minimize the disturbances to site and soil conditions.
- B. Deliver anchor bolts and anchorage devices, which are to be embedded in cast-in-place concrete, in ample time not to delay work.
- C. Store materials to permit easy access for inspection and identification. Keep steel

members in a safe, dry, off ground location, using pallets, platforms, or other supports. Protect steel members and packaged materials from corrosion and deterioration, discoloration or staining.

- D. Do not store materials on structure in a manner that might cause distortion or damage to members of supporting structures. Repair or replace damaged materials or structures as directed.

1.9 PROJECT CONDITIONS

- A. The structural steel contractor shall coordinate the structural steel work with the work of other Contracts. Verify all dimensions and details of this Contract and those of other Contracts that affect the work before proceeding. Any discrepancies shall be immediately reported to the architect.
- B. Be fully responsible for the accurate installation of the work. Any discrepancy which arises from his failure to execute the work in conformity to the drawings and specifications shall be properly remedied at the contractor's own expense and in a manner acceptable to the architect.
- C. Locate dimensionally on setting plans all anchor bolts, inserts, bearing and base plates, etc., and prepare and deliver all required templates and fully dimensioned setting plans in time for the proper execution of the work. Anchor bolts shall be set by another subcontractor. The structural steel contractor shall check all such settings for correctness after they have been cast in place, and before proceeding with erection work.
- D. Report to the architect and certify compliance with the above checking requirements in writing and indicate any inaccuracies found in the location of anchor bolts or inserts, and corrections which must be made to their installation. Any inaccuracies not included in the report and found during or after steel erection shall be the responsibility of the structural steel contractor and the cost of corrective measures shall be borne by him.
- E. Use base lines, bench marks, or other standards for survey work that have been provided or verified by others. If permanent building bench marks have been established, these will be used for field checking.
- F. Coordinate with all other trades to insure that work of this section does not cause undue conflict. Insure that location of erection devices such as cranes, derricks, booms or hoists, does not cause over-stresses to steel frame to work previously placed by other trades or to existing structures. When required, retain the services of a licensed professional engineer to ascertain that erection devices do not create unsafe conditions or cause overstresses.
- G. Ensure full co-ordination with other related trades and professions.

1.10 SUBSTITUTION

- A. Architect reserves the right to require substitute shapes of other sizes than those indicated on the drawings when it is apparent that the shapes specified cannot be furnished within the time required for the progress of construction. Make said substitutions without additional cost to the owner.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Steel shapes, including structural steel wide flange and structural tee rolled shapes, channels, angles, plates, pipe, and hollow structural sections: As noted on structural drawings.
- B. High Strength Bolts:
 - 1. Slip-critical bolts as noted on structural drawings, with hardened washers
- C. Anchor Bolts: As noted on structural drawings
- D. Filler metal for welding electrodes. As noted on structural drawings.
- E. Structural steel primer paint: rust inhibitive primer conforms to the following criteria
 - 1. Demonstrate a minimum of adhesion as classified by 4B of ASTM D 3359 method A
 - 2. Demonstrate a minimum opacity as determined by ASTM D 2805
 - 3. Demonstrate corrosion resistance per standards ASTM B 117 & ASTM D 5894
 - 4. "Slip Critical" compatible rating where applicable
 - 5. The product shall not contain any of the prohibited compounds as listed in Green Seal *Standard for Paintings and Coatings*, GS-11, latest edition and in Master Painters Institute (MPI) *Green Performance Standard*, GPS-1-08.
 - 6. The product shall meet the VOC limits as set forth in the MPI Green Performance Standard, GPS-1-08, with a maximum allowable VOC of 340 g/L for rust preventative coatings. Limits are expressed in THINNED state. Preference shall be given to products with the least crystalline silica content.
 - 7. The product shall meet all the requirements of MPI Standards: 23, 26, 76, 79, 95, 107, 135, 173, 275. Products not listed with MPI are acceptable if and only if they meet the same environmental criteria for the same product category.
 - a. Exterior exposed steel, normal conditions: Use alkyd or polyamide solvent based paints (MPI #'s 76, 79 & 101)
 - b. Interior exposed steel: Use water based paint (MPI # 107)
 - c. Special Applications, highly corrosive environments: Use zinc rich paints (MPI #'s 20 & 200)
- F. Structural steel field paint for exposed members: rust inhibitive primer conforms to the following criteria
 - 1. Demonstrate a minimum of adhesion as classified by 4B of ASTM D 3359 method A
 - 2. Demonstrate a minimum opacity as determined by ASTM D 2805
 - 3. Demonstrate corrosion resistance per standards ASTM B 117 & ASTM D 5894
 - 4. "Slip Critical" compatible rating where applicable.
 - 5. The product shall not contain any of the prohibited compounds as listed in Green Seal *Standard for Paintings and Coatings*, GS-11, latest edition and in the Master Painters Institute *Green Performance Standard*, GPS-1-08.
 - 6. The product shall meet the VOC limits as set forth in the MPI Green Performance Standard, GPS-1-08, with a maximum allowable VOC of 400 g/L for rust preventative coatings. Limits are expressed in THINNED state. Preference shall be given to products with the least crystalline silica content.
 - 7. The product shall meet all the requirements of MPI Standards: 23, 26, 76, 79, 95, 107, 135, 173, 275. Products not listed with MPI are acceptable if and only if they meet the same environmental criteria for the same product category. Products not listed with MPI are acceptable if and only if they meet the same environmental criteria for the same product category.
 - a. Exterior exposed steel, normal conditions: Use alkyd or polyamide solvent

- based paints (MPI #'s 23, 79)
- b. Interior exposed steel: Use water based paint (MPI # 107)

PART 3 EXECUTION

3.1 FABRICATION

- A. All shop connections shall be high strength bolted unless specifically shown otherwise. Fabricate work in shop in as large assemblies as practicable. Use welded connections ONLY where shown on drawings. If a bolted connection is not possible obtain written approval from the Engineer of Record for the welded connection.
- B. Camber: As indicated on drawings.
- C. Mill column ends and bearing stiffeners to give full bearing over the cross section. Plane contact surfaces of bearing plates when required by the AISC Specifications. It is not necessary to plane bottom surfaces of plates on grout beds.
- D. Drill or punch holes at right angles to the surface of the metal, not more than 1/16" larger than the connector diameter. Do not make or enlarge holes by burning. Drill material having a thickness in excess of the connector diameter and material thicker than 7/8". Holes shall be clean-cut without torn or ragged edges. Remove outside burrs resulting from drilling operations.
- E. Provide holes in members to permit connection of the work of other trades. Use suitable templates for proper location of these holes. Steel requiring adjustment or accurate alignment shall be provided with slotted holes or full bearing shims as shown.
- F. Provide holes, slots and openings required by other trades together with necessary reinforcing required. Use suitable templates for proper location of these openings. All such openings shall be shown on the shop drawings. No change in size or location will be permitted without prior approval.
- G. Manual flame cutting shall be done only with a mechanically guided torch. An unguided torch may be used provided the cut is within 1/8" of the required line.

3.2 SHOP CONNECTIONS

- A. Provide connections as shown on the drawing exactly as detailed. Where connections are not detailed, the minimum connections shall comply with appropriate tables headed, "Framed Beam Connections" shown in the AISC "Manual of Steel Construction" unless otherwise noted on the drawings. Use high strength bolts unless otherwise shown.
- B. Do not use welded connections unless shown on details. Field welding is not allowed without written instruction from the Engineer of Record.
- C. Proportion and detail all connections on shop drawings to resist forces shown on design drawings. If no reactions are indicated on design drawings, design connections for non-composite beams to resist the end reaction shown in the AISC tables for Uniform Load Constants for Beams. Connections for composite beams shall be proportioned to resist 150% of the above mentioned tabulated load.
- D. Bolting
 - 1. Bolts shall be of a length that will extend not less than 1/4" beyond the nuts. Enter bolts into holes without damaging the thread.

2. Use high-strength bolts in friction as shown. Make high-strength bolted joints without the use of erection bolts. Bolt heads and nuts shall rest squarely against the metal. Where structural members have sloping surface, bolted connections shall be provided with beveled washers to afford square seating or framing for bolt heads or nuts. Bring members tightly together with sufficient high-strength "fitting-up" bolts which shall be retightened as all the bolts are finally tightened. Manual torque wrenches will not be accepted for final tightening. Protect bolt heads from damage during placing. Final tightening of high-strength bolts shall be by properly calibrated power torque wrenches. Bolts that have been completely tightened shall be marked for identification.

E. Welding

1. The following environmentally preferable welding processes shall be used as described for the related application without exception:
 - a. Submerged Arc Welding (SAW): Plate girders, fillet and butt joints in pipes, cylinders, columns and beams, and welds where 'downhand' or horizontal positions are possible.
 - b. Gas Metal Arc Welding (GMAW) shall be used where SAW is not applicable (such as for angled connections and anything irregular or short).
 - c. Field welding shall be allowed only in special circumstances; in such cases Flux Core Arc welding (FCAW) shall be specified
2. Do not begin structural welding until joint elements are inspected for surface preparation, fit-up, and cleanliness of surface to be welded and are then bolted or tacked in intimate contact and adjusted to dimensions shown on drawings, or both, with allowance for any weld shrinkage that is expected. No members are to be spliced without prior approval by the Engineer of Record.
 - a. Containment surface preparation debris must meet SSPC-Guide 6 guidelines.
3. Pre-heat and interpass temperature shall be in accordance with Table 4.2 (including footnotes) of the AWS Code for Welding in Building Construction. The temperature shall be measured from the side opposite to that which the pre-heat is applied, where possible.
4. All groove welds shall be continuous and full penetration welds unless otherwise shown on the design drawings. Welds made without the aid of a back-up bar shall have their roots chipped, ground or roughened out to sound metal from the second side, before welding is done from the second side.
5. All welds shall be sound throughout. There shall be no crack in any weld or weld pass. Weld may be considered sound if it contains only slight porosity or fusion defects which are well dispersed.
6. The heat, input, length of weld and sequence of weld shall be controlled to prevent distortions. The surfaces to be welded and the filler metals to be used shall be subject to inspection before any welding is performed.

3.3 SHOP PAINTING AND CLEANING

A. Finishing, coating, plating

1. Shop painting and factory finishing shall be preferred to field painting whenever possible. Where applicable, finishes and surface preparations based on a physical process such as abrasive blasting, grinding, buffing and polishing are preferred to coatings and solvent based cleaning. Where coatings are necessary powder-coated fabrication is preferred to painting and plating. Avoid plated metals especially those using cadmium and chromium as plate material or cyanide or copper/formaldehyde based electroless copper as the plating solution.

- B. Remove all rust, scale, grease and other detrimental foreign matter in accordance with SSPC-SP 3, Power Tool Cleaning, unless conditions/opportunities listed below apply.
 - 1. Use surface preparation classification recommended by paint manufacturer, SSPC or Master Painters Institute (MPI) for paint product used.
 - a. SSPC-Guide 6, Guide for Containing Debris Generated During Paint Removal Operations, must be followed for all applicable surface preparation techniques.
- C. Immediately after surface preparation, apply structural steel primer paint where specified, in accordance with manufacturer's instructions and at a rate to provide dry film thickness of not less than 2.0 mils. Use painting methods which result in full coverage of joints, corners, edges and exposed surfaces. Use type of primer paint as specified in "Materials" article above. Apply two coats to surfaces that will be inaccessible after erection
- D. Paint all structural steel in accordance with the foregoing specification, except as follows:
 - 1. Steel which is to receive spray-on fireproofing.
 - 2. Within 2" of field welds or welds made after paint is applied.
 - 3. Within 3" of high strength friction bolts.
 - 4. Machined surfaces and threaded parts required for adjustment of the structure. Protect these with suitable rust inhibiting coating which may be removed after final installation of the work so that proper finished coatings may be applied.

3.4 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 will be exposed in the finished Work unless they will function as weep holes, by plugging with zinc solder and filing off smooth.

3.5 SOURCE QUALITY CONTROL

- A. Refer to testing and inspection requirements specified above.

3.6 EXAMINATION

- A. Verify field measurements prior to start of erection. Check the alignment and elevation of all column supports and location of all anchor bolts with transit and level instruments before starting erection. Notify architect of any errors. Obtain Architect's approval of methods proposed for correcting errors prior to proceeding with corrections and erection.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.7 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.

3.8 ERECTION

- A. Set structural steel accurately in locations and to elevations indicated and according to AISC 303 and AISC 360.
- B. Maintain erection tolerances of structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges."
- C. Column billets and bearing plates shall be supported and aligned on steel wedges, shims, or leveling nuts. After the supported members have been plumbed and properly positioned by instrument and anchor nuts tightened, the entire bearing area under the plate shall be packed solidly with grout specified in another Section. Wedges and shims shall be set back a minimum of 3/4" from the edges of plates and shall be left in place. Leveling plates are not permitted.
- D. Plumbing, Leveling and Bracing
 - 1. Structural steel shall be erected true and level, and temporary bracing shall be introduced wherever necessary to provide for all loads to which the structure may be subjected, including equipment and the operation thereof. Such bracing shall be left in place as long as may be required for safety. No welding shall be done or bolts drawn up tight until structural steel has been properly aligned. Obtain approval for guy locations to assure lack of interference with operations of other trades.
- E. Drifting
 - 1. Light drifting necessary to draw holes together will be permitted, but drifting of unfair holes will not be permitted. Twist drills shall be used to enlarge holes as necessary to the next larger size; use next larger size bolts as required. Reaming that weakens the members, or make it impossible to fill the holes properly or to adjust accurately after reaming, will not be allowed.

3.9 FIELD CONNECTIONS

- A. In addition to the requirements for shop connections comply with the following:
 - 1. 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.
 - 2. Joint Type: As noted on structural drawings.
- B. Weld Connections: Comply with AWS D1.1/D1.1M[and AWS D1.8/D1.8M] 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. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances in AISC 303 for mill material.

3.10 REPAIRS AND PROTECTION

- A. Galvanized Surfaces: Clean areas where galvanizing is damaged or missing and repair galvanizing to comply with ASTM A 780.
- 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 3, Power Tool Cleaning.
- C. After erection, all damaged areas in shop coat, exposed surfaces of bolt heads, nuts and washers, and all field welds and unpainted areas adjacent to field welds and high strength bolts shall be painted with a "touch-up" application of same paint used in the shop coat and then painted with same paint used for shop coat tinted another color. Retouch in field, any scraped, abraded, and unpainted surfaces. Painting shall be as specified for shop coats.
- D. Structural steel which is to support mechanical equipment and will be left exposed to the weather in the finished project shall be field painted with one coat of anti-corrosive paint as described in Part 2 for Paint Materials.

3.11 WASTE MANAGEMENT

- A. Separate for recycling and place in designated containers the following metal waste in accordance with the Waste Management Plans and local recycler standards: ferrous metals.
- B. Collect all metal cut-offs and scraps and recycle as above.
- C. Fold up metal banding, flatten and place in designated area.
- D. Close and seal tightly all partly used paint and finish containers and store protected in a well-ventilated, fire-safe area at moderate temperature.
- E. Designated un-used paint for:
1. Immediate re-use
 2. Long term maintenance needs
 3. Recycling by an appropriate facility.
 4. Donation
- F. Place empty containers of solvent-based paints in areas designated for hazardous materials.
- G. Do not dispose of paints or solvents by pouring on the ground. Place amounts too small to re-use in designated containers for proper disposal
- H. Place materials defined as hazardous or toxic waste in designated containers.

END OF SECTION

SECTION 05 50 00 – METAL FABRICATIONS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Miscellaneous metal fabrications including:
 - 1. Stairs, ramps, landings, gratings, treadpans, handrails, balusters and stringers
 - 2. Weathervane
 - 3. Miscellaneous Metals including aluminum, galvanized steel, structural steel, bronze, copper, cast bronze

1.2 RELATED SECTIONS

- A. Section 05 12 00 - Structural Steel
- B. Division 06 - Wood, Plastic and Composites
- C. Division 07 - Thermal and Moisture Protection

1.3 REFERENCES

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by basic designation only.
- B. ASTM A108 (2013) Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished.
- C. ASTM A992/A992M-11 Standard Specification for Structural Steel Shapes
- D. AAMA G90/Z275- Galvanized Steel. When noted or specified to be galvanized, hot-rolled steel members shall be hot-dipped, add cold-rolled and bent-up or formed shapes shall be electro-plated galvanized. All galvanizing shall be done after fabrication, in so far as practicable, and shall conform with the requirements of ASTM A123, A123M-08 or A386. Where size of assemble is too large for galvanizing, only these assemblies shall be galvanized prior to fabrication.
- E. Bronze. NAVY G 88-8-0-4 lead and mercury free. Conform to dimensions as shown on drawings.
- F. Copper. Industry Standard: Except as otherwise shown or specified, comply with applicable recommendations and details of the "Copper in Architecture" handbook published by the Copper Development Association (CDA). Conform to dimensions as shown on drawings.
- G. Stainless Steel Spec Type 304
- H. NAAMM AMP 521 (2001) Pipe Railing Manual.
- I. NAAMM AMP 510 - Metal Stairs Manual; 1992, Fifth Edition.
- J. Reference written specification as described on Structural Sheet S.1 – General Notes

1.4 SUBMITTALS

- A. Submit under provisions of Division 01.
- B. Product Data: Manufacturer's data sheets on each product to be used, including:
 - 1. Preparation instructions and recommendations.
 - 2. Storage and handling requirements and recommendations.
 - 3. Installation methods.
- C. Shop Drawings: Show dimensions, layout, profiles and product components; details for all metal fabrications including but not limited to stairs, handrails and guardrails, including details on connection attachments, gates, kickplates, and angles.
 - 1. Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories.
 - 2. Include erection drawings, elevations, and details where applicable.
 - 3. Indicate welded connections using standard AWS A2.0 A2.4 welding symbols. Indicate net weld lengths.
- D. Finish Samples: Submit color samples, for approval by Architect, that represent the allowable range of finish established from production material specified.
- E. Component Samples: If requested by Architect, submit samples of anchors, fasteners, hardware, assembled corner sections and other materials and components.
- F. Operation and Maintenance Data: Include methods for maintaining installed products and precautions against cleaning materials and methods detrimental to finishes and performance.
- G. Executed warranty documents specified.
 - 1. Welding Certificates: Copies of certificates for welding procedures and personnel, per the latest edition of the American Welding Society Structural Welding Code.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufacturer's unopened packaging until ready for installation.
- B. Store materials protected from exposure to harmful weather conditions and at temperature conditions recommended by manufacturer.
 - 1. Store inside, if possible, in a clean, well-drained area free of dust and corrosive fumes.
 - 2. Stack vertically or on edge so that water cannot accumulate on or within materials. Use non-staining wood or plastic shims between components to provide water drainage and air circulation.
 - 3. Cover materials with tarpaulins or plastic hung on frames to provide air circulation.
 - 4. Keep water away from stored assemblies.

1.6 WARRANTY

- A. Manufacturer's Warranty: Submit warranty against defects in materials and workmanship for period of 5 years from the date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with at least five years of documented experience.
- B. Source Limitations: Obtain each type of metal plate wall panel from single source and from single manufacturer.
- C. Requests for substitutions will be considered in accordance with provisions of Division 01.

2.2 DISSIMILAR MATERIALS

- A. Dissimilar metals shall be separated by an insulating material suitable for the dissimilar metals.

2.3 EXTERIOR STAIR FROM SECOND FLOOR

- A. General: Verify actual measurements by field measurement before fabrication; show recorded measurements on shop drawings.
- B. Allow for out-of-square and irregular conditions.
- C. Verify location of all support connections before fabrication; provide appropriate fabrication details to suit existing conditions.
- D. Railings
 - 1. Galvanized finished per AAMA G90/Z275- Galvanized Steel.
 - 2. Finish: Painted
- E. Treads and Grating.
 - 1. Pattern: Rectangular bar grating, 1 inch (25.4 mm) by 3/16 inch (4.8 mm).
 - 2. Treads: Stainless steel
 - 3. Provide nosing on leading edge
 - 4. Finish: Painted

2.4 INTERIOR STAIR FROM BASEMENT TO FIRST FLOOR

- A. General: Verify actual measurements by field measurement before fabrication; show recorded measurements on shop drawings.
- B. Allow for out-of-square and irregular conditions.
- C. Verify location of all support connections before fabrication; provide appropriate fabrication details to suit existing conditions.
- D. Railings
 - 1. Steel metal designed in accordance with NAAMM Metal Stairs Manual.
 - 2. Round Diameter: 2 inches (50 mm).
- E. Treads
 - 1. Patterned Metal: Traditional diamond pattern
 - 2. Treads: Steel metal, 12 gauge, designed in accordance with NAAMM Metal Stairs Manual.
 - 3. Provide nosing on leading edge.

2.5 INTERIOR STAIR AND RAILING FROM FIRST TO SECOND FLOOR AND BALCONY.

- A. General: Verify actual measurements by field measurement before fabrication; show recorded measurements on shop drawings.
- B. Allow for out-of-square and irregular conditions.
- C. Verify location of all support connections before fabrication; provide appropriate fabrication details to suit existing conditions.
- D. ASTM A108 (2013) Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished – Rubbed Oil Finished.
- E. Handrail Bracket Components (Julius Blum & Co., Inc. or comparable with Architects approval):
(All handrail bracket components to be Bronze finish.)

| | |
|---------------------------------------|-----|
| Carlstadt Self-Aligning Wall Brackets | 843 |
| Carlstadt Self-Aligning Post Brackets | 841 |
| Post Bracket Extensions | 862 |
| Glass-Mounted Handrail Adapter Kit | 824 |

2.6 BALCONY HANDRAIL

- A. General: Verify actual measurements by field measurement before fabrication; show recorded measurements on shop drawings.
- B. Verify location of all support connections before fabrication; provide appropriate fabrication details to suit existing conditions.
- C. ASTM A108 (2013) Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished – Rubbed Oil Finished.
- D. Railing Components (Julius Blum & Co., Inc. or comparable with Architects approval):
Bronze Connectorail - 1 1/2" pipe sizes in drawn pipe alloy C23000 (Red Brass) with a smooth mill finish. Bronze fittings are satin finished —180 grit—and lacquered.

2.7 WEATHERVANE

- A. Verify location of all support connections before fabrication; provide appropriate fabrication details to suit existing conditions.
- B. Natural weathering mill finished copper and bronze. No applied finish.
- C. Solder: ASTM B 32; Provide 50-50 tin/lead or lead free alternative of similar or greater strength solder. Killed acid flux.

2.8 FAUX PIE SAFE PANELS

- A. Acceptable Manufacturer:
McNichols Co.
PO Box 30300
Tampa, FL 33630-3300
Tel. (800)237-3820
Web. www.mcnichols.com
Email. Sales@mcnichols.com

- B. Round Hole Perforated:
 - 1. Finish: Plain Steel
 - 2. Hole Diameter: 1/16" RD
 - 3. Centers: 3/32" Stg.
 - 4. Gauge: 20
 - 5. %O/A: 41%

2.9 COMPONENTS

- A. As listed on drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Site Verification of Conditions: Examine work in place to verify that it is satisfactory to receive the work of this Section. Do not begin this work until unsatisfactory conditions have been corrected. Installation constitutes acceptance of responsibility for performance.

3.2 FABRICATION

- A. As listed on drawings.
- B. Solder:
 - 1. Solder metal joints except those indicated or required to be movement type joints in accordance with the "Copper in Architecture" handbook published by the Copper Development Association Inc. (CDA).
 - 2. Tin edges of copper sheets and cleats at soldered joints.
 - 3. After soldering, remove flux. Wipe and wash solder joints clean with fresh water and baking soda to neutralize flux.
- C. Copper Thickness: Comply with CDA recommendations for copper size and shape.
- D. Flux: Muriatic acid neutralized with zinc or approved brand of soldering flux.
- E. Fasteners: Same metal as flashing/sheet metal or other non-corrosive metal as recommended by sheet manufacturer. Match finish of exposed heads with material being fastened.

3.3 INSTALLATION

- A. General: Install products as indicated on the Drawings, and in accordance with Shop Drawings and manufacturer's printed instructions, as applicable except where specified otherwise.
- B. Stairs, Ramps, Landings, Treads and Railings: Shall be installed by the manufacturer or its authorized representative as indicated and in accordance with Shop Drawings and manufacturer's installation instructions. Stairs and railings shall be installed with all accessories furnished by the manufacturer or fabricator as required for complete and finished stair installation.
- C. Installation:
 - 1. Set work level, true to line, plumb.
 - 2. Shim and grout as necessary.

3. Weld field connections and grind smooth.
4. Where practical, conceal fastenings
5. Secure metal to wood with lag screws of adequate size with appropriate washers as approved by architect/engineer.
6. Secure metal to concrete with embedded anchors, setting compounds, caulking and sleeves, or setting grout.
 - a. Use expansion bolts, toggle bolts, or screws for light duty service.
7. Meet structural requirements for erecting items of structural nature.
8. Do not field splice fabricated items unless size requires splicing.
9. Weld splices.
10. Furnish handrails complete with brackets.
11. Provide fabricated items complete with attachment devices as required to install.
12. After galvanized units have been erected and anchored apply galvanizing repair paint in accordance with manufacturer's recommendations.
 - a. Comply NAAMM's - Metal Finishes Manual for Architectural and Metal Products, for recommendations of designating finishes.
 - b. Field Touch-Up Materials: As recommended by coating manufacturer for field application.
13. Abrasive warning tapes:
 - a. Apply where indicated near the end of the construction, after jobsite has been cleaned and nearly ready for occupancy.
 - b. Clean and prepare surfaces to receive tape prior to application.
 - c. Apply tape only when ambient temperature is within manufacturer's recommended limits.
 - d. Where tape is damaged by construction activities, remove, reclean, and reapply.
14. Weathervane Metal Accessories:
 - a. Provide cleats, straps, hangers, anchoring devices, and similar accessory units as required for installation of work, noncorrosive, size and gage required for performance.
 - b. Install level, plumb, and at the height indicated and with surfaces free from distortion or other defects in appearance.

3.4 PROTECTION

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

END OF SECTION

SECTION 05 51 33 - INCLINED METAL LADDERS

PART 1 – GENERAL

1.1 SECTION INCLUDES

- A. Galvanized Steel Finish Ships Ladders.

1.2 RELATED SECTIONS

- A. Section 05 12 00 - Structural Steel: Structure and opening support.
- B. Section 06 10 00 - Rough Carpentry: Framing and opening support.
- C. Section 05 12 00 - Structural Steel: Framing and support.

1.3 SUBMITTALS

- A. Submit under provisions of Division 01.
- B. Manufacturer's data sheets on each product to be used, including:
 - 1. Preparation instructions and recommendations.
 - 2. Storage and handling requirements and recommendations.
 - 3. Installation methods.
- C. Shop Drawings for Ladders:
 - 1. Plan and section of ladder installation.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufacturer's unopened packaging until ready for installation.
- B. Store ladder until installation inside under cover. If stored outside, under a tarp or suitable cover.

1.5 WARRANTY

- A. Limited Warranty: Manufactures standard warranty against defective material and workmanship, covering parts only, no labor or freight. Defective parts, if deemed so by the manufacturer, will be replaced at no charge, freight excluded, upon inspection at manufacturer's plant which warrants same.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturer: FS Industries, which is located at:
 - P. O. Box 72659
 - Providence, RI, 02907
 - Toll Free Tel: 800-421-0314
 - Tel: 401-421-0314
 - Fax: 401-421-5679 Web: www.fsindustries.com

- B. Requests for substitutions will be considered in accordance with provisions of Division 01.

2.2 GALVANIZED FINISH STEEL SHIPS LADDER

- A. Galvanized Finish Steel Ships Ladder and Components: Ladder, mounting brackets and handrails on both sides.
 - 1. Model: Hatch Access with Flush Top Tread, 68 Degree Steep Incline, 24" Wide Treads.
 - 2. Capacity: Unit shall support a 500 lb minimum total load without failure.
 - 3. Ladder Stringer: 10 inch by 8.4# structural channel. Pitch: 68 degrees.
 - 4. Ladder Mounting Brackets:
 - a. Floor Bracket: Integral with Lag Holes.
 - b. Top Bracket: Integral with Lag Holes.
 - 5. Handrails: 1-1/2 inches by 14 gauge square tubing.
 - 6. Treads: 6"x24" Bar Grating Treads.

2.3 FABRICATION

- A. Completely fabricate ladder ready for installation before shipment to the site.
- B. Completely fabricate handrail components ready for field assembly to ladder before shipment to site.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
- B. Examine materials upon arrival at site. Notify the carrier and manufacturer of any damage.

3.2 INSTALLATION

- A. Install in accordance with manufacturer's instructions.

3.3 PROTECTION

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

END OF SECTION

SECTION 06 10 00 - ROUGH CARPENTRY

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Work of this Section shall be governed by the Contract Documents. Provide materials, labor, equipment and services necessary to furnish, deliver and install all work of this Section and as shown on the drawings, as specified herein and as required by job conditions.

Work of this Section shall include but not be limited to the following:

1. Wood nailers, blocking, framing, furring and grounds.
 2. Temporary closures.
 3. Diagonal wall sheathing.
 4. Setting door frames.
 5. Hanging doors.
 6. Installation of rough and finish hardware.
- B. Related Work Specified Elsewhere
1. Section 06 20 00 - Finish Carpentry
 2. Division 07 – Thermal and Moisture Protection
 3. Division 08 – Openings
 4. Section 09 20 00 - Gypsum Board

1.2 QUALITY ASSURANCE

- A. Lumber grading rules and wood species shall be in conformance with PS20.
- B. Grading rules of the following associations shall apply to materials furnished under this Section:
1. Northeastern Lumber Manufacturer Assoc., Inc. (NLMA).
 2. Southern Pine Inspection Bureau (SPIB).
 3. West Coast Lumber Inspection Bureau (WCLIB).
 4. Western Woods Products Assoc. (WWPA).
- C. Plywood Grading Rules
1. Soft wood plywood PS-1.
 2. Hardwood plywood PS-51.
 3. American Plywood Association (APA).
- D. Diagonal Wall Sheathing
1. Replace any damaged diagonal wall sheathing with salvage material if available or similar.
- E. Grade Marks
1. Identify lumber and plywood official grading agency certified by Board of Review, American Lumber Standards Committee, mill number or name, grade or lumber, species graded where applicable, and condition of seasoning at time of manufacturer.

F. Interior Wood Treatment

1. Pressure impregnated rough lumber and plywood with fire protective chemicals to provide a fire hazard classification with a flame spread not over 25 shall be in accordance with UL label "FRS-Exterior" and also AWPA Standard C27 and C20.
2. In addition, air dry rough lumber to a moisture content not to exceed 15%.

G. Reference Standards

1. American Society for Testing & Materials (ASTM).
2. American Wood Preservers Association (AWPA).
3. American Wood Preservers Bureau (AWPB).
4. Federal Specifications (FS).
5. National Forest Products Association (NFPA).
6. Product Standards (PS).
7. Southern Pine Inspection Bureau (SPIB).
8. Western Woods Products Assoc. (WWPA).
9. Underwriters Laboratories (UL).

PART 2 - PRODUCTS

2.1 LUMBER

- A. Lumber: the best of its respective kinds, as best suited for the particular purpose intended, free from shakes, loose knots, or other imperfections which might impair its strength, durability or appearance.
- B. Sizes indicated on the drawings or specified herein are nominal sizes, except where finished dimensions are stated. The Contractor may use lumber of larger sizes than the dress dimensions listed in the American Lumber Standards for the various board measure sizes provided he/she makes all necessary adjustments of contingent work and assumes all responsibility for such adjustments.
1. Specified dimensions are nominal, actual dimensions shall conform to PS20.
- C. Lumber shall be surfaced on all four sides (S4S) unless otherwise specified.
- D. Lumber for rough woodwork on the interior of the building; commercial softwood species:
1. General framing: Doug. Fir Larch or Southern Pine No. 2 or better.
 2. Plates, blocking, nailers: Doug. Fir Larch or Southern Pine No. 2 or better.
- E. Rough lumber, either kiln-dried or air-dried to a moisture content not to exceed 19% as per ASTM D-2016.
- F. Plywood for rough carpentry work shall conform to Product Standard PS1-74.
- G. Plywood for securing telephone equipment shall conform to grade designation C-D Plugged INT-APA.
- H. For blocking and nailers of dimension lumber size, provide Construction or No. 2 grade lumber with 19 percent maximum moisture content of any species.

2.2 ROUGH HARDWARE

- A. Nails: common steel wire, untreated for interior work as per FS FF-N-105.
- B. Bolts: standard mild steel, square head machine bolts with square nuts and malleable iron or steel plate washers or carriage bolts with square nuts and cut washers conforming to the following:
 - 1. Bolts FS-FF-B-575 and 584
 - 2. Nuts FF-N-836D
 - 3. Expansion shields FS-FF-B-561
 - 4. Toggle Bolts FS-FF-B-588
 - 5. Lag screws & bolts FS-FF-B-561
 - 6. Washers FS-FF-W-92
- C. Wood screws as per FS-FF-S-111D.
- D. Concrete and masonry anchors: standard expansion-shield self-drilling type concrete anchors where shown or noted on the drawings, or where reviewed by the Architect.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Study the Contract Drawings and Specification with regard to the work as shown and required under this section so as to insure its completeness.
- B. Examine surfaces and condition to which this work is to be attached or applied, and notify the Architect if conditions or surfaces exist which are detrimental to the proper and expeditious installation of the work. Starting on the work shall imply acceptance of the surfaces and conditions to perform the work as specified.
- C. Verify dimensions taken at the job site affecting the work. Bring field dimensions which are at variance to the attention of the Architect. Obtain decision regarding corrective measures before the start of installation.

3.2 INSTALLATION

- A. General
 - 1. Erect rough carpentry true to line, levels and dimensions required; squared, aligned, plumbed, and securely fastened in place.
 - 2. Shim where required to true up furring, blocking and the like. Use wood or metal shims. Cardboard shims will not be permitted.
 - 3. Do all cutting, fitting, drilling and tapping of other work as required to secure work in place and to perform the work included herein, Do all the cutting and fitting of carpentry work, for the work of other trades as required.
 - 4. Framing Standard: Comply with AF&PA's "Details for Conventional Wood Frame Construction," unless otherwise indicated.
 - 5. Sistering of existing/historic lumber should be done in a manner that retains as much of the original material as possible as part of the sistering, including retaining original material next to sistering material.
- B. Grounds, Blocking and Furring

1. Provide grounds, blocking, nailing strips, furring, curbs, etc., to afford proper support of construction and materials, including the work of other trades and dress to the sizes shown or required and set true at the proper lines and levels to receive the finished work. Block or shim out as required and securely fasten in place.
2. Provide and accurately set rough wood centering for all openings in masonry work where required, and strike when no longer needed.
3. Secure work to wood members using nails or screws spaced 12" o.c. and one inch from ends. Recess all anchoring devices unless otherwise noted.
4. Provide wood grounds for securing finished carpentry work, interior wood finish, cabinet work and other items to be furnished under this or other sections of the specifications. Coordinate this work so as not to delay job progress.
5. Grounds or furring strips shall be 1-1/2" wide by 3/4" thick unless otherwise noted.
6. Secure rough carpentry to steel members with clips, hangers, or straps welded or bolted to the steel and securely nail, screw, or bolt to woodwork, as required by conditions.

C. Rough Hardware

1. Securely fasten rough carpentry together. Nail, spike, lag screw or bolt as required by conditions encountered in the field.
2. Secure rough carpentry to masonry with countersunk bolts in expansion sleeves or other acceptable manner, with fastening not more than 16" apart. Secure woodwork to hollow masonry with toggle bolts spaced not more than 16" apart.
3. Nailing and bolting of wood members shall conform to the requirements of the BOCA Code, latest edition."
4. Inserts to secure wood nailers to concrete: malleable iron threaded type with 3/8" diameter bolts of length to allow for countersinking. Unless otherwise noted, place at end of each nailer and at intervals not exceeding 30" on center. Bolt to wood form.

D. Temporary Protection

1. Provide and afford proper temporary protection to finished work installed by other trades, such as saddles, door frames, stone work, entrances, which may be damaged during the course of the work on this project.
2. Remove temporary protection and enclosures when need of same ceases or when they interfere with the progress of the work.

3.3 INSTALLATION OF HOLLOW METAL

- A. Install work using skilled workmen thoroughly experienced in the installation of hollow metal work.
- B. Install rated doors in conformance with NFPA 80.
- C. Set frames plumb and level at proper locations, aligned and braced securely until permanent anchors are fixed. Anchor bottom of frames to floor with expansion bolts, after adjustments are made. Where required, to properly brace frames, provide additional struts anchored to rough ceiling construction above.
- D. Wire brush areas of doors and frames which become abraded scratched or show signs of rust and touch up with same primer as shop coat.

- E. Dimple in all exposed fasteners and fill with a metallic filler and finish flush with adjoining surfaces and prime ready for painting.
- F. Accurately hang doors on approved hardware, with clearances as follows:
 - 1. Jams 3/32"
 - 2. Head 1/8"
 - 3. Sill 3/16" AFF

3.4 INSTALLATION OF FINISH HARDWARE

- A. Schedule keying conference with Architect and Owner.
- B. Hardware shall be accurately fitted and secured in place, adjusted to operate perfectly and be free from scratches or other defacements.
- C. Perform the installation using skilled workmen who are familiar with this type of work.
- D. Upon completion of the work and before final acceptance by the Owner, the Contractor shall, in the presence of the Owner and/or the Architect shall demonstrate that the hardware is in satisfactory working order that all keys fit in their respective locks, and upon acceptance of the work, shall tag and deliver all keys to the Owner.

END OF SECTION

SECTION 06 20 00 - FINISH CARPENTRY

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Work of this Section shall be governed by the Contract Documents. Provide materials, labor, equipment and services necessary to furnish, deliver and install all work of this Section and as shown on the drawings, as specified herein and as required by job conditions.

Work of this Section shall include but not be limited to the following:

1. Fabrication, restoration and Installation of exterior trim.
2. Fabrication, restoration and installation of interior trim.
3. Providing miscellaneous items of wood trim.
3. Providing jamb extensions and door thresholds.
4. Staircase and ADA ramp trimming.
5. Repair and restoration of T&G wood ceilings.
6. Reception/cashiers desk.
7. Mirror frames in restrooms.
8. Exterior display cabinet

- B. Related Work Specified Elsewhere

1. Section 02 42 93 - Selective Removal and Salvage
2. Section 06 10 00 - Rough Carpentry
3. Section 07 24 00 - Exterior Finish Systems
4. Division 07 – Thermal and Moisture Protection
5. Division 08 – Openings
6. Division 09 – Finishes
7. Section 10 28 00 - Washroom Accessories
8. Section 11 00 00 - Rolling Safety Ladder
9. Section 11 61 43 - Stage Curtains and Equipment
10. Section 12 24 13 - Roller Window Shades

1.2 INTENT

- A. It is the specific intent of this Section to provide for the restoration of architectural woodwork and the construction of new architectural woodwork to a complete, fully intact, structurally sound, and securely anchored condition matching with an “integrated” appearance of original woodwork, except as specifically indicated otherwise, through consolidation, patching using resin patches and dutchmen, and replacement without damaging or deteriorating remaining sound original elements. New work should be done in a manner to provide a consistent character and finish as existing original unless otherwise specified by Architect. All work required to fulfill this intent shall be included as work of this Section.

1.3 QUALITY ASSURANCE

- A. Architectural Woodwork Carpenter/Architectural Woodwork Restoration Specialist: Award architectural woodwork restoration to a firm regularly engaged in restoring architectural woodwork and installing architectural woodwork similar to the work required by this Section that can demonstrate to Owner's satisfaction that, within previous five years, the firm has successfully performed and completed in a timely manner at least

three projects similar in scope and type to work required on this Project involving buildings designated as Landmarks by local governmental authorities, buildings listed in the National Register of Historic Places, or buildings listed in a State Register of Historic Places under the direction of preservation authorities.

1. Foreman: Architectural woodwork restoration work shall be directly supervised by a full-time foreman with experience equal to or greater than that required of Architectural Woodwork Restoration Specialist. Foreman shall read and speak English fluently. Foreman shall be on site daily when work of this Section is being performed for duration of work of this Section. Same foreman shall remain on Project throughout work of this Section unless his performance is deemed unacceptable.
 2. Cabinetmakers: Architectural woodwork carpentry and/or restoration work shall be carried out by skilled cabinetmakers who are thoroughly experienced in the restoration and replication of historic architectural woodwork and who have a minimum of three years' experience restoring architectural woodwork similar to work required by this Section. In acceptance or rejection of work of this Section, no allowance will be made for workers' inattention or lack of skill.
- B. Finish Carpentry by an Architectural Woodwork Institute (AWI) Certified woodworking firm.
- C. Laws, Codes, and Regulations: Work of this Section shall comply with all applicable federal, state, and local laws, codes, and regulations.
- D. Referenced Standards: Work of this Section shall comply with applicable requirements and recommendations of latest editions of the documents listed herein, except as modified by more stringent requirements of the Contract Documents and of applicable laws, codes, and regulations of authorities having jurisdiction. Where the language in any of the documents referred to herein is in the form of a recommendation or suggestion, such recommendations or suggestions shall be deemed to be mandatory under this Contract unless specifically indicated otherwise in Contract Documents. Provide a reference copy of each of the following standards at Project site during all periods when work of this Section is being performed. In each case in which there is a conflict between requirements of referenced standards; requirements of laws, codes, and regulations; and requirements of this Section, the most stringent or restrictive requirement shall govern.
1. U.S. Department of Interior. National Park Service. *The Secretary of the Interior's Standards for the Treatment of Historic Properties*.
 2. Architectural Woodwork Institute (AWI), *Architectural Woodwork Quality Standards*. All architectural woodwork restoration shall comply with requirements for "Premium Grade" work as defined in *Architectural Woodwork Quality Standards*, unless specifically indicated otherwise.
- E. Pre-Restoration Documentation: Document configurations and conditions of architectural woodwork before beginning restoration with clear, sharp, color photographs.
1. Pre-Restoration Photographs: Document each area of architectural woodwork to be restored with photographs showing overall elements and sections of woodwork and with detail photographs showing each area of damage and deterioration to be repaired. Clearly show all existing conditions, including all conditions that might be misconstrued as damage resulting from work of this Section.
 2. Photograph and Identification Requirements

- a. Images: Clear, sharp, high-resolution, color images. Unclear images, out-of-focus images, underexposed images, and overexposed images will not be accepted.
 - b. Format: Color prints, minimum 5-inch x 7-inch.
 - c. Identification and Keying: Label each photograph with project name, date and time photograph was taken, and location. Key overall photographs to drawings and key detail photographs to overall photographs and to drawings so that area depicted in photograph is easily identifiable. Clearly label identification and keying information on each print using an approved archival procedure. Submit key drawings together with photographs.
- F. Sources of Materials: Obtain each type of material to be used for architectural woodwork restoration from a single source to ensure a match in quality, performance, and appearance.
- G. Knowledge of Site and Project Conditions: Before submitting bid, Bidders shall make themselves thoroughly familiar with the Drawings and Specifications, with the scope of this Project, and with all conditions at the Project site relating to requirements of this Section and limitations under which the work will be performed and shall determine or verify dimensions and quantities. Submission of a bid shall be considered conclusive evidence that Contractor is thoroughly familiar with Project requirements and site conditions and limitations.

1.4 SUBMITTALS

- A. General: Submit the following in compliance with the requirements of the Contract Documents. Revise and resubmit each item as required to obtain Architect's approval.
- B. Submit one (1) each of the following to the Architect for review prior to delivery:
- 1. Wood Trim - 12" Lengths of all profiles
- C. Shop Drawings: Dimensioned drawings of all architectural woodwork to be restored including elements to be restored and new elements to replace damaged elements and deteriorated elements as specified in Division 1.
- 1. Elevations and sections at scales that clearly show all work required to restore woodwork. Show all locations to receive consolidation, resin patches, dutchman patches, and member replacement. Indicate finishes.
 - 2. Certify that dimensions on shop drawings have been field measured.
- D. Samples
- 1. Wood: Sets of samples of each type (species, grain pattern, color, etc.) of new wood for repair or replacement. Each set shall contain two 6-inch by 12-inch by 1-inch samples, one without finish and one with finish.
 - 2. Wood Filler and Resin/Consolidants: Each type of wood to be filled, 2-inch-square samples matching color of wood with approved resin/consolidants.
 - 3. Color Putty: Each type of wood to be filled, 1-inch-square samples matching color of wood.
 - 4. Fasteners: Each type to be used in work of this Section.

1.5 MOCK-UPS

- A. General: Before beginning general architectural woodwork restoration work, prepare mock-ups to provide standards for work of this Section. Do not proceed with architectural woodwork restoration work until Architect has approved mock-ups.
1. Locate mock-ups as directed by Architect.
 2. Notify Architect 48 hours prior to start of each mock-up.
 3. Use crew that will execute the work and follow requirements of this Section.
 4. Repeat mock-ups as necessary to obtain Architect's approval.
 5. Protect approved mock-ups to ensure that they are without damage, deterioration, or alteration at time of Substantial Completion.
 6. Approved mock-ups in undamaged condition at time of Substantial Completion may be incorporated into the Work.
 7. Approved mock-ups will represent minimum standards for the architectural woodwork restoration work. Subsequent architectural woodwork restoration work that does not meet standards of approved mock-ups will be rejected.
- B. Prepare the Following Mock-Ups
1. Providing New Wood Elements to Match Original Elements: One element of each type of new element to be provided where more than one element is to be provided.
 2. Providing New Standing and Running Trim: One 3-foot length of each configuration and dimension to be provided.
 3. Providing Dutchman Patches: One dutchman patch in each species of wood to be repaired.
 4. Patching Losses Using Resin Patching Compound: Two patches.
 5. Restoring Wood Sheathing One location, full height x 6 linear feet.
 6. Restoring Interior Woodwork: One location, 16 sq. ft., minimum.
- C. Qualification Data: Submit qualification data for firm and personnel specified in "Quality Assurance" Article that demonstrates that both firm and personnel have capabilities and experience complying with requirements specified. For firm and foreman, provide a list of at least three completed projects similar in size and scope to work required on this Project. For each project list project name, address, architect, conservator, supervising preservation agency, scope of contractor's work, and other relevant information. Submit this information with the bid.
- D. Product Data: Manufacturer's published technical data for each product to be used in work of this Section including material description, chemical composition (ingredients and proportions), physical properties, recommendations for application and use, test reports and certificates verifying that product complies with specified requirements, and Material Safety Data Sheets (MSDS).
- E. Documentation: Pre-restoration configuration and condition of architectural woodwork as specified in "Quality Assurance" Article, above.
- F. Work Description: Prior to beginning architectural woodwork restoration on site or in the shop, submit detailed written description of proposed restoration materials and procedures for each phase of work required for architectural woodwork restoration. Description shall include, but not be limited to:
1. Materials and Procedures: Materials, methods, tools, and equipment for each type of work to be performed in restoring architectural woodwork.
 2. Protection: Description, including drawings and diagrams, of proposed materials and methods of protection for preventing harm, damage, and deterioration caused by work of this Section to all persons (whether involved in the Work or

not), building elements, materials, and finishes, surrounding landscape and site, and the environment (including air and water).

3. Alternate Restoration Materials and Methods (If Any): Alternate materials and methods (if any) to those specified for architectural woodwork restoration may be utilized only if those specified in the Section are deemed to be infeasible based on site conditions, by the Architect and alternative proposed by Contractor are determined to be acceptable by Architect. Provide evidence of successful use on comparable projects and demonstrate effectiveness for use on this Project.

1.6 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Fully protect each fabricated item from the weather while in transit from point of origin or fabrication to the job site. When delivered at the building place immediately under cover and adequately protect from damage, keep clean and store and handle in a manner so as to avoid injury.
- B. Discard and remove from site deteriorated materials, contaminated materials, and products that have exceeded their expiration dates. Replace with fresh materials.

1.7 PROJECT CONDITIONS

- A. Safety: Take all necessary measures to protect all persons, whether or not involved with work of this Section, from harm caused by work of this Section.
- B. Protection of Building: Protect building elements and finishes from damage and from deterioration caused by work of this Section using all means necessary. Repair all damage to materials and all damage to finishes to Architect's satisfaction at no additional cost to Owner.
 1. Take all necessary precautions to prevent fire and spread of fire. Do not use torches, heat guns, or any other heat generating equipment to remove paint or finishes. Place paint or solvent soaked rags, waste, overalls, or other material that might constitute a fire hazard in metal containers and remove from premises daily in coordination with Project's requirements for waste removal.

1.8 ENVIRONMENTAL CONDITIONS

- A. Temperature and Humidity: Comply with requirements of this Section, with requirements of referenced standards, and with recommendations of material manufacturers concerning temperature and humidity requirements for materials installation and application.
- B. Acclimatization of Wood: Store wood in space in which it is to be installed for at least seven days prior to installation.

1.9 LEAD-CONTAINING PAINT (LCP)

- A. General: Perform all work that disturbs lead-containing paint (LCP), handle all material that involves lead-containing paint, and transport and dispose of all lead-containing paint and residue in compliance with all applicable federal, state, and local laws and regulations for identification, removal, labeling, handling, containerization, transportation, and disposal of lead-containing material including, but not limited to, those referenced herein.

- B. U.S. Department of Labor OSHA Regulations: Including but not limited to: Title 29, Code of Federal Regulations (CFR) Section 1926.62: "Lead Exposure in Construction" and Title 29, CFR Section 1910.1200: "Hazard Communication Standard."
- C. U.S. Environmental Protection Agency (USEPA) Regulations: Including but not limited to: Title 40 CFR Part 262: "Standards Applicable to Generators of Hazardous Waste" and Part 263: "Standards Applicable to Transporters of Hazardous Waste."
- D. U.S. Department of Transportation (USDOT) Regulations: Including but not limited to: 49 CFR Parts 172, 173, 174, 175, 177, 178, 179, and 180.

PART 2 - PRODUCTS

2.1 WOOD STANDARDS AND SPECIES

- A. General: All wood for work of this Section shall comply with the following requirements:
 - 1. Quality Standard: Wood shall conform to, or exceed, requirements for wood for use in "Premium Grade" woodwork of each type required as defined by *AWI Architectural Woodwork Quality Standards*.
 - 2. Moisture Content: Provide kiln-dried (KD) lumber with an average moisture content range of 6–11 percent or to comply with requirements of Architectural Woodwork Institute standards for material for "Premium Grade" work in relation to relative humidity conditions during time of fabrication and in installation areas, whichever requirement is more restrictive.
 - 3. Color and Grain Pattern: In each case wood for patching, repair, and replacement shall match color and grain pattern of existing wood or of original wood as applicable to each condition.
 - 4. Absence of Defects: Wood that is to be finished or painted shall be free from defects and blemishes on surfaces exposed to view that will show after top coat of finish or paint is applied. Reject materials that are in any way defective and do not comply with specifications for quality and grade or are otherwise not in proper condition.
- B. Species:
 - 1. Finished Lumber – Finished Lumber - All lumber shall conform to the current published standards of the following associations or agencies, as applicable unless otherwise specified herein:
 - a. ASTM Designation D-245
 - b. Western Pine Association
 - c. Douglas Fir Plywood Association
 - d. U. S. Commercial Standards CS45 or CS122
 - 2. Unless otherwise specified on the drawings, architectural woodwork shall be Clear Douglas Fir or as specified on drawings.
 - 3. Restored wood shall match species of wood to be repaired, selected to match grain pattern and color of existing wood.

2.2. MOISTURE CONTENT

- A. Boards and dimension lumber not over 2 inches in nominal thickness shall be kiln-dried or air-dried, and moisture content shall not exceed 19%. Upon application by the contractor, the Architect may permit the contractor to furnish boards and dimension lumber having moisture content in excess of 19%, subject to the following conditions:
 - 1. That the lumber be suitably piled under cover for air drying on the site.

2. That the lumber be air-dried to a moisture content not in excess of 19% prior to placement in the structure.
- B. Moisture content of lumber over 2 inches in nominal thickness shall conform to the rules of the association under which it is graded and may be incorporated in the structure without further seasoning. Exterior and interior finishing lumber shall be kiln-dried and, at the time of delivery to the building site, the moisture content shall not exceed 12% for material 1 inch or less in thickness and shall not exceed 14% for material over 1 inch in thickness. Millwork, which is assembled or built-up of more than one piece at the mill, except doors, shall have a moisture content not in excess of 12%.

2.3 STORAGE AND PROTECTION

- A. Lumber delivered to the site shall be carefully piled off the ground in such manner as to insure proper drainage, ventilation and protection from the weather as approved by the Architect.

2.4 WORKMANSHIP, FABRICATION AND PREPARATION FOR FINISHES

- A. Only first class material and workmanship will be permissible in the execution of this work. Execute work using craftsmen skilled in this trade so as to provide millwork of high grade quality and finish. There shall be no open joint in the finished work, and except removal members, conceal all fastenings.
- B. Construct finished work in the most careful and thorough manner in accordance with details and submitted shop drawings finish exposed surfaces and edges smooth and free from marks, blemishes, or defacements of any kind caused by workmanship or in the manufacturing of the work.
- C. Shop fabricate finished carpentry items into the largest possible components practical for installation with location of joints subject to the Architect's review.
- D. All surfaces of interior woodwork shall be smooth machine-finished and sandpapered. All stains and fingermarks shall be removed before finishing. Interior woodwork shall not be brought into the building or erected until time determined by the Architect. All interior millwork or finishing carpentry shall be formed of the materials as specified and shall be finished and assembled at the mill, as far as practical, and delivered at the building ready to set in place.

2.5 WOOD REPAIR MATERIALS

- A. Adhesive for Dutchman Repairs and Member Replacement: Epoxy resin glue designed for use with wood. Provide West System products as manufactured by West System, Inc., Bay City, Michigan 48707 (866-937-8797). Provide the following materials: 105 Resin and 206 Slow Hardener.
- B. Wood Consolidation and Patching System for Wood with Painted Finish: System of epoxy resins and fillers designed for consolidating and patching deteriorated wood. Provide West System products as manufactured by West System, Inc., Bay City, Michigan 48707 (866-937-8797). Provide the following materials as appropriate to each condition requiring consolidation and patching: 105 Resin; 205 Fast Hardener; 206 Slow Hardener; 209 Extra Slow Hardener; 403 Filler: Microfibers; 406 Filler: Coloidal Silica; 407 Filler: Microballoons; and 409 Filler: Microspheres.
 1. General: Prepare epoxy resins using accurate measuring containers, calibrated pumps, or other means approved by Architect to ensure proper proportioning of

resins and hardeners. Mix each batch in clean container without traces of cured resins. Mix components thoroughly following manufacturer's instructions. Do not mix more epoxy resin than can be applied before it thickens sufficiently to affect its use.

2. Wood Consolidant: Mix resin and hardener as recommended by manufacturer to provide material of a viscosity that will thoroughly penetrate deteriorated wood.
 3. Wood Filler: Mix resin, hardener, and fillers as recommended by manufacturer and as determined by testing to provide appropriate properties for filling in each case. Composition of filler may vary depending on surface area of patch, depth of patch, whether patch is on vertical or horizontal surface, temperature of wood and surrounding air at time of application, and other conditions affecting action of epoxy resin and fillers. Adjust ingredients and proportions within limits recommended by manufacturer to provide optimum filler for each condition.
- C. Patching Material and Filler for Woodwork with Transparent Finish: Pigmented, two-component epoxy putty specifically formulated and colored for patching wood. Provide Wood Epoxy Putty Sticks as manufactured by Mohawk Finishing Products, RPM Wood Finishes Group, Inc., P.O. Box 22000, Hickory, NC 28603 (800-545-0047), or approved equal, in color to match wood being patched in each case. Mix different colors of putty sticks as required to match wood being patched.
- D. Fillers for Small Holes, Gouges, Splits, and Scratches in Woodwork with Transparent Finish
1. Shellac Sticks: Shellac sticks to match color of surface to be filled as manufactured by Mohawk Finishing Products, RPM Wood Finishes Group, Inc., P.O. Box 22000, Hickory, NC 28603 (800-545-0047), or approved equal.
 2. Retouching Crayons: Beeswax sticks impregnated with powdered dry pigments matching color of surface to be filled, manufactured by Liberon and available from Sepp Leaf Products, Inc., 381 Park Avenue South, New York, NY 10016 (800-971-7377), or approved equal.
 3. Color Putty: Color Fil Putty as manufactured by Mohawk Finishing Products, RPM Wood Finishes Group, Inc., P.O. Box 22000, Hickory, NC 28603 (800-545-0047), or approved equal, in color to match wood being patched in each case. Mix different colors of color putty as required to match wood being patched.

2.6 CLEANING AND SURFACE PREPARATION MATERIALS

- A. Coating Removers: Comply with requirements of Section 090190 – "Paint and Coating Removal."
- B. Detergent: Silicate buffered, non-ionic, rinseless-type synthetic detergent, containing no soaps, free alkali, solvents, abrasives, acids, caustics or other deleterious materials, such as Surfonic JL-80X Surfactant, manufactured by Huntsman International, and available in smaller quantities from Conservation Support Systems, P.O. Box 91746, Santa Barbara, CA 93190 (800-482-6299), or approved equal.
- C. Mineral Spirits: As manufactured by Ashland Chemical, Inc., Carteret, NJ, or approved equal.
- D. Cleaner and Wax Remover: Solution of detergent (Surfonic JL-80X, one percent) in mineral spirits.
- E. Metallic Cleaning Pads: Extra fine bronze wool or stainless steel wool.

F. Non-metallic Cleaning Pads: Scotch-Brite 7447 (Maroon) Abrasive Pads, manufactured by 3M Co.

G. Cloths: Clean, lint-free cotton rags and cheesecloth.

2.7 PAINT AND TRANSPARENT FINISHES

A. Comply with requirements of Section 09 90 00 – Painting and Coating.

2.8 SHOP FABRICATION

A. General: Fabricate new woodwork to match existing forms and profiles. Restore existing millwork to exactly match existing original work in form, dimension, profile, and joinery, unless otherwise indicated.

1. Fabricate millwork to comply with AWI Section 1000, Premium Grade.

PART 3 - EXECUTION

3.1 INSPECTION

A. Study the Contract Drawings and Specification with regard to the work as shown and required under this section so as to insure its completeness.

B. Examine surfaces and condition to which this work is to be attached or applied, and notify the Architect if conditions or surfaces exist which are detrimental to the proper and expeditious installation of the work. Starting on the work shall imply acceptance of the surfaces and conditions to perform the work as specified.

C. Verify dimensions taken at the job site affecting the work. Bring field dimensions which are at variance to the attention of the Architect. Obtain decision regarding corrective measures before the start of installation.

3.2 INSTALLATION

A. General

1. Using skilled workmen install the millwork in a plumb rigid and secure manner using concealed and appropriate anchoring means and methods as per the reviewed shop drawings and encountered conditions.

3.3 REMOVING FINISHES

A. General: Remove finishes from woodwork where finish removal is indicated to comply with requirements of Sections 09 90 00 – Paint and Coating and 08 50 00 – Wood Window and Door Restoration.

3.4 RESTORATION OF ARCHITECTURAL WOODWORK, GENERAL

A. Restore woodwork. Restoration work includes all necessary repair work to return architectural woodwork to a fully intact and structurally sound condition and original appearance as acceptable to Architect.

B. Procedure

1. Remove and label existing hardware and fixtures.

2. Remove elements of architectural woodwork indicated to be replaced following requirements of Section 02 42 93 – Selective Removal and Salvage.
3. Remove finishes as indicated to comply with requirements of Section 09 90 00 – Painting and Coating.
4. Remove extraneous nails, staples, bolts, hooks, and other hardware from woodwork. Fill resulting holes, gouges and indentations with approved filler and sand smooth.
5. Restore damaged woodwork elements (consolidation, filled resin patching, dutchman patching, and shellac stick, retouching crayon, and putty fills).
6. Provide new wood elements to replace missing elements and severely deteriorated elements.
7. Reattach loose components. Provide new fasteners and anchors for secure attachment.
8. Provide new finish to match original finish to comply with requirements of Section 09 90 00 – Painting and Coating.
9. Reinstall removed hardware and fixtures.

3.5 RESTORING EXTERIOR WOOD SHEATHING

- A. General: Repair exterior wood sheathing using epoxy consolidation, dutchman repairs, and/or member replacement as required to ensure that all sound existing material is saved and that, at completion of work, all wood elements have been repaired to be free of rotted and deteriorated wood and are solid and true to original planes and profiles. Remove all protruding fasteners to provide smooth, optimum substrate for installation of metal panels.

3.6 RESTORING WOODWOOD FOR PAINTED FINISH

- A. General: Repair wood elements for painted finish using epoxy consolidation, epoxy consolidation and patching, dutchman repairs, and/or member replacement as indicated and as appropriate to each individual member to ensure that sound existing material is saved and that, at completion of work, all wood elements are free of rotted and deteriorated wood and solid and true to original planes and profiles with all arrises sharp and true.

3.7 RESTORING WOODWOOD FOR TRANSPARENT FINISH

- A. General: Repair wood elements for transparent finish using tinted epoxy patching, dutchman repairs, member replacement, and/or surface defect fills using shellac sticks, retouching crayons, and color putty as indicated and as appropriate to each individual condition to ensure that sound existing material is saved and that, at completion of work, all wood elements are free of rotted and deteriorated wood and solid and true to original profiles with all arrises sharp and true.

3.8 PROTECTION AND CLEANING

- A. Protect each item at all times, by adequate and suitable means, during and after installation and until accepted by the Owner.
- B. Surfaces which become damage, marred, scratched, abraded or are not sound shall be repaired and/or removed and replaced, as determined by the Architect and/or the Owner's representative.
- C. Clean all surfaces of grime, dust and general construction dirt.

- D. Field touch-up shall be the responsibility of the millwork contractor and shall include the filling and touch-up of exposed job made nail or screw holes, refinishing of raw surfaces resulting from job fittings, repair of job inflicted scratches and marks, and final cleaning up of the finished surfaces.

END OF SECTION

SECTION 07 21 00 - FIBER GLASS BUILDING INSULATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Batt and Roll Insulation.

1.2 RELATED SECTIONS

- A. Section 07 24 00 - Exterior Finish Systems.
- B. Section 07 53 23 – Ethylene-Propylene-Diene-Monomer Roofing: Insulation in low-slope roofing applications.
- C. Section 06 10 00 – Rough Carpentry: Framing

1.3 REFERENCES

- A. ASTM C 423 - Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.
- B. ASTM C 518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
- C. ASTM C 553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.
- D. ASTM C 612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation.
- E. ASTM C 665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.
- F. ASTM C 764 - Standard. Specification for Mineral Fiber. Loose-Fill Thermal Insulation.
- G. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
- H. ASTM E 96 - Standard Test Methods for Water Vapor Transmission of Materials.
- I. ASTM E 119 - Standard Test Methods for Fire Tests of Building Construction and Materials.
- J. ASTM E 136 - Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750 Degrees C.
- K. ASTM E 814 - Standard Test Method for Fire Tests of Through-Penetration Fire Stops.
- L. Federal Specification HH-I-521F: Insulation Blankets, Thermal (Mineral Fiber, For Ambient Temperatures).
- M. Federal Specification HH-I-558B: Insulation, Blocks, Blankets, Felts, Sleeving (Pipe and Tube Covering), and Pipe fitting Covering, Thermal (Mineral Fiber, Industrial Type)
- N. National Fire Protection Association (NFPA) Life Safety Code

- O. Underwriters Laboratories (UL) - UL 2079 Standard test method for fire resistance of Building Joint Systems.

1.4 SUBMITTALS

- A. Submit under provisions of Division 01.
- B. Product Data: Manufacturer's data sheets on each product to be used, including:
 - 1. Preparation instructions and recommendations.
 - 2. Storage and handling requirements and recommendations.
 - 3. Installation methods.
- C. Manufacturer's Certificates: Certify products meet or exceed specified requirements.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Manufacturer with a minimum of ten years experience manufacturing products in this section shall provide all products listed.
- B. Installer Qualifications: Products listed in this section shall be installed by a single organization with at least five years experience successfully installing insulation on projects of similar type and scope as specified in this section.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store products in manufacturer's unopened packaging bearing the brand name and manufacturer's identification until ready for installation.
- B. Storage: Store materials in dry locations with adequate ventilation, free from water, and in such a manner to permit easy access for inspection and handling.
- C. Handling: Handle materials to avoid damage.

1.7 SEQUENCING

- A. Coordination with the installation of air seal materials specified elsewhere in the project, in Section 07 26 00 and Section 07 27 00.
- B. Ensure that products of this section are supplied to affected trades in time to prevent interruption of construction progress.

1.8 PROJECT CONDITIONS

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturer: CertainTeed Corp., Insulation Group, which is located at:
750 E. Swedesford Rd.
P. O. Box 860

Valley Forge, PA 19482-0860
Toll Free Tel: 800-233-8990
Fax: 610-341-7940
Email: request info
Web: certainteed.com/CertainTeed/Pro/Design+Professional/Insulation

- B. Requests for substitutions will be considered in accordance with provisions of Division 01 of the Specifications.

2.2 BATT AND ROLL INSULATION

See Finish Schedule and Partition Types on drawings for all Kraft Faced and Unfaced Thermal and Acoustical Fiberglass Batt Insulation.

- A. Thermal Batt Insulation: Certainteed Fiber Glass Building Insulation. Fiber glass building insulation for walls, ceilings, attics and floors. Complies with ASTM C 665; preformed glass fiber batt insulation:
 - 1. UnFaced: ASTM C 665 Type I.
 - a. Fire Hazard Classification: ASTM E 84:
 - 1) Maximum Flame Spread Index; 25.
 - 2) Maximum Smoke Developed Index; 50.
 - b. Noncombustibility: ASTM E 136, passes.
 - 2. Facing: ASTM C 665 Type II, Class C, Category 1, faced on one side with Kraft paper providing a vapor barrier of 1.0 or less.
- B. Acoustical/Thermal Insulation: Certainteed NoiseReducer Batts. Fiber glass acoustical insulation for wood stud framing. Complies with ASTM C 665; preformed glass fiber batt insulation:
 - 1. Facing: ASTM C 665, Type II, Class C, Category 1, kraft faced, no tabs. Acoustical/Thermal Batt Insulation, Certainteed CertaPro AcoustaTherm Batts. Complies with ASTM C 665; preformed glass fiber batt insulation.
 - 2. Unfaced: ASTM C 665, Type I.,
 - a. Fire Hazard Classification: ASTM E 84:
 - 1) Maximum Flame Spread Index; 5.
 - 2) Maximum Smoke Developed Index; 5.
 - b. Noncombustibility: ASTM E 136, passes.

2.3 UNDER FLOOR SHEATHING

- A. ¼" Luan Plywood Sheets on underside of floor structure in all basement and crawl space areas.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared.
- B. Verify that all exterior and interior wall, partition, and floor/ceiling assembly construction has been completed to the point where the insulation may correctly be installed.
- C. Verify that mechanical and electrical services in ceilings, walls and floors have been installed and tested and, if appropriate, verify that adjacent materials are dry and ready to

receive insulation.

- D. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install in exterior spaces without gaps or voids. Do not compress insulation.
- C. Trim insulation neatly to fit spaces. Insulate miscellaneous gaps and voids.
- D. Fit insulation tight in spaces and tight to exterior side of mechanical and electrical services within plane of insulation.
- E. Install insulation with vapor barrier installed facing the warm side. Seal or tape joints as required.
- F. Install ¼" Luan Plywood on underside of floor structure in all basement and crawl space areas to keep insulation in place.

3.4 PROTECTION

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

END OF SECTION

SECTION 07 21 40 - SPRAY FOAM INSULATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Closed Cell Spray Foam Insulation.

1.2 RELATED SECTIONS

- A. Section 07 53 23 – Ethylene-Propylene-Diene-Monomer Roofing: Insulation in low-slope roofing applications.
- B. Section 07 80 00 - Firestopping: Insulation installed in conjunction with firestopping or smoke containment systems.
- C. Section 09 21 00 - Gypsum Board: Insulation installed in conjunction with interior wall and ceiling finish systems.

1.3 REFERENCES

- A. ASTM C 518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
- B. ASTM C 177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus.
- C. ASTM C 1338 - Standard Test Method for Determining Fungi Resistance of Insulation Materials and Facings.
- D. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
- E. ASTM E 96 - Standard Test Methods for Water Vapor Transmission of Materials.
- F. ASTM D 1621 - Standard Test Method for Compressive Properties of Rigid Cellular Plastics.
- G. ASTM D 1622 - Standard Test Method for Apparent Density of Rigid Cellular Plastics.
- H. ASTM D 1623 - Standard Test Method for Tensile and Tensile Adhesion Properties of Rigid Cellular Plastics.
- I. ASTM D 2126 - Standard Test Method for Response of Rigid Cellular Plastics to Thermal and Humid Aging.
- J. ASTM D 2842 - Standard Test Method for Water Absorption of Rigid Cellular Plastics.

1.4 PERFORMANCE REQUIREMENTS

- A. Conform to applicable code for flame and smoke, concealment, and over coat requirements.

1.5 SUBMITTALS

- A. Submit under provisions of Division 01.

- B. Product Data: Manufacturer's data sheets on each product to be used, including:
 - 1. Preparation instructions and recommendations.
 - 2. Storage and handling requirements and recommendations.
 - 3. Installation methods.
- C. Manufacturer's Certificates: Certify products meet or exceed specified requirements.

1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Manufacturer with a minimum of ten years experience manufacturing products in this section shall provide all products listed.
- B. Installer Qualifications: Products listed in this section shall be installed by a single organization with at least five years experience successfully installing insulation on projects of similar type and scope as specified in this section.
- C. Test Area: Provide a test area for evaluation of surface preparation techniques and application workmanship.
 - 1. Finish areas designated by Architect.
 - 2. Do not proceed with remaining work until test application is approved by Architect.
 - 3. Refinish test area as required to produce acceptable work.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store products in manufacturer's unopened packaging bearing the brand name and manufacturer's identification until ready for installation.
- B. Storage: Store materials in dry locations with adequate ventilation, protected from freezing rain, direct sunlight and excess heat and in such a manner to permit easy access for inspection and handling. Store at temperature between 55 and 80 degrees F (12.7 to 26.6 degrees C).
- C. Handling: Handle materials to avoid damage.

1.8 PRE-APPLICATION MEETINGS

- A. Convene minimum two weeks prior to starting work of this section.

1.9 SEQUENCING

- A. Ensure that products of this section are supplied to affected trades in time to prevent interruption of construction progress.

1.10 PROJECT CONDITIONS

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.
- B. Do not apply insulation when substrate temperatures are under 40 degrees F (4.4 degrees C) prior to installation.

- C. Surfaces must be dry prior to application of spray foam. Excess humidity may cause poor adhesion, and result in product failure.
- D. To avoid overspray, product should not be applied when conditions are windy.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturer: CertainTeed Corp., Insulation Group, which is located at:
750 E. Swedesford Rd.
P. O. Box 860
Valley Forge, PA 19482-0860
Toll Free Tel: 800-233-8990
Fax: 610-341-7940
Email: request info
Web: certainteed.com/CertainTeed/Pro/Design+Professional/Insulation
- B. Requests for substitutions will be considered in accordance with provisions of Division 01.

2.2 SPRAY FOAM INSULATION

- A. Insulation: HFC-blown type Closed Cell Foam: CertainTeed CertaSpray Closed Cell Foam is a medium-density, MDI-based polyurethane thermoset rigid foam. When CertaSpray A-side closed cell is mixed with CertaSpray B-side closed cell under pressure in a 1:1 volumetric ratio, they react and expand into a medium-density closed cell foam with an in-place core density of 1.9- 2.2 pcf:
 - 1. Physical and Mechanical Properties:
 - a. Core Density: 1.9-2.4 pcf when tested in accordance with ASTM D 1622.
 - b. Thermal Resistance (aged): 5.8 less than or equal to 2-1/2 inches / 6.4 when greater than 2-1/2 inches when tested in accordance with ASTM C 518 at 75 degrees F, (h-ft²- degrees F)/Btu.
 - c. Thermal Resistance (initial): 6.4 when tested in accordance with ASTM C 518 at 75 degrees F, (h-ft²- degrees F)/Btu.
 - d. Closed Cell Content: 88-95 percent when tested in accordance with ASTM D 2842.
 - e. Compressive Strength: Greater than 25 psi when tested in accordance with ASTM D 1621.
 - f. Tensile Strength: 23 psi when tested in accordance with ASTM D 1623.
 - g. Water Absorption: Less than 2 percent by volume when tested in accordance with ASTM D 2842.
 - h. Dimensional Stability: Less than 9 percent by volume when tested in accordance with ASTM D 2126 at 75 degrees F/95 percent RH, 28 Day.
 - i. Water Vapor Transmission: 1.3 perm/inch when tested in accordance with ASTM E 96.
 - j. Air Permeability: 0.013 when tested in accordance with ASTM E 283 at 1 inch thickness, L/s/m².
 - k. Fungi Resistance: Pass, with no growth when tested in accordance with ASTM C 1338.
 - 2. Fire performance
 - a. Flame Spread: Less than 25 when tested in accordance with ASTM E 84.
 - b. Smoke: Less than 450 when tested in accordance with ASTM E 84.

3. Thermal Performance (aged): Tested in accordance with ASTM C 518 and/or ASTM C 177 at 75 degrees F mean temperature.
 - a. Thickness 2 inches, R-Value 11.6 (h-ft²-degreesF)/Btu.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared.
- B. Verify that all exterior and interior wall, partition, and floor/ceiling assembly construction has been completed to the point where the insulation may correctly be installed.
- C. Verify that substrate and cavities are dry and free of any foreign material that will impede application.
- D. Verify that mechanical and electrical services in ceilings, walls and floors have been installed and tested and, if appropriate, verify that adjacent materials are dry and ready to receive insulation.
- E. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- C. Mask and protect adjacent surfaces from overspray or dusting.

3.3 INSTALLATION

- A. Install in accordance with manufacturer's instructions. Product must be installed according to local code, and must be applied by a qualified applicator.
- B. Apply insulation by spray method, to uniform monolithic density without voids.
- C. Apply to minimum cured thickness as indicated on the Drawings or as scheduled at the end of this Section.
- D. Seal plumbing stacks, electrical wiring and other penetrations into attic to control air leakage.
- E. Apply insulation to fill voids around accessible service and equipment penetrations.
- F. Do not install spray foam insulation in areas where it will be in contact with equipment or materials with operating temperatures of 180 degrees F (82 degrees C) or greater.
- G. Apply insulation in unvented roof spaces and cathedral ceiling areas.
- H. Patch damaged areas.

3.4 FIELD QUALITY CONTROL

- A. Inspection will include verification of insulation and density.

3.5 PROTECTION

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

3.6 SCHEDULES

- A. For the following locations, apply the average cured thickness indicated.
 - 1. Unvented roof spaces: 2 inches.

END OF SECTION

SECTION 07 24 00 – EXTERIOR FINISH SYSTEM

PART 1 – GENERAL

1.1 SECTION INCLUDES

- A. Composite wall system consisting of code approved secondary air/weather barrier, Base Coat, Reinforcing Mesh and Finish Coat.
- B. Schedule of Finish Coat.
- C. Products are listed in this specification to establish a standard of quality. Requests for substitutions will be considered in accordance with provisions of Division 01.

1.2 RELATED SECTIONS

- A. Section 07 62 00 – Flashing and Sheet Metal: Perimeter Flashings
- B. Section 07 92 00 - Joint Sealants
- C. Division 08 - Openings

1.3 REFERENCES

- A. ASTM C150 Specification for Portland cement.
- B. ASTM D1682 Test for Break Load and Elongation of Textile Fabrics.
- C. UL 723, ASTM E84 Tests for Surface Burning Characteristics of Building Materials.
- D. ASTM G23 Operating Light and Water Exposure Apparatus (Carbon-Arc Type) for Exposure of Non-metallic Materials.
- E. ASTM G53 Operating Light and Water Exposure Apparatus (Fluorescent UV-Condensation Type) for Exposure of Nonmetallic Materials.
- F. ASTM C67 Sampling and Testing Brick and Structural Clay Tile.
- G. ASTM B117 Standard Method of Salt Spray (Fog) Testing.
- H. ASTM D968 Abrasion Resistance of Organic Coatings by Falling Abrasive.
- I. FS TT-C-555B Coating Textured for Interior and Exterior Masonry Surfaces.
- J. MIL-Y-114OG Yarn, Cord, Sleeving, Cloth and Tape-Glass.
- K. Mil. Std. 810B Mildew Resistance (Method 508)
- L. ASTM E96 Water Vapor Transmission (Method B)

1.4 DEFINITIONS

- A. Exterior assembly comprised of code approved secondary air/weather barrier, Base Coat, Reinforcing Mesh, and Finish Coat.

1.5 SYSTEM DESCRIPTION

- A. Performance Requirements: System shall meet or exceed the following performance standards when tested in accordance with the following methods:
- B. Accelerated Weathering: ASTM G23-81 (testing period of 2000 hours) or ASTM G53-81 (testing period of 3000 hours); No cracking, flaking, or adverse effects.
- C. Wind-driven Rain: Federal Specification TT-C-555B; No visible leaks or dampness throughout to the rear face and less than 90 gram increase.
- D. Salt Spray Resistance: ASTM B117 Salt Spray (Fog) Testing; testing period of 300 hours; No adverse effects.
- E. Mildew Resistance: MIL Standard 810B, Method 508; no mildew growth supported after 28 days.
- F. Abrasion Resistance: ASTM D968-81, Method A; no cracking, checking, or loss of film integrity after 500 liters of sand.
- G. Surface Burning Characteristics: UL 723, ASTME84; test specimen consists of Base Coat, Reinforcing Mesh and Finish Coat; flame spread less than 25 and smoke developed less than 450.

1.6 SUBMITTALS

- A. Submit under provisions of Division 01.
- B. Product Data: Provide data on materials, product characteristics, performance criteria, limitations and durability.
- C. Shop Drawings: Indicate wall joint pattern and joint details, thickness, and installation details.
- D. Samples: Submit two 12 inch size samples of Exterior Finish System illustrating Finish Coat custom color and texture range.
- E. Certificate: System manufacturer's approval of applicator.
- F. System manufacturer's installation instructions: Indicate preparation required, installation techniques, jointing requirements and finishing techniques.

1.7 QUALITY ASSURANCE

- A. Manufacturer: More than 10 years in the EIFS industry, with more than 1000 completed EIFS projects.
- B. Applicator: Approved by Manufacturer of Exterior Finish Systems in performing work of this section.
- C. Regulatory Requirements: Conform to applicable code requirements for finish system.
- D. Design and Detailing the Exterior Finish System:
 - 1. General

- a. The system shall be installed in strict accordance with current recommended published details and product specifications from the system's manufacturer.
 - b. Sealants and backer rod as required at dissimilar materials and expansion joints within the Exterior Finish System shall provide a complete watertight system.
2. Substrate Systems
- a. Deflection of the substrate systems shall not exceed L/360.
 - b. Acceptable Substrates: Applications on cement-board, ASTM C1325 Type A Exterior, minimum 1/2" substrates, over the following sheathings that are first applied over the framing and which may be required to satisfy structural requirements and/or fire resistive construction requirements: e²XP™ sheathing (ASTM C1177), GlasRoc® sheathing (ASTM C1177), Securock™ glass-mat sheathing (ASTM C1177), DensGlass® exterior sheathing (ASTM C1177).
 - c. Other substrates shall be approved by the system's manufacturer in writing prior to the application.
 - d. The applicator shall verify that the proposed substrate is acceptable prior to the Exterior Finish System installation.
 - e. The substrate systems shall be engineered with regard to structural performance by others.
3. System Joints
- a. Expansion joints in the system are required at building expansion joints, at prefabricated panel joints, floor lines of wood frame construction, where substrates change and where structural movement is anticipated. It is the sole responsibility of the project design team, including the architect, engineer, etc., to ultimately determine specific expansion joint placement, width and design.
 - b. Reference construction documents for specific locations.
4. Coordination with Other Trades Architect shall evaluate adjacent materials such as windows, doors, etc. for conformance to manufacturer's details. Adjacent trades shall provide scaled shop drawings for review.

1.8 DELIVERY, STORAGE AND HANDLING

- A. Deliver, store and handle products under provisions of Division 01.
- B. Deliver Exterior Finish System materials in original unopened packages with manufacturer's labels intact.
- C. Protect Cement-Board materials during transportation and installation to avoid physical damage.
- D. Store Exterior Finish System materials in cool, dry place protected from freezing. Store at no less than 4°C/40°F. Protect from extreme heat and direct sunlight.
- E. Store Exterior Finish System Reinforcing Mesh and Sheathing Fabric in cool, dry place protected from exposure to moisture.

1.9 PROJECT/SITE CONDITIONS

- A. Do not apply Exterior Finish System in ambient temperatures below 4°C/40°F. Provide supplementary heat during installation and drying period when temperatures less than 4°C/40°F prevail.
- B. Do not apply Exterior Finish System materials to frozen surfaces.

- C. Maintain ambient temperature at or above 4°C/40°F during and at least 24 hours after Exterior Finish System installation and until dry.

1.10 SEQUENCING AND SCHEDULING

- A. Coordinate and schedule installation of Exterior Finish System with related work of other sections.
- B. Coordinate and schedule installation of trim, flashing, and joint sealers to prevent water infiltration behind the System.
- C. Coordinate and schedule installation of air/weather barrier, windows, doors, A/C units etc.

1.11 WARRANTY

- A. Provide manufacturer's for Exterior Finish System installations standard ten-year coating material warranty under provisions of Division 01.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. The drawings and specifications are based on catalog data, specifications and products of Senergy Cement-Board Stucco 1000 System manufactured by BASF Corporation-Wall Systems and designate the type and quality of work intended under this section.

BASF Corporation-Wall Systems
3550 St. Johns Bluff Rd South
Jacksonville Florida 32224
Tel: 800-221-9255
Fax: 904-996-6300
Web: www.senergy.basf.com

1. Substitutions: The Architect will consider products of comparable manufacturers as a substitution, pending the contractor's submission of adequate documentation of the substitution in accordance with procedures in Division 01 of the Project Manual. Supporting technical data, samples, published specifications and the like must be submitted for comparison.
2. Contractor shall warrant that proposed substitutions, if accepted, will provide performance equivalent to the materials specified herein.
3. These specifications have been developed by Senergy Cement-Board Stucco 1000 System manufactured by BASF Corporation-Wall Systems.

2.2 MATERIALS

- A. Senergy Base Coats:
 1. ALPHA Base Coat: 100% acrylic base coat, field-mixed with Portland cement; manufactured by BASF Corp.
 2. ALPHA DRY BASE COAT: dry-mix base coat containing Portland cement; manufactured by BASF Corp.
- B. Portland cement: conform to ASTM C150, Type I, II, or I/II, grey or white; fresh and free of lumps.

- C. Water: clean and potable without foreign matter.
- D. Senergy Reinforcing Mesh: MIL-Y-1140G; balanced, open weave glass fiber reinforcing mesh; twisted multi-end strands treated for compatibility with Senergy lamina components.
 - 1. FLEXGUARD 4: standard weight.
 - 2. CORNER MESH: intermediate weight, pre-marked for easy bending, for reinforcing at exterior corners.
 - 3. SELF-ADHERING MESH TAPE (4" or 9"): a standard weight mesh coated with a pressure sensitive adhesive and used with SENERSHIELD or Base Coat as reinforcement over acceptable sheathing joints, rough openings and at terminations.
 - 4. 4" SHEATHING FABRIC: for use with SENERSHIELD-R for reinforcement over acceptable sheathing joints, rough openings and at terminations.
- E. TINTED PRIMER: 100% acrylic-based primer; color as selected to closely match the selected Senergy Finish color; manufactured by BASF Corp.
- F. Senergy Finish coat: SENERFLEX 100% acrylic resin finish, air cured, compatible with Base Coat, Finish color factory- mixed, color as selected by Architect, Finish texture FINE.

2.3 ACCESSORIES

- A. Starter track, L bead, J bead, angled termination bead, casing beads, corner beads, expansion joints and weep screed must comply with ASTM D1784 or C1063 for vinyl. Type as recommended by BASF Wall Systems.
- B. FLASHING PRIMER: water-based primer for use prior to application of SENERFLASH™ on all acceptable surfaces.
- C. SENERFLASH™: 30-mil thick, self-sealing, self-healing composite membrane of polyester fabric and rubberized asphalt. Compatible with SENERSHIELD™ or SENERSHIELD-R Air/Weather Barrier.
- D. 4" SHEATHING FABRIC: (4") spun bonded non-woven reinforced polyester web for use with SENERSHIELD-R.
- E. SENERSHIELD-R: ready-mixed, flexible Air/Weather Barrier.

PART 3 – EXECUTION

3.1 EXAMINATION

- A. Verify project site conditions under provisions of Division 01.
- B. Walls
 - 1. Sheathing
 - a. Sheathing must be applied in accordance with project documents.
 - b. Sheathing must be securely fastened per manufacturers' recommendations, applicable building code and project requirements.
 - c. Sheathing must be applied with corrosion resistant fasteners.
 - 2. Air/weather Barrier

- a. Verify that the air/weather barrier is installed over the sheathing per applicable building code requirements, manufacturers' specifications and Senergy details, prior to application of the Senergy Cement-Board Stucco 1000 System.
- 3. Cement-Board Substrates
 - a. Acceptable substrates are cement-boards which satisfy ASTM C1325 (Type A, Exterior).
 - b. Cement-board must be securely fastened per manufacturers' recommendations, applicable building code and project requirements.
 - c. Wall sheathings shall have maximum deflection not to exceed L/360 of span under positive or negative design loads unless otherwise approved in writing by Senergy before installation.
 - d. Examine surfaces to receive Senergy Cement-Board Stucco 1000 System and verify that substrate and adjacent materials are dry, clean and sound. Verify substrate surface is flat, free of fins or planar irregularities greater than 1/4" in 10'.
 - e. Cement-board must be a single piece around corners of openings.
 - f. Cement-board must be fastened with corrosion resistant fasteners.
 - g. Cement-board and sheathing joints must be offset.
- 4. Flashings
 - a. Head, jamb and sills of all openings must be flashed with a minimum 9" strip of secondary air/weather barrier prior to window/door, HVAC, etc. installation. Refer to *Senergy Moisture Protection Guidelines*.
 - b. Windows and openings shall be flashed according to design and building code requirements.
 - c. Individual windows that are ganged to make multiple units require that the heads be continuously flashed and/or the joints between the units must be fully sealed.
- 5. Utilities
 - a. The system must be properly terminated at all lighting fixtures, electrical outlets, hose bibs, etc.
- 6. Roof
 - a. Verify that all roof flashings have been installed in accordance with the guidelines.
- C. Unsatisfactory conditions shall be reported to the general contractor and/or builder and/or architect and/or owner. Do not proceed until all unsatisfactory conditions have been corrected.
- D. Supplemental framing/blocking may be required to secure cement board at vertical control/expansion joints.

3.2 PREPARATION

- A. Protect all surrounding areas and surfaces from damage and staining during application of Senergy Cement-Board Stucco 1000 System.
- B. Protect finished work at end of each day to prevent water penetration.
- C. Prepare substrates in accordance with manufacturer's instructions.

3.3 MIXING

- A. General: No additives are permitted unless specified in product mixing instructions. Close containers when not in use. Clean tools with soap and water immediately after use.

- B. Air/Weather Barrier
 - 1. SENERSHIELD-R
 - a. Mix SENERSHIELD-R with a clean, rust-free paddle and drill until thoroughly blended. Do not add water.
- C. Senergy Base Coats:
 - 1. ALPHA Base Coat:
 - a. Prepare in a container which is clean and free of foreign substances. Do not use container which has contained or been cleaned with a petroleum-based product.
 - b. Mix Base Coat with a clean, rust-free paddle and drill until thoroughly blended before adding Portland cement.
 - c. Mix one part (by weight) Portland cement with one part Base Coat. Add Portland cement in small increments, mixing until thoroughly blended after each additional increment.
 - d. Clean, potable water may be added to adjust workability
 - 2. ALPHA DRY Base Coat:
 - a. Mix and prepare each bag in a 5-gallon pail which is clean and free of foreign substances. Do not use a container which has contained or been cleaned with a petroleum-based product.
 - b. Fill the container with approximately 1 1/2 gallons of clean, potable water.
 - c. Add ALPHA DRY Base Coat in small increments, mixing after each additional increment.
 - d. Mix ALPHA DRY Base Coat and water with a clean, rust-free paddle and drill until thoroughly blended.
 - e. Additional ALPHA DRY Base Coat or water may be added to adjust workability.
- D. Senergy TINTED PRIMER, and Finish Coats:
 - 1. Mix the factory-prepared Senergy materials to a smooth, workable consistency.
 - 2. A small amount of clean, potable water may be added to adjust workability.

3.4 APPLICATION

- A. General: Apply Senergy Cement-Board Stucco 1000 System materials in accordance with Senergy specifications.
- B. Accessories: Attach starter track per manufacturer's instructions and *Senergy Cement-Board Stucco System 1000 Typical Details*.
- C. Air/Weather Barrier
 - 1. All sheathing joints and windows/openings must be protected and the air/weather barrier applied in accordance with *Senergy® Moisture Protection Guidelines*.
 - 2. Substrate shall be of a type approved by BASF Wall Systems.
 - 3. Substrate shall be dry, clean, sound, and free of releasing agents, paint, or other residue or coatings. Verify substrate is flat, free of fins or planar irregularities greater than 1/4" in 10'.
 - 4. Unsatisfactory conditions shall be reported to the General Contractor and corrected before application of the air/weather barrier.
 - 5. Install air/weather barrier directly over sheathings.

- a. Apply mixed SENERSHIELD-R with 4" roller and roller pad over all fasteners, sheathing joints, terminations, inside and outside corners.
 - b. Immediately place and center 4" SHEATHING FABRIC over wet SENERSHIELD-R at all sheathing joints, terminations, inside and outside corners. Ensure fabric extends evenly on both sides of the sheathing joint.
 - c. Lap SHEATHING FABRIC 2 1/2" minimum at intersections.
 - d. Allow to dry.
 - e. Apply SENERSHIELD-R to the entire wall surface with a 3/4" nap roller to a uniform consistent thickness of 10 mils with no pinholes or voids. Note: A minimum of two (2) 10 wet mil coats of SENERSHIELD-R is required over wood based sheathing.
6. Installed materials should be checked before cement board and final system application.
 7. Ensure [air/weather barrier] SENERSHIELD-R and SHEATHING FABRIC 4" or 9" overlap the top flange of the starter track.
- D. Install cement board over secondary weather barrier, securely fastened, per manufacturers' recommendations, applicable building code and project requirements.
- E. Install trim accessories per manufacturer's recommendations. Refer to Senergy's Cement-Board Stucco Trim and Accessories bulletin for accessory placement.
- F. Senergy SELF-ADHERING MESH TAPE (4")
1. Center the SELF-ADHERING MESH TAPE (4") over all cement board joints and terminations and firmly press while unrolling.
 2. Ensure SELF-ADHERING MESH TAPE is continuous, void of wrinkles. Overlap SELF-ADHERING MESH TAPE a minimum 2 1/2".
 3. Apply mixed Base Coat to surface of SELF-ADHERING MESH TAPE by troweling from the center to the edges.
 4. Allow Base Coat and SELF-ADHERING MESH TAPE to dry prior to application of Senergy Reinforcing Mesh and Base Coat.
- G. Senergy Base Coat/CORNER MESH and Reinforcing Mesh: Base Coat shall be applied so as to achieve Reinforcing Mesh embedment with no Reinforcing Mesh color visible.
- H. Senergy CORNER MESH:
1. Install CORNER MESH at exterior corners.
 2. Apply CORNER MESH prior to application of Senergy Reinforcing Mesh.
 3. Cut CORNER MESH to workable lengths.
 4. Apply mixed ALPHA, ALPHA DRY Base Coat to cement board at out side corners using a stainless steel trowel.
 5. Immediately place CORNER MESH against the wet Base Coat and embed the CORNER MESH into the Base Coat by troweling from the corner; butt edges and avoid wrinkles.
 6. After Base Coat is dry and hard, apply a layer of FLEXGUARD 4 Reinforcing Mesh over the entire surface of the CORNER MESH in accordance with 3.04 H.
- I. FLEXGUARD 4 Reinforcing Mesh:
1. Apply mixed ALPHA, ALPHA DRY Base Coat to entire surface of cement-board with a stainless steel trowel to embed the Reinforcing Mesh.

- a. Immediately place FLEXGUARD 4 Reinforcing Mesh against wet Base Coat and embed the Reinforcing Mesh into the Base Coat by troweling from the center to the edges.
2. Lap Reinforcing Mesh 2 1/2" minimum at edges.
3. Ensure Reinforcing Mesh is continuous at corners, void of wrinkles and fully embedded in Base Coat.
4. If required, apply a second layer of Base Coat to achieve total nominal Base Coat/Reinforcing Mesh thickness of 1/16".
5. Allow Base Coat with embedded Reinforcing Mesh to dry hard (normally 8 to 10 hours).

J. Senergy TINTED PRIMER:

1. Apply TINTED PRIMER to dry Base Coat/Reinforcing Mesh with a sprayer, 3/8" nap roller, or good quality latex paint brush at a rate of approximately 150 - 250 ft² per gallon.
2. TINTED PRIMER shall be dry to the touch before proceeding to the Senergy Finish Coat application.

K. Senergy Finish Coat

1. SENERFLEX® FINISH: FINE.
 - a. Apply Finish directly to the stucco brown coat with a clean, stainless steel trowel.

NOTE:

 1. *Certain colors may require the use of Senergy TINTED PRIMER over the Base Coat prior to application of Finish.*
 2. *Select Finish Coat color with a light reflective value (LRV) of 20% or higher. The use of dark colors (LRV less than 20%) is not recommended with EIFS that incorporate expanded polystyrene insulation (EPS). EPS has a sustained service temperature limitation of approximately 160°F.*
 - b. Apply and level Finish during the same operation to minimum obtainable thickness consistent with uniform coverage.
 - c. Maintain a wet edge on Finish by applying and texturing continually over the wall surface.
 - d. Work Finish to corners, joints or other natural breaks and do not allow material to set up within an uninterrupted wall area.
 - e. Float Finish to achieve final texture.

3.5 CLEANING

- A. Clean work under provisions of Division 01.
- B. Clean adjacent surfaces and remove excess material, droppings, and debris.

3.6 PROTECTION

- A. Protect finished work under provisions of Division 01.

END OF SECTION

SECTION 07 53 23 – ETHYLENE-PROPYLENE-DIENE-MONOMER ROOFING (EPDM)

PART 1 - GENERAL

1.1 DESCRIPTION

- A. The project consists of installing White Single-Ply EPDM Membrane Roofing System as outlined below:
 - 1. Apply the Fully Adhered EPDM Roofing System in conjunction with the insulation specified over the existing roofing.

1.2 EXTENT OF WORK

- A. Provide all labor, material, tools, equipment, and supervision necessary to complete the installation of a White 90-mil thick EPDM membrane Fully Adhered Roofing System including flashings and insulation as specified herein and as indicated on the drawings in accordance with the manufacturer's most current specifications and details.
- B. The roofing contractor shall be fully knowledgeable of all requirements of the contract documents and shall make themselves aware of all job site conditions that will affect their work.
- C. The roofing contractor shall confirm all given information and advise the owner's representative, prior to bid, of any conflicts that will affect their cost proposal.
- D. White Fully Adhered Roofing System is listed in this specification to establish a standard of quality. Requests for substitutions will be considered in accordance with provisions of Division 01.

1.3 SUBMITTALS

- A. Prior to starting work, the roofing contractor must submit the following:
 - 1. Shop drawings showing layout, details of construction and identification of materials.
 - 2. Sample of the manufacturer's Total Systems Warranty covering all components of the roofing system.
 - 3. Submit a letter of certification from the manufacturer which certifies the roofing contractor is authorized to install the manufacturer's roofing system and lists foremen who have received training from the manufacturer along with the dates training was received.
 - 4. Certification of the manufacturer's warranty reserve.
- B. Upon completion of the installed work, submit copies of the manufacturer's final inspection report to the specifier prior to the issuance of the manufacturer's warranty.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Deliver materials to the job site in the manufacturer's original, unopened containers or wrappings with the manufacturer's name, brand name and installation instructions intact and legible. Deliver in sufficient quantity to permit work to continue without interruption.
- B. Comply with the manufacturer's written instructions for proper material storage.
 - 1. Store materials between 60°F and 80°F in dry areas protected from water and direct sunlight. If exposed to lower temperature, restore to 60°F minimum temperature before using.

2. Store materials containing solvents in dry, well ventilated spaces with proper fire and safety precautions. Keep lids on tight. Use before expiration of their shelf life.
- C. Insulation and underlayment products must be on pallets, off the ground and tightly covered with waterproof materials. Manufacturer's wrap does not provide sufficient waterproofing. Insulation and underlayment products that become wet or saturated are to be discarded.
- D. Any materials which are found to be damaged shall be removed and replaced at the applicator's expense.

1.5 WORK SEQUENCE

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

1.6 USE OF THE PREMISES

- A. Before beginning work, the roofing contractor must secure approval from the owner's representative for the following:
 1. Areas permitted for personnel parking.
 2. Access to the site.
 3. Areas permitted for storage of materials and debris.
 4. Areas permitted for the location of cranes, hoists and chutes for loading and unloading materials to and from the roof.
- B. Interior stairs or elevators may not be used for removing debris or delivering materials, except as authorized by the building superintendent.

1.7 EXISTING CONDITIONS

- A. If discrepancies are discovered between the existing conditions and those noted on the drawings, immediately notify the owner's representative by phone and solicit the manufacturer's approval prior to commencing with the work. Necessary steps shall be taken to make the building watertight until the discrepancies are resolved.

1.8 WORKMANSHIP

- A. Applicators installing new roof, flashing and related work shall be factory trained and approved by the manufacturer they are representing.
- B. All work shall be of highest quality and in strict accordance with the manufacturer's published specifications and to the owner's representative satisfaction.
- C. There shall be a supervisor on the job site at all times while work is in progress.
- D. All field seams and flashing details are to be completed according to manufacturer's specifications and details by the end of each work day.

1.9 QUALITY ASSURANCE

- A. The White Fully Adhered EPDM Roofing System must achieve a UL Class B.
- B. The specified roofing assembly must have been successfully tested by a qualified testing agency to resist the design uplift pressures calculated according to International Building Code (IBC) and American Society of Civil Engineers (ASCE 7) ANSI/SPRI WD-1 "Wind Design Standard Practice for Roofing Assemblies".
- C. The membrane must be manufactured by the material supplier. Manufacturer's supplying membrane made by others are not acceptable.
- D. The manufacturer must have a minimum of 20 years experience in the manufacturing of vulcanized thermoset sheeting.
- E. Unless otherwise noted in this specification, the roofing contractor must strictly comply with the manufacturer's current specifications and details.
- F. The roofing system must be installed by an applicator authorized and trained by the manufacturer in compliance with shop drawings as approved by the manufacturer. The roofing applicator shall be thoroughly experienced and upon request be able to provide evidence of having at least five (5) years successful experience installing single-ply EPDM roofing systems and having installed at least one (1) EPDM roofing application or several similar systems of equal or greater size within one year.
- G. Provide adequate number of experienced workmen regularly engaged in this type of work who are skilled in the application techniques of the materials specified. Provide at least one thoroughly trained and experienced superintendent on the job at all times roofing work is in progress.
- H. There shall be no deviations made from this specification or the approved shop drawings without the prior written approval of the specifier. Any deviation from the manufacturer's installation procedures must be supported by a written certification on the manufacturer's letterhead and presented for the specifier's consideration.
- I. Upon completion of the installation, the applicator shall arrange for an inspection to be made by a non-sales technical representative of the membrane manufacturer in order to identify any needed corrective repairs that will be required for warranty issuance. Notify the owner's representative seventy-two (72) hours prior to the manufacturer's final inspection.
- J. Inspector shall be employed and trained by the manufacturer and have received product-specific training from the manufacturer of the products.
- K. The White Fully Adhered EPDM Membrane must meet the CRRC (Cool Roof Rating Council) requirements for reflectance and emittance. When tested in accordance with ASTM C1549, the White material should have an initial solar reflectance of .76 and a 3-year aged reflectance of .64. The material has also been tested for emittance in accordance with ASTM C1371; an initial emittance of .90 and a 3-year aged emittance of .87 were achieved.
- L. The White Fully Adhered EPDM Membrane must exceed 25,200 kJ/m² under Xenon-Arc UV Light testing used for testing "Resistance to Outdoor (Ultraviolet) Weathering." (ASTM D 4637 Specification requires a 7560 kJ/m² minimum total radiant exposure at 70 W/m² irradiance at 176°F black panel temperature to pass.)The membrane shows no visible signs of cracking or crazing.

1.10 JOB CONDITIONS, CAUTIONS AND WARNINGS

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

1.15 WARRANTY

- A. Provide manufacturer's 30 year Total System Warranty covering both labor and all materials with no dollar limitation. The maximum wind speed coverage shall be peak gusts of 80 mph measured at 10 meters above ground level. Certification is required with bid submittal indicating the manufacturer has reviewed and agreed to such wind coverage.
- B. Pro-rated System Warranties shall not be accepted.

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. The drawings and specifications are based on catalog data, specifications and products of Carlisle's Sure-White Adhered Roofing System manufactured by Carlisle Syntec Systems and designate the type and quality of work intended under this section.
Carlisle Syntec Systems
P.O. Box 7000
Carlisle Pennsylvania 17013

Tel: 800-479-6832
Fax: 717-245-7053
Web: www.carlislesyntec.com

1. All components of the specified roofing system shall be products of Carlisle SynTec or accepted by Carlisle SynTec as compatible.
2. Unless otherwise approved by the specifier and accepted by the membrane manufacturer, all products (including insulation, fasteners, fastening plates and edgings) must be manufactured and supplied by the roofing system manufacturer and covered by the warranty. Manufacturer of roof membrane shall also manufacture all polymeric components for the roofing system, including, but limited to, membrane, adhesives, primers, flashings, caulks and tapes.
3. Contractor shall warrant that proposed substitutions, if accepted, will provide performance equivalent to the materials specified herein.
4. These specifications have been developed by Carlisle Syntec Systems.
5. Substitutions: The Architect will consider products of comparable manufacturers as a substitution, pending the contractor's submission of adequate documentation of the substitution in accordance with procedures in Division 01 of the Project Manual. Supporting technical data, samples, published specifications and the like must be submitted for comparison.

2.2 MEMBRANE

- A. Furnish Sure-White 90-mil thick EPDM (Ethylene, Propylene, Diene Terpolymer) in the largest sheet possible with 3" or 6" Factory-Applied tApe (FAT). The membrane shall conform to the minimum physical properties of ASTM D4637. When a 10 foot wide membrane is to be used, the membrane shall be manufactured in a single panel with no factory splices to reduce splice intersections.

2.3 INSULATION/UNDERLAYMENT

- A. When applicable, insulation shall be installed in multiple layers. The first and second layer of insulation shall be mechanically fastened to the substrate in accordance with the manufacturer's published specifications.
- B. Insulation shall be as indicated and supplied by Carlisle SynTec.
 1. Carlisle SecurShield HD Cover Board– a rigid insulation panel composed of a high-density, closed-cell polyisocyanurate foam core laminated to moisture resistant coated-glass fiber-mat facer for use as a cover board or recover board meeting ASTM 1289-06, Type II, Class 2 (100 psi). Available 1/2" thick 4' x 8' panel weight 11 lbs with an R-value of 2.5.
 2. InsulFoam VIII (EPS: Expanded Polystyrene) – A closed-cell lightweight expanded polystyrene (EPS) that meets ASTM C578, Type VIII. Nominal density of 1.25 lbs/cubic ft (pcf) available in 4' x 4' or 4' x 8' sizes with thickness from 1/4" to 40". Custom lengths, widths and tapered boards are available. Specified beneath Sure-Seal HP Recovery Board. Insulation shall be 2" in thickness.

2.4 FASTENING COMPONENTS

- A. To be used for mechanical attachment of insulation and to provide additional membrane securement:
- B. Fasteners, Plates and Bars.
 1. HP- Fasteners: a threaded, #14 fastener with a #3 phillips drive used with steel and wood roof decks.

2. HP-X Fasteners: A heavy duty #15 threaded fastener with a #3 phillips drive used for insulation securement into steel, wood plank or minimum 15/32 inch thick plywood when increased pullout resistance is desired.
3. Pre-Assembled ASAP Fasteners: A pre-assembled 3" diameter Plastic Plate and # 12 threaded fastener with a #3 drive used for insulation attachment into steel or wood decks. Installed using OMG Fastening Tools.
4. InsulFast Fasteners: A threaded #12 fastener with #3 phillips drive used for insulation attachment into steel or wood decks.
5. HP Term Bar Nail-Ins: A 1-1/4" long expansion anchor with a zinc plated steel drive pin used for fastening the Carlisle Termination Bar or Seam Fastening Plates to concrete, brick, or block walls.
6. Seam Fastening Plate: a 2" diameter metal fastening plate used in conjunction with RUSS or EPDM membrane for additional membrane securement.
7. Insulation Fastening Plates: a nominal 3 inch diameter plastic or metal plate used for insulation attachment.
8. Sure-White Pressure-Sensitive RUSS (Reinforced Universal Securement Strip): a 6" wide, nominal 45-mil thick clean, cured, white reinforced EPDM membrane with 3" wide Factory-Applied Tape laminated along one edge. Used on Sure-White Adhered Roofing Systems.

2.5 ADHESIVES, CLEANERS AND SEALANTS

- A. All products shall be furnished by Carlisle and specifically formulated for the intended purpose.
- B. 90-8-30A Bonding Adhesive: A high-strength, yellow colored, synthetic rubber adhesive used for bonding Sure-Seal/Sure-White EPDM membranes to various surfaces. Available in 5 gallon pails.
- C. Carlisle Weathered Membrane Cleaner: A clear, solvent-based cleaner used to loosen and remove dirt and other contaminants from the surface of exposed EPDM membrane (for repairs, etc.) prior to applying EPDM Primer. Weathered Membrane Cleaner can also be used when applying Splicing Cement. Available in 1 and 5-gallon pails.
- D. Sure-Seal/Sure-White SecurTAPE™ (Factory Applied): A 3" or 6" wide by 100' long splice tape used for splicing adjoining sections of EPDM membrane. Complies with the South Coast Air Quality Management District Rule 1168.
- E. EPDM Primer: A solvent-based primer used to prepare the surface of EPDM membrane for application of Splice Tape or Pressure-Sensitive products. Available in 1 gallon pails.
- F. Lap Sealant: A heavy-bodied material used to seal the exposed edges of a membrane splice. Available in tubes.
 1. Sure-White Lap Sealant is a white sealant for use with Sure-White (white-on-black) Roofing Systems.
- G. Water Cut-Off Mastic: A one-component, low viscosity, self wetting, Butyl blend mastic used to achieve a compression seal between the EPDM membrane or Elastoform Flashing and applicable substrates. Available in tubes.
- H. One-Part Pourable Sealer: Available in black or white, a one-component, moisture curing, elastomeric polyether sealant used for attaching lightning rod bases and ground cable clips to the membrane surface and as a sealant around hard-to-flash penetrations such as clusters of pipes.
- I. Universal Single-Ply Sealant A one-part polyether, non-sagging sealant designed for sealing expansion joints, control joints and counterflashings. Available in white only.

2.6 METAL EDGING AND MEMBRANE TERMINATIONS

- A. General: All metal edgings shall be tested and meet ANSI/SPRI ES-1 standards and comply with International Building Code. All metal work is to be supplied and warranted by the manufacturer.
 - 1. SecurEdge 300 Parapet Wall Coping: a snap-on edge system consisting of a 24 gauge galvanized metal water dam and .032" thick Kynar 500 finish aluminum. Metal fascia color shall be as designated by the Owner's Representative. ANSI/SPRI ES-1 Certified. Coping FM Approved 1-90 with 20 ga. Cleat, 1-180 with 16 ga. Cleat. Fascia FM Approved 1-225.
 - 2. SecurEdge 3000 Roof Edge System: a metal fascia system with a 20 gauge steel retainer bar and .032" thick Kynar 500 finish aluminum fascia. Metal fascia color shall be as designated by the Owner's Representative. ANSI/SPRI ES-1 Certified. 3000 Coping FM Approved 1-465 with .050 aluminum retainer, 1-180 with 20 ga. Steel retainer. 3000 XT Coping FM Approved 1-315.
- B. SecurSeal Drip Edge: a metal fascia/edge system with a 22 or 24 gauge continuous anchor cleat and .032 inch thick aluminum fascia. Metal fascia color shall be as designated by the Owner's Representative.
- C. Termination Bar: a 1" wide and .098" thick extruded aluminum bar pre-punched 6" on center; incorporates a sealant ledge to support Lap Sealant and provide increased stability for membrane terminations.

2.7 WALKWAYS

- A. Protective surfacing for roof traffic shall be Sure-White Pressure-Sensitive Walkway Pads (with Factory-Applied Tape on the underside of the walkway) adhered to the membrane surface in conjunction with Sure-Seal Primer.

2.8 OTHER MATERIALS

- A. Metal Flashing, as required, and miscellaneous items needed to fulfill the project requirements.

PART 3 - EXECUTION

3.1 GENERAL

- A. Comply with the manufacturer's published instructions for the installation of the membrane roofing system including proper substrate preparation, jobsite considerations and weather restrictions.
- B. Position sheets to accommodate contours of the roof deck and shingle splices to avoid bucking water.

3.3 INSULATION PLACEMENT

- A. Install insulation or membrane underlayment over the substrate with boards butted tightly together with no joints or gaps greater than 1/4 inch. Stagger joints both horizontally and vertically if multiple layers are provided.
- B. Secure insulation to the substrate with the required mechanical fasteners in accordance with the manufacturer's specifications.

3.4 MEMBRANE PLACEMENT AND BONDING

- A. Unroll and position membrane without stretching. Allow the membrane to relax for approximately 1/2 hour before bonding. Fold the sheet back onto itself so half the underside of the membrane is exposed.
- B. Apply the Bonding Adhesive in accordance with the manufacturer's published instructions and coverage rates, to both the underside of the membrane and the substrate. Allow the adhesive to dry until it is tacky but will not string or stick to a dry finger touch.
 - 1. Roll the coated membrane into the coated substrate while avoiding wrinkles. Brush down the bonded half of the membrane sheet with a soft bristle push broom to achieve maximum contact.
 - 2. Fold back the unbonded half of the membrane sheet and repeat the bonding procedure.
- C. Install adjoining membrane sheets in the same manner, overlapping edges approximately 4 inches. Do not apply bonding adhesive to the splice area.

3.5 MEMBRANE SPLICING

- A. Position membrane sheet to allow for required splice overlap. Mark the bottom sheets with an indelible marker approximately 1/4" to 1/2" from the top sheet edge. The pre-marked line on the membrane edge can also be used as a guide for positioning splice tape.
- B. When the membrane is contaminated with dirt, fold the top sheet back and clean the dry splice area (minimum 3" wide) of both membrane sheets by scrubbing with clean natural fiber rags saturated with Sure-Seal Weathered Membrane Cleaner. When using Sure-Seal (black) PRE-KLEENED membrane, cleaning the splice area is not required unless contaminated with field dirt or other residue.
- C. Apply EPDM Primer to splice area and permit to flash off.
- D. When adhering Factory Applied Tape (FAT), pull the poly backing from FAT beneath the top sheet and allow the top sheet to fall freely onto the exposed primed surface. Press top sheet on to the bottom sheet using firm even hand pressure across the splice towards the splice edge
- E. For end laps, apply 3" or 6" SecurTAPE to the primed membrane surface in accordance with the manufacturer's specifications. Remove the poly backing and roll the top sheet onto the mating surface.
- F. Tape splices must be a minimum of 2-1/2" wide using 3" wide SecurTAPE extending 1/8" minimum to 1/2" maximum beyond the splice edge. Field splices at roof drains must be located outside the drain sump.
- G. For projects where a 90-mil membrane OR 20-year or longer System Warranty is specified, splice enhancements are required. Refer to Carlisle Sure-Seal/Sure-White Roofing System Specification.
- H. Immediately roll the splice using positive pressure when using a 2" wide steel roller. Roll across the splice edge, not parallel to it. When FAT is used, Carlisle's Stand-Up Seam Roller can be used to roll parallel to the splice edge.
- I. At all field splice intersections, apply Lap Sealant along the edge of the membrane splice to cover the exposed SecurTAPE 2" in each direction from the splice intersection. Install Carlisle's Pressure-Sensitive "T" Joint Covers or a 6" wide section (with rounded corners)

of Sure-Seal Pressure-Sensitive Flashing over the field splice intersection.

3.6 FLASHING

- A. Wall and curb flashing shall be cured EPDM membrane. Continue the deck membrane as wall flashing where practicable. Use Pressure-Sensitive Curb Wrap when possible to flash curb units.
- B. Follow manufacturer's typical flashing procedures for all wall, curb, and penetration flashing including metal edging/coping and roof drain applications.

3.7 WALKWAYS

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

3.8 DAILY SEAL

- A. On phased roofing, when the completion of flashings and terminations is not achieved by the end of the work day, a daily seal must be performed.

3.9 CLEAN UP

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

END OF SECTION

SECTION 07 61 00 - METAL ROOF PANELS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Metal roofing, including flashing and accessories.

1.2 RELATED SECTIONS

- A. Section 07 62 00 – Flashing and Sheet Metal
- B. Section 07 92 00 - Joint Sealant

1.3 REFERENCES

- A. ASTM B 209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2001.
- B. ASTM E 408/C - 1371: "Standard Test Method for Total Normal Emittance of Surfaces Using inspection - Meter Techniques.
- C. ASTM E 903/C - 1549: Standard Test Method for Solar Absorbance, using Integrating Spheres.
- D. ASTM E 1646 - Standard Test Method for Water Penetration of Exterior Metal Roof Panel Systems by Uniform Static Air Pressure Difference; 1995.
- E. ASTM E 1680 - Standard Test Method for Rate of Air Leakage through Exterior Metal Roof Panel Systems; 1995.
- F. UL 580 - Standard for Tests for Uplift Resistance of Roof Assemblies; 1994.
- G. UL2218: Class 4 Impact Resistance Rating.
- H. SMACNA (ASMM) - Architectural Sheet Metal Manual; Sheet Metal and Air Conditioning Contractors National Association; 1993.

1.4 SUBMITTALS

- A. Submit under provisions of Division 01.
- B. Product Data: Manufacturer's data sheets on each product to be used, including:
 - 1. Preparation instructions and recommendations.
 - 2. Storage and handling requirements and recommendations.
 - 3. Installation methods.
- C. Shop Drawings: Submit shop drawings showing layout, profiles and product components, including anchorage, accessories, finish colors and textures.
- D. Selection Samples: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors and patterns.
- E. Verification Samples: For each finish product specified, two samples, minimum size 6 inches square, representing actual product, color, and patterns.

- F. Manufacturer's Certificates: Certify products meet or exceed specified requirements.
- G. Operation and Maintenance Data: Include methods for maintaining installed products and precautions relating to cleaning materials and methods that might be detrimental to finishes and performance.
- H. Close Out: Warranty documents specified herein.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Installer with documented experience in performing work of this section who has specialized in the installation of work similar to that required for this project.
- B. Pre-Installation Meeting: Conduct pre-installation meeting to acquaint installers of roofing and related work with project requirements, substrate conditions, manufacturer's installation instructions and manufacturer's warranty requirements.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufacturer's unopened packaging with identification labels intact until ready for installation.
- B. Store materials protected from exposure to harmful conditions. Store material in dry, above ground location.
 - 1. Stack pre-finished material to prevent twisting, bending, abrasion, scratching and denting. Elevate one end of each skid to allow for moisture to run off.
 - 2. Prevent contact with material that may cause corrosion, discoloration or staining.
 - 3. Do not expose to direct sunlight or extreme heat trim material with factory applied strippable film.

1.7 PROJECT CONDITIONS

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.8 WARRANTY

- A. Manufacturer's Warranty: Provide manufacturer's standard warranty document executed by authorized company official covering finish, including color, fade, chalking, and film integrity.
- B. Warranty Period: 20 years commencing on Date of Substantial Completion.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturer: Petersen Aluminum Corp., which is located at:
1005 Tonne Rd.
Elk Grove Village, IL 60007
Toll Free Tel: 800-323-1960
Tel: 847-228-7150
Fax: 800-722-7150

Email: request info (bbatkoff@petersenmail.com); Web: www.pac-clad.com

- B. Requests for substitutions will be considered in accordance with provisions of Division 01.

2.2 SHEET METAL ROOFING

- A. General: Factory fabricated panels; panels fabricated on site using portable roll former are prohibited.
1. Performance Requirements: Provide sheet metal roofing that has been manufactured, fabricated and installed to achieve the following performance without defects, damage, failure or infiltration of water.
 - a. Wind Uplift: Provide UL 580 Class 90 rated assembly.
 - b. Static Air Infiltration: 0.06 cu ft/min/sq ft at 6.24 lb/sq ft (300 Pa) air pressure differential, maximum, when tested in accordance with ASTM E 283 or ASTM E 1680.
 - c. Water Infiltration: No evidence of water penetration at inward static air pressure differential of 12.0 lb/sq ft (575 kPa), when tested in accordance with ASTM E 331 or ASTM E 1646.
 - d. Thermal Movement: Accommodate movement expected due to ambient and surface temperature ranges likely to occur at project site.
 2. Panel Lengths: As indicated on drawings; panels 55 feet and less fabricated in one continuous length.
 3. Texture: Smooth texture, dull matte specular gloss 25 to 35 percent at 60 degrees F.
 4. Finish: Factory applied PAC-CLAD finish:
 - a. Topside: Full-strength fluoropolymer, 70 percent Kynar 500 or Hylar resin, 1.0 mil total dry film thickness.
 - b. Underside: Wash coat of 0.3 to 0.4 mil dry film thickness.
 - c. Color: As selected by Architect from manufacturer's standard colors.
 5. Panel Fasteners: Non-penetrating type, as required to achieve wind uplift rating or otherwise as recommended by manufacturer.
- B. Roof Panels: Petersen Aluminum Tite-Loc Panels; tension-leveled panels with 2 inch high mechanically crimped standing seams.
1. Seam Style: Triple-folded to 180 degrees (Tite-Loc Plus).
 2. Material: 0.032 inch aluminum, ASTM B 209 3105-H14 alloy.
 3. Panel Width: 18 inch, center to center.
 4. Eave Notching: Factory produced eave notching for trimmed eave panels.
 5. Sealant Bead: Factory applied sealant bead.
- C. Flashing and Trim: Manufacturer's standard flashing and trim profiles, factory formed; fabricated as recommended in SMACNA Architectural Sheet Metal Manual.
1. Material: Same as roof panels.
 2. Color: To match roof panels.

2.3 ACCESSORY MATERIALS

- A. Underlayment: ASTM D 226, Type II No. 30 asphalt saturated organic roofing felt.
- B. Sealant: Elastomeric.
- C. Bituminous Coating: Cold-applied asphaltic mastic, free of asbestos fibers, sulfur, and other harmful impurities.

- D. Touch-Up Paint: Approved by panel manufacturer.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that substrates are acceptable for roofing installation in accordance with manufacturer's instructions.
- B. Do not begin installation until substrates have been properly prepared.
- C. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Coordinate metal roofing with other work, including but not limited to drainage, flashing and trim, deck substrates, parapets, copings, walls, and other adjoining work.
- C. Install metal roofing panels to profiles, patterns and drainage indicated, in accordance with manufacturer's instructions, and as necessary to achieve specified performance and a leak-free installation. Allow for structural and thermal movement.
- D. Separate dissimilar metals using bituminous coating to prevent galvanic action.
- E. Use fasteners recommended by panel manufacturer; conceal fasteners wherever possible; cover and seal exposed fasteners.
- F. Provide uniform, neat seams; provide sealant-type joint where indicated and form joints to conceal sealant.

3.3 FIELD QUALITY CONTROL

- A. Post Installation Testing: Owner reserves right to perform post installation testing of installed sheet metal roofing.

3.4 CLEANING

- A. Remove temporary coverings and protection of adjacent work areas.
- B. Touch-up, repair or replace damaged products.
- C. Clean in accordance with manufacturer's instructions prior to Substantial Completion.
- D. Remove construction debris from project site and legally dispose of debris.

3.5 PROTECTION

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

END OF SECTION

SECTION 07 62 13 - SHEET METAL GUTTERS AND DOWNSPOUTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Gutters and downspouts
- B. Accessories

1.2 REFERENCES

- A. American Society for Testing and Materials (ASTM):
 - 1. ASTM A792: Standard Specification for Steel Sheet, 55 percent Aluminum Zinc Alloy Coated by the Hot Dip Process.

1.3 SUBMITTALS

- A. Product Data: Submit manufacturer current technical literature for each type of product.
- B. Samples: Provide nominal 3 x 5 inch sample of each color indicated for gutters, downspouts and accessories.

1.4 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Manufacturer shall have a minimum of five (5) years of experience in the production of sheet metal gutters and downspouts.
- B. Fabricator Qualifications: Shall be approved by manufacturer for fabrication of gutters and downspouts.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Store materials on dry, level, firm, and clean surface.

1.6 WARRANTY

- A. Finish Warranty:
 - 1. Manufacturing Defects: Standard form in which manufacturer agrees to repair or replace items that fail by blistering, checks, crazes, flakes, peels or weathers unevenly due to a defect in manufacturing within warranty period from date of original installation.
 - 2. Warranty Period: 20 years.

PART 2 - PRODUCTS

2.1 MANUFACTURER

- A. Garrety Manufacturing, Inc.
 - 1. Tel. 800-628-5849
 - 2. www.garretymfg.com

B. Substitutions:

1. Requests for substitutions will be considered in accordance with provisions of Division 1 of the Project Manual.

2.2 GUTTERS

A. Materials:

Steel Coil Stock: Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A792, Class AZ50 coating designation

B. Half-Round Gutter Fabrication:

1. Gutter Size: 6 inches.
2. Length: 10 feet.
3. Steel Thickness: 0.028 (24 gauge)

C. Gutter Corner Fabrication:

1. Provide mitered corners, lapped, sealed and riveted. Corners shall extend a minimum of 12 inches from the corner in each direction. Lap joint and sealant where connecting to continuous gutter.
2. Match material, shape and finish of gutter.

2.3 DOWNSPOUTS

A. Round downspout fabrication:

1. Size: 4 inch diameter.
2. Length: 10 feet.
3. Texture: Smooth.
4. Steel Thickness: 0.028 (24 gauge)

2.4 ACCESSORIES

A. Gutters:

1. End Caps: Match material, shape and finish of gutter.
2. Outlet Tubes: Match material and shape of downspout.
3. Gutter Support:
 - a. Gutter Hanger: Match existing type and configuration of gutter hangers.
Steel

B. Downspouts:

1. Downspout Support:
 - a. Exposed strap.
 - b. Finish: Match Downspout
2. Miscellaneous downspout components: Provide all necessary elbows, downspout offset sections, and pop rivets as required for a complete installation. All miscellaneous components shall match downspouts.

- C. Fasteners: Stainless steel fasteners of sufficient length to penetrate minimum 1 inch into substrate.
- D. Sealants: Tripolymer, single component sealant as recommended by manufacturer at gutter joints.
- E. Downspout Strainer: Steel wire-ball downspout strainer.

2.5 FINISH

- A. Downspouts Exterior/Interior Finish: Galvalume steel, "Mill Finish"
- B. Gutter Exterior/Interior Finish: KYNAR 500 (White), color to be selected by architect from manufacturer's standard colors.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Verify that substrates are in place and ready for installation of gutters and downspouts.

3.2 INSTALLATION

- A. General: Install Work securely in place and provide for expansion and contraction of components using lapped and sealed joints
 1. Do not install damaged components.
 2. Separate dissimilar metals to prevent galvanic action through the use of bituminous coating or other permanent separation recommended by SMACNA.
 3. Space expansion joints in gutters as recommended by manufacturer.
 4. Rivet joints where required for strength, exposed rivet shall match gutter or downspout color.
 5. Torch cutting of components is not allowed.
- B. Gutters:
 1. Install gutter supports to match existing but at no more than 24 inches on center.
 2. Slope gutters evenly to downspouts; provide end caps at gutter ends and seal watertight per manufacturer's instructions.
 3. Install outlet tubes at all downspout locations, seal watertight.
 4. Apply joint sealants at gutter joints per manufacturer's installation instructions and to meet the requirements of Section 07 92 00 – Joint Sealants.
- C. Downspouts:
 1. Install downspouts, provide elbows and offsets, and secure downspouts to wall construction using downspout supports spaced to match existing but no more than 10 feet on center. Maximum distance of downspout support from top or bottom of downspout shall be 2 feet.
 2. Where downspout connects to building perimeter drainage system, lap downspout and perimeter drainage pipe a minimum of 3 inches.
 3. Install formed metal splash pans under downspouts draining onto other roof surfaces.

3.3 CLEANING AND PROTECTION

- A. Remove damaged, defective or improperly installed materials. Replace with new materials installed per requirements of this section.
- B. Clean finished surfaces according to manufacturer's written instructions; maintain clean condition until Final Completion.

END OF SECTION

SECTION 07 70 00 – FLASHING AND SHEET METAL

PART 1 – GENERAL

1.1 SUMMARY

A. The work of this section includes all roofing and sheet metal work as shown on the drawings and specified herein and includes, but is not necessarily limited to, the following:

1. Flashings, counterflashings
2. Through-wall flashings
3. Flashing and counterflashing of all roof penetrations

1.2 WORK NOT INCLUDED

A. The following items are included in other sections of these specifications or in other contracts as noted below:

1. Roof ventilators, roof fan units, and air intakes - Heating and Ventilating Contract.

1.3 SUBMITTALS

A. Samples: Submit samples of flashing materials, fabricated expansion member and other materials as may be required

1.4 WORKMANSHIP

A. The work under this section shall be properly coordinated with the work of all other trades with which it comes in contact. Workmanship shall be first class in every respect and sheet metal work erected shall be installed so as to obtain an absolutely watertight job. Verify the work of other trades which is to be concealed by this work. Such work which is to be concealed shall be inspected and approved before proceeding with the installation.

B. Examine all surfaces on which or against which work of this section is to be applied and, if any defects are discovered, notify the Architect. Verify that all defects are corrected, as the installation of sheet metal work shall be considered an indication of acceptance of all surfaces as having been properly installed.

C. Except as otherwise shown on drawings or specified, the workmanship of sheet metal work, method of forming joints, anchoring, cleating, provisions for expansion and similar connection shall conform to the standard details and recommendations of the Copper and Brass Research Association in effect on the date of these specifications.

PART 2 - MATERIALS

2.1 METAL FLASHING

A. All flashings, counterflashings, formed drips, cap flashings shall be a terne coated stainless steel, type 304, as manufactured by Follansbee Steel Corp. meeting Pennsylvania State Specification R-20 with a minimum ga. of 28 or as otherwise noted on the drawings.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Sheet metal or any type as specified that is exposed to the weather shall be permanently watertight and weathertight.
- B. Suitable provision shall be made for free expansion and contraction without destroying the metal and causing leaks.
- C. Seams shall lap in the direction of the flow.
- D. Where through-flashings are bent down to form counterflashing, the edges are not to be folded, but other counterflashing shall have edge folded and returned upon themselves at least 1/2 inch and bent to the required shape before being placed.
- E. Mechanical Key Flashing:
 - 1. Flashing generally start one (1) inch back of face of wall and shall extend through wall and be turned down a minimum of four (4) inches over base flashing or as detailed on drawings.

END OF SECTION

SECTION 07 84 00 - FIRESTOPPING

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Provide firestop systems consisting of a material, or combination of materials installed to retain the integrity of fire resistance rated construction by maintaining an effective barrier against the spread of flame, smoke and/or hot gases through penetrations, fire resistive joints, and perimeter openings in accordance with the requirements of the Building Code for this project
- B. Firestop systems shall be used in locations including, but not limited to, the following:
 - 1. Penetrations through fire resistance rated floor and roof assemblies including both empty openings and openings containing penetrants.
 - 2. Penetrations through fire resistance rated wall assemblies including both empty openings and openings containing penetrants.
 - 3. Membrane penetrations in fire resistance rated wall assemblies where items penetrate one side of the barrier.
 - 4. Joints between fire resistance rated assemblies.
 - 5. Perimeter gaps between rated floors/roofs and an exterior wall assembly.
- C. Related Sections include, but are not limited to, the following:
 - 1. Division 07 – Thermal and Moisture Protection
 - 2. Division 09 – Finishes
 - 3. Division 22 – Plumbing
 - 4. Division 23 – Heating, Ventilating and Air Conditioning
 - 5. Division 26 – Electrical

1.3 REFERENCES

- A. New York State Uniform Fire Prevention and Building Code (*New York City Building Code*) *Editing Note: change according to location and code authority for project.*
- B. National Fire Protection Association (NFPA)
 - 1. NFPA 101 (Life Safety Code)
- C. American Society For Testing and Materials Standards (ASTM):
 - 1. ASTM E84: Standard Test Method for Surface Burning Characteristics of Building Materials.
 - 2. ASTM E814: Standard Test Method for Fire Tests of Through-Penetration Firestops.
 - 3. ASTM E1966: Test Method for Resistance of Building Joint Systems.
 - 4. ASTM E1399: Test Method for Cyclic Movement and Measuring Minimum and Maximum Joint Width.
 - 5. ASTM E119: Methods of Fire Tests of Building Construction and Materials.

6. ASTM E2174: Standard Practice for On-Site Inspection of Installed Fire Stops
7. ASTM E2307: Standard Test Method for Determining the Fire Endurance of Perimeter Fire Barrier Systems Using the Intermediate-Scale, Multi Story Test Apparatus (ISMA)
8. ASTM E2393-04: Standard Practice for On-Site Inspection of Installed Fire Resistive Joint Systems and Perimeter Fire Barriers

D. Underwriters Laboratories Inc. (UL):

1. UL Qualified Firestop Contractor Program.
2. UL 263: Fire Tests of Building Construction and Materials.
3. UL 723: Surface Burning Characteristics of Building Materials.
4. UL 1479: Fire Tests of Through-Penetration Fire Stops.
5. UL 2079: Tests for Fire Resistance of Building Joint Systems.

E. UL Fire Resistance Directory -Volume 2:

1. Through-Penetration Firestop Devices (XHJI)
2. Fire Resistive Ratings (BXUV)
3. Through-Penetration Firestop Systems (XHEZ)
4. Fill, Void, or Cavity Material (XHHW)

F. Omega Point Laboratories (OPL)

1. Building Products, Materials & Assemblies – Volume II

G. Factory Mutual Research (FM):

1. FM 4991: FM Approval Standard of Firestop Contractors – Class 4991

1.4 DEFINITIONS

- A. Firestopping: The use of a material or combination of materials in a fire-rated structure (wall or floor) where it has been breached, so as to restore the integrity of the fire rating on that wall or floor.
- B. System: The use of a specific firestop material or combination of materials in conjunction with a specific wall or floor construction type and a specific penetrant(s).
- C. Barrier: Any bearing or non-bearing wall or floor that has an hourly fire and smoke rating.
- D. Through-penetration: Any penetration of a fire-rated wall or floor that completely breaches the barrier.
- E. Membrane-penetration: Any penetration in a fire-rated wall or floor/roof-ceiling assembly that breaches only one side of the barrier.
- F. Fire Resistive/Construction Joint: Any gap, joint, or opening, whether static or dynamic, between two fire rated barriers including where the top of a wall meets a floor; wall edge to wall edge applications; floor edge to floor edge configurations; floor edge to wall.
- G. Perimeter Barrier: Any gap, joint, or opening, whether static or dynamic, between a fire rated floor assembly and an exterior wall assembly.
- H. Approved Testing Agencies: Not limited to: Underwriters Laboratory (UL), Factory Mutual (FM), Warnock Hersey, and Omega Point Laboratory (OPL).

1.5 PERFORMANCE REQUIREMENTS

- A. Penetrations: Provide through-penetration and membrane-penetration firestop systems that are produced and installed to resist the spread of fire, passage of smoke and other hot gases according to requirements indicated, to restore the original fire-resistance rating of assembly penetrated.
1. Provide and install complete penetration firestopping systems that have been tested and approved by nationally accepted testing agencies per ASTM E814 or UL 1479 fire tests in a configuration that is representative of field conditions.
 2. F-Rated Systems: Provide firestop systems with F-ratings indicated, as determined per ASTM E814 or UL 1479, but not less than one (1) hour or the fire resistance rating of the assembly being penetrated.
 3. T-Rated Systems: Provide firestop systems with T-ratings indicated, as well as F-ratings, as determined per ASTM E814 or UL 1479, where required by the Building Code.
 4. L- Rated Systems: Provide firestop systems with L- ratings less than 5cfm/sf.
 5. W-Rated systems: Provide firestop systems that are resistant to water. For piping penetrations for plumbing and wet-pipe sprinkler systems, provide moisture-resistant through-penetration firestop systems.
 6. For penetrations involving non-metallic, CPVC, PVC, or plastic piping, tubing or conduit, provide firestop systems that are chemically compatible in accordance with Manufacturer requirements.
 7. For penetrations involving insulated piping, provide firestop systems not requiring removal of insulation.
 8. For penetrations involving fire or fire/smoke dampers, only firestop products approved by the damper manufacturer shall be installed in accordance with the damper installation instructions.
- B. Fire Resistive Joints: Provide joint systems with fire resistance assembly ratings indicated, as determined by UL 2079 (ASTM E1399 and E1966), but not less than the fire resistance assembly rating of the construction in which the joint occurs. Firestopping assemblies must be capable of withstanding anticipated movements for the installed field conditions.
1. For firestopping assemblies exposed to view, traffic, moisture, and physical damage, provide products that after curing do not deteriorate when exposed to these conditions both during and after construction.
 2. For floor penetrations exposed to possible loading and traffic, provide firestop systems capable of supporting floor loads involved either by installing floor plates or by other means, as specified by the Architect.
 3. L- Rated Systems: Provide firestop systems with L- ratings less than 5cfm/sf.
- C. Firestopping products shall have flame spread ratings less than 25 and smoke-developed ratings less than 450, as determined per ASTM E 84. Note: Firestop products installed in plenum spaces shall have a smoke developed rating less than 50.
- D. Engineering Judgment (EJ): Where there is no specific third party tested and classified firestop system available for an installed condition, the Contractor shall obtain from the firestopping material manufacturer an Engineering Judgment (EJ) to be submitted to the Approving Authority, Design Professional and Authority Having Jurisdiction for approval prior to installation. The EJ shall follow International Firestop Council (IFC) guidelines.

1.6 SUBMITTALS

- A. Product Data: For each type of firestopping product selected. Manufacturer's certification must verify that firestopping materials are free of asbestos, lead and contain volatile organic compounds (VOCs) within limits of the local jurisdiction.
- B. Design Listings: Submit system design listings, including illustrations, from a qualified testing and inspecting agency that is applicable to each firestop configuration.
- C. Installation Instructions: Submit the manufacturer's installation instruction for each firestop assembly.
- D. Where there is no specific third party tested and classified firestop system available for a particular configuration, the Contractor shall obtain from the firestopping material manufacturer an Engineering Judgment (EJ) for submittal.
- E. Material Safety Data Sheet (MSDS): Submit for each type of firestopping product selected.
- F. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Submit documents as per 1.7.
- G. A quality control manual approved by FM or UL (if applicable).
- H. Firestop Schedule: Submit schedule (see appendix A) itemizing the following:
 - 1. Manufacturer's product reference numbers and/or drawing numbers.
 - 2. Listing agency's design number.
 - 3. Penetrating Item Description/Limits: Material, size, insulated or uninsulated, and combustibility.
 - 4. Maximum allowable annular space or maximum size opening.
 - 5. Wall type construction.
 - 6. Floor type construction.
 - 7. Hourly Fire resistance rating of wall or floor.
 - 8. F rating.
 - 9. T, L, and W rating, if applicable.
- I. Firestop Application Log: A separate binder shall be prepared and kept on site for use by the Inspection Agency and the Authority Having Jurisdiction. The binder shall contain the following:
 - 1. The binder shall be a three (3) ring binder.
 - 2. Firestop Schedule (see appendix A)
 - 3. All approved firestopping assemblies including engineering judgments shall be provided and organized by trade.
 - 4. Copy of manufacturer's installation instruction for each firestop assembly.
 - 5. A matrix or table of contents listing each assembly shall be provided.
 - 6. The binder shall be updated as new firestop assemblies or EJ's are added.
 - 7. The binder shall be kept on-site at a location approved by the Owner.

1.7 QUALITY ASSURANCE

- A. Provide firestopping system design listings from UL, FM, Warnock Hersey or OPL in accordance with the appropriate ASTM Standard(s) per article 1.5.
- B. Contractor Qualifications: An acceptable Firestop Contractor shall be:

1. Licensed by State or Local Authority where applicable, or
 2. FM Research approved in accordance with FM Standard 4991, or
 3. UL Qualified Firestop Contractor, or
 4. Meet the following requirements
 - a. Installation personnel shall be trained by the approved firestop manufacturer.
 - b. The installation firm shall be experienced in installing firestop systems and fire resistive joint systems similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful performance.
 - c. Qualifications include having the necessary experience, staff, and training to install manufacturer's products per specified tested and listed system requirements.
 - d. Minimum of three (3) years experience and shown to have successfully completed not less than 5 comparable scale projects and provide references.
- C. Single Source Limitations: Obtain firestop systems for all conditions from a single manufacturer.
- D. Materials from different firestop manufacturers shall not be installed in the same firestop system or opening.
- E. Firestopping material shall be asbestos and lead free and shall not incorporate nor require the use of hazardous solvents.
- F. Firestopping sealants must be flexible, allowing for normal movement.
- G. Firestopping materials shall not shrink upon drying as evidenced by cracking or pulling back from contact surfaces such that a void is created.
- H. Firestopping materials shall be moisture resistant, and may not dissolve in water after curing.
- I. Materials used shall be in accordance with the manufacturer's written installation instructions.
- J. Identify installed firestop systems with preprinted metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches of edge of the firestop systems so that labels will be visible to anyone seeking to remove penetrating items or firestop systems. Use mechanical fasteners for metal labels. For plastic labels, use self-adhering type with adhesives capable of permanently bonding labels to surfaces on which labels are placed and provide a label material that will result in partial destruction of label if removal is attempted. Include the following information on labels:
1. The words "Warning - Firestop System - Do Not Disturb. Notify Building Management of Any Damage."
 2. Contractor's name, address, and phone number.
 3. Firestop system designation of applicable testing and listing agency.
 4. Date of installation
 5. Firestop system manufacturer's name.
 6. Installer's name.
- K. Inspection of penetrations through fire rated floor and wall assemblies shall be in accordance with ASTM E2174, Standard Practice for On-Site Inspection of Installed Fire

Stops and ASTM E2393-04 Standard Practice for On-Site Inspection of Installed Fire Resistive Joint Systems and Perimeter Fire Barriers. The Owner may engage a qualified, independent inspection agency, or material testing agency to perform these inspections. *(Editing Note: NYC Projects are subject to the requirements of Special Inspections in accordance with Chapter 17 of the 2008 NYC Building Code.)*

- L. Field Mock-up Installations: Prior to installing firestopping, erect mock-up installations for each type firestop system indicated in the Firestop Schedule to verify selections made and to establish standard of quality and performance by which the firestopping work will be judged by the Owner or Owner's Representative. Obtain acceptance of mock-up installations by the Owner or Owner's Representative before start of firestopping installation. Provide at least 72 hours notice to Owner or Owner's Representative prior to inspection.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver firestopping products to Project site in original, unopened containers or packages with intact and legible manufacturer's labels identifying product and manufacturer, date of manufacture/expiration, lot number, listing agency's classification marking, and mixing instructions for multi-component materials.
- B. Store and handle materials per manufacturer's instructions to prevent deterioration or damage due to moisture, temperature changes, contaminants, or other causes.
- C. All firestop materials shall be installed prior to expiration date.

1.9 PROJECT CONDITIONS

- A. Environmental Limitations: Install firestopping when ambient or substrate temperatures are within limits permitted by the manufacturer's written instructions. Do not install firestopping when substrates are wet due to rain, frost, condensation, or other causes.
- B. Ventilate per the manufacturers written instructions on the product's Material Safety Data Sheet.
- C. Verify the condition of the substrates before starting work.
- D. Care should be taken to ensure that firestopping materials are installed so as not to contaminate adjacent surfaces.

1.10 COORDINATION

- A. Coordinate areas prior to firestopping installation with the Owner, Construction Manager and/or all other Contractors.
- B. Coordinate construction of openings and penetrating items to ensure that firestopping assemblies are installed according to specified requirements. Opening shall not exceed maximum restrictions allowable for annular spacing per listing or acceptable Engineering Judgments.
- C. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate through-penetration firestop systems.
- D. Do not conceal firestopping installations until the Owner's inspection agency or Authorities Having Jurisdiction have examined each installation.

- E. Schedule firestopping after installation of penetrants and joints but prior to concealing or obstructing access to areas requiring firestopping.
- F. Preinstallation Conference: This conference should be a joint meeting attended by the Owner's Representative and all prime contractors, respective firestopping sub-contractors and firestopping company field advisor to review project requirements. The agenda for the conference should include the following topics:
 - 1. Review scope of work.
 - 2. Review shop drawings and firestop application log.
 - 3. Review mock-up requirements.
 - 4. Discuss identification labels and locations.
 - 5. Review schedule, coordination and sequencing with all trades.
 - 6. Review any engineering judgments or other special requirements.
 - 7. Function and frequency of inspections and testing labs.
- G. Destructive testing shall be performed at mock up and at pre determined intervals according to ASTM E 2174 and ASTM E 2393-04 by the inspector and with the installing Contractor present. Inspector to test for in place installation conformance to tested and listed system or engineering judgment details. Non conformances will result in additional destructive testing, at the cost of the installer.

PART 2 – PRODUCTS

2.1 FIRESTOPPING, GENERAL

- A. Firestopping products specified in system design listings by approved testing agencies may be used providing they conform to the construction type, penetrant type, annular space requirements and fire rating involved in each separate assembly.
- B. Manufacturer of firestopping products shall have been successfully producing and supplying these products for a period of not less than three years and be able to show evidence of at least ten projects where similar products have been installed and accepted.
- C. Accessories: Provide components for each firestop system that is needed to install fill materials and to comply with "Performance Requirements" Article. Use only components specified by the firestopping manufacturer and by the approved testing agencies for the firestop systems indicated. Accessories include, but are not limited to the following items:
 - 1. Permanent forming/damming/backing materials, including the following:
 - a. Slag wool fiber insulation.
 - b. Foams or sealants used to prevent leakage of fill materials in liquid state.
 - c. Fire-rated form board.
 - d. Polyethylene/polyurethane backer rod.
 - e. Rigid polystyrene board.
 - 2. Temporary forming materials.
 - 3. Substrate primers.
 - 4. Steel sleeves
- D. All firestopping products and systems shall be designed and installed so that the basic sealing system will allow the full restoration of the thermal and fire resistance properties of the barrier being penetrated with minimal repair if penetrants are subsequently removed.

2.2 MIXING

- A. For those products requiring mixing before application, comply with firestopping manufacturer's written instructions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other items or procedures needed to produce products of uniform quality with optimum performance characteristics for application indicated.

2.3 MANUFACTURERS

- A. Subject to compliance with the requirements, provide products by one of the following or equivalent manufacturers:
 - 1. Grace Construction Products.
 - 2. Nelson Firestop Products.
 - 3. Hilti Firestop Products.
 - 4. A/D Fire Protection Systems Inc.
 - 5. RectorSeal Corporation (The).
 - 6. Specified Technologies Inc.
 - 7. 3M; Fire Protection Products Division.
 - 8. Tremco; Sealant/Weatherproofing Division.

PART 3 – EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
- C. Verify that all pipes, conduits, cables, and/or other items which penetrate fire-rated construction have been permanently installed prior to installation of firestops.

3.2 PREPARATION

- A. Surface Cleaning: Clean out openings immediately before installing firestop systems to comply with written recommendations of firestopping manufacturer and the following requirements:
 - 1. Remove from surfaces of opening substrates and from penetrating items foreign materials that could interfere with adhesion of firestop systems.
 - 2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with firestop systems. Remove loose particles remaining from cleaning operation.
 - 3. Remove laitance and form-release agents from concrete.

3.3 FIRESTOP SYSTEMS INSTALLATION

- A. General: Install firestop systems to comply with "Performance Requirements" article in Part 1 and firestopping manufacturer's written installation instructions and published drawings for products and applications indicated.
- B. Installation of firestopping shall be performed by an applicator/installer qualified as described in article 1.7.

- C. Apply firestopping in accordance with approved testing agencies listed system designs or manufacturer's EJ per the manufacturer's installation instructions.
- D. Verify that environmental conditions are safe and suitable for installation of firestop products.
- E. Install forming/damming/backing materials and other accessories required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire resistance ratings required.
- F. Install joint forming/damming materials and other accessories required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths of installed firestopping material relative to joint widths that allow optimum movement capability and achieve fire resistance ratings required.
- G. Install metal framing, curtain wall insulation, mechanical attachments, safing materials and firestop materials as applicable within the system design.
- H. Install fill materials for firestop systems by proven techniques to produce the following results:
 - 1. Fill voids, joints and cavities formed by openings, forming materials, accessories, and penetrating items as required to achieve fire-resistance ratings indicated.
 - 2. Apply materials so they fully contact and adhere to substrates formed by openings and penetrating items.
 - 3. For fill materials that will remain exposed after completing Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.
 - 4. Tool non-sag firestop materials after their application and prior to the time skinning begins. Use tooling agents approved by the firestopping manufacturer.
- I. On vertical pipe penetrations, lift riser clamps to permit the installation of firestopping around the entire pipe penetration. For penetrations involving fire or fire/smoke dampers, only firestop products approved by the damper manufacturer shall be installed in accordance with the damper installation instructions.

3.4 FIELD QUALITY CONTROL

- A. Inspecting Agency: Authorities Having Jurisdiction, the Owner, or Owner's Representative shall be allowed to perform random destructive testing during inspection of firestop systems to verify compliance per listings or manufacturer's installation instructions. All areas of work must be accessible until inspection by the applicable Authorities Having Jurisdiction and inspection agencies. The contractor shall be responsible to repair all tested assemblies with no cost to the owner.
- B. Proceed with enclosing firestop systems with other construction only after inspections are complete.
- C. Where deficiencies are found, repair or replace firestop systems so they comply with requirements.

3.5 CLEANING AND PROTECTION

- A. Clean off excess fill materials adjacent to openings, as Work progresses by methods and with cleaning materials that are approved in writing by firestopping manufacturer(s) and

that do not damage materials in which openings occur. Leave finished work in neat, clean condition with no evidence of spillovers or damage to adjacent surfaces.

- B. Provide final protection and maintain conditions during and after installation that ensure firestop systems are without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated firestop systems immediately and install new materials to produce firestop systems complying with specified requirements.

FIRESTOP SCHEDULE

| | | |
|----------------|--------------------------------------|---|
| Project No: | Contractor Name and Address: | Date Submitted: |
| Project Title: | Supplier/Installer Name and Address: | Company Field Advisor Name and Address: |
| | Manufacturer Name and Address: | |

| Manufacturer's Product Reference Numbers and/or Drawing Numbers | U.L., FM, Warnock Hersey or Omega Point Lab Penetration Design Nos. | Penetrating Item: Material, Size, Insulated, Combustible, Joint, Perimeter, etc. Description: | Maximum Allowable Annular Space or Maximum Size Opening | Wall type Construction | | Floor Type Construction | Fire Resistance Rating of Wall or Floor (Hourly) | F Rating | T Rating (floors Only) | L Rating (if available) | W Rating (if available) |
|---|---|---|---|------------------------|---------|-------------------------------|--|----------|------------------------|-------------------------|-------------------------|
| | | | | DE S. | CONS T. | | | | | | |
| Example No. 1 DCFSS-130 | UL #130 | Maximum 4" Steel Pipe Non-Insulated | | P4 | 6" CMU | N.A. | 1 Hour | 1 Hour | N.A. | . | |
| Example No. 2 5300-ICF88.01 | UL #591 | Maximum 4" PVC Pipe | | N.A. | N.A. | UL # D916 | 3 Hour | 1 Hour | 2 Hour | | |
| Exmple No. 3 | CW-S-2006 | Curtain Wall/Perimeter | 6" to 12" | NA | NA | 4 1/2" Reinforced LW concrete | 2 Hour | 2 Hour | NA | 1 CFM/ Lin Ft. | |
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END OF SECTION

SECTION 07 92 00 - JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Exterior polyurethane sealants.
2. Exterior polyurethane EIFS sealants.
3. Exterior and interior polyurethane traffic sealants.
4. Interior latex sealants.
5. Interior silicone food contact sealants.
6. Interior sanitary silicone sealants.
7. Metal lap joint sealants.
8. Threshold and sheet metal bedding sealants.
9. Joint accessories.

B. Related Sections:

1. Section 07 24 00 – Exterior Insulation and Finish Systems.
2. Section 08 80 00 – Glazing: Glazing sealants and protective glazing systems.

1.2 REFERENCES

A. ASTM International Inc.

1. ASTM C 510 - Standard Test Method for Staining and Color Change of Single- or Multicomponent Joint Sealants.
2. ASTM C 719 - Standard Test Method for Adhesion and Cohesion of Elastomeric Joint Sealants Under Cyclic Movement (Hockman Cycle).
3. ASTM C 794 - Standard Test Method for Adhesion-in-Peel of Elastomeric Joint Sealants.
4. ASTM C 834 - Standard Specification for Latex Sealants.
5. ASTM C 920 - Standard Specification for Elastomeric Joint Sealants.
6. ASTM C 1087 - Standard Test Method for Determining Compatibility of Liquid-Applied Sealants with Accessories Used in Structural Glazing Systems.
7. ASTM C 1193 - Standard Guide for Use of Joint Sealants.
8. ASTM C 1247 - Standard Test Method for Durability of Sealants Exposed to Continuous Immersion in Liquids.
9. ASTM C 1248 - Standard Test Method for Staining of Porous Substrate by Joint Sealants.
10. ASTM C 1311 - Standard Specification for Solvent Release Sealants.
11. ASTM D 2203 - Standard Test Method for Staining from Sealants.

1.3 SUBMITTALS

A. Shop Drawings:

1. If required, submit details to show installation and interface between sealants and adjacent work.

B. Product Data:

1. Materials list of items proposed to be provided under this Section;
2. Manufacturer's specifications and other data needed to prove compliance with the specified requirements;

- C. Samples:
 - 1. Submit color charts for each sealant type for initial selection.
 - 2. Submit standard cured color samples for each sealant type illustrating selected colors.
- D. Test Reports:
 - 1. Submit manufacturer's recommended installation procedure modifications resulting from field adhesion tests.
- E. Manufacturer's Installation Instructions:
 - 1. Submit manufacturer's published installation procedures.
 - 2. Include instructions for completing sealant intersections when different materials are joined.
 - 3. Include instructions for removing existing sealants and preparing joints for new sealant.
- F. Manufacturer's Certificate:
 - 1. Certify products are suitable for intended use and products meet or exceed specified requirements.
 - 2. Certify applicator is approved by manufacturer.
- G. Qualifications Data:
 - 1. Submit applicator's qualifications, including reference projects of similar scope and complexity, with current phone numbers and contact names of architects and owners for verification.
- H. Manufacturer's Field Reports:
 - 1. Indicate time present at project site.
 - 2. Include observations, indicate compliance with manufacturer's installation instructions, and supplemental instructions provided to installers.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data:
 - 1. Submit recommended inspection intervals.
 - 2. Submit instructions for repairing and replacing failed sealant joints.

1.5 QUALITY ASSURANCE

- A. Perform work in accordance with the following:
 - 1. Building Joints: ASTM C 1193.
 - 2. Pre-construction testing is not required when sealant manufacturer can furnish data acceptable to Architect based on previous testing for materials matching those of the Work.
- B. Field Pre-Construction Testing:
 - 1. Test each elastomeric sealant and joint substrate in accordance with the following, before beginning work of this section:

- a. Install sealants in field samples using joint preparation methods determined by laboratory pre-construction testing.
- b. Remove existing sealant, clean joint, and install new sealant using manufacturer's recommended joint preparation methods.
- c. Install field-test joints in location as approved by Architect.
- d. Test Method: Manufacturer's standard field adhesion test to verify joint preparation and primer required to obtain optimum adhesion of sealants to joint substrate.
- e. When test indicates sealant adhesion failure, modify joint preparation, primer, or both and retest until joint passes sealant adhesion test.

1.6 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum ten years documented experience.
- B. Applicator Qualifications:
 1. Company specializing in performing work of this section with minimum three years documented experience, minimum three successfully completed projects of similar scope and complexity, and approved by manufacturer.
 2. Designate one individual as project foreman who shall be on site at all times during installation.

1.7 MOCKUP

- A. Install sealants in mockups specified in other sections including sealant and joint accessories to illustrate installation quality and color.
- B. Incorporate accepted mockup as part of Work.
 1. Repair seal joint mockups used for field adhesion testing.

1.9 DELIVERY, STORAGE AND HANDLING

- A. Accept materials on site in manufacturers unopened original packaging. Inspect for damage.
- B. Store primers and sealants in cool dry location with ambient temperature range of 60-80°F (15-27°C).

1.10 ENVIRONMENTAL REQUIREMENTS

- A. Do not install primers or sealants when atmospheric temperatures or joint surface temperatures are less than 40°F (4°C).

1.11 SCHEDULING

- A. Schedule work so waterproofing, water repellents and preservative finishes are installed after sealants, unless sealant manufacturer approves otherwise in writing.
- B. Ensure sealants are cured before covering with other materials.

1.12 WARRANTY

- A. Submit signed copies of the following warranties against adhesive and cohesive failure of sealant and against infiltration of water and air through sealed joint for period of 3 years

from date of completion.

1. Manufacturer's standard warranty covering sealant materials.
2. Applicator's standard warranty covering workmanship.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Tremco Sealant/Weatherproofing Division of RPM International, Inc.
3735 Green Road
Beachwood OH 44122
Ph: 800-321-7906
Fax: 216-292-5036
Email: TSCS@tremcoinc.com
- B. Requests for substitutions will be considered in accordance with provisions of Division 01.

2.2 URETHANE SEALANTS

- A. Single Component Urethane: ASTM C 920, Type S, Grade NS, Class 35, Uses NT, M, A, O; single component, moisture curing, nonstaining, non-bleeding, color as selected. GREENGUARD Children and Schools Certified (verifiable at <http://www.greenguard.org/en/SearchResults.aspx?BrandID=10001>).
 1. Dymonic FC
- B. Single Component Self-Leveling Urethane: ASTM C 920, Type S, Grade P, Class 35; self leveling, single component, moisture curing, nonstaining, nonbleeding, color as selected.
 1. Vulkem 45SSL

2.3 SILICONE SEALANTS

- A. Single Component Silicone: ASTM C 920, Type S, Grade NS, Class 50; Uses NT, M, G, A and O: single component, neutral curing, nonstaining, nonbleeding, color as selected. GREENGUARD Children and Schools Certified (verifiable at <http://www.greenguard.org/en/SearchResults.aspx?BrandID=10001>).
 1. Spectrem 3
- B. Single Component Silicone: ASTM C 920, Type S, Grade NS, Class 25; Uses NT, G, A and O: single component, moisture curing, nonstaining, nonbleeding, color as selected. GREENGUARD Children and Schools Certified (verifiable at <http://www.greenguard.org/en/SearchResults.aspx?BrandID=10001>).
 1. Trensil 200

2.4 OTHER SEALANTS

- A. Latex Sealant: ASTM C 834; single component, solvent curing, nonstaining, nonbleeding, nonsagging; color as selected.
 1. Tremflex 834
- B. Synthetic Rubber Sealant:

1. Acoustical Sealant
- C. Butyl Sealant: ASTM C 1311, butyl or polyisobutylene, single component, nondrying, non-skinning, non-curing.

1. Butyl Sealant

2.5 ACCESSORIES

- A. Joint Cleaner: Non-corrosive and non-staining type, recommended by sealant manufacturer; compatible with joint forming materials.
- B. Primer: Non-staining type, recommended by sealant manufacturer to suit application.
- C. Joint Backing: Round foam rod compatible with sealant; oversized 25 to 50% larger than joint width; recommended by sealant manufacturer to suit application
- D. Bond Breaker: Pressure sensitive tape recommended by sealant manufacturer to suit application.
- E. Masking tape: Non-staining, non-absorbent tape product compatible with joint sealants and adjacent joint surfaces.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify substrate surfaces and joint openings are ready to receive work.
 1. Verify joint surfaces are clean and dry.
 2. Ensure concrete surfaces are fully cured.
- B. Report unsatisfactory conditions in writing to the Architect;
- C. Do not proceed until unsatisfactory conditions are corrected.

3.2 PREPARATION

- A. Prepare joints in accordance with ASTM C 1193 and manufacturer's instructions.
- B. Clean joint surfaces to remove dirt, dust, oils, wax, paints, and other contamination capable of affecting primer and sealant bond.
 1. Clean concrete joint surfaces to remove curing agents and form release agents.
- C. Protect elements surrounding the Work of this section from damage or disfiguration. Apply masking tape to adjacent surfaces when required to prevent damage to finishes from sealant installation.

3.3 EXISTING WORK

- A. Mechanically remove existing sealant.
- B. Clean joint surfaces of residual sealant and other contaminants capable of affecting sealant bond to joint surface.
- C. Allow joint surfaces to dry before installing new sealants.

3.4 SEALANT INSTALLATION

- A. Install primer and sealants in accordance with ASTM C 1193 and manufacturer's instructions.
- B. Install joint backing to maintain the following joint ratios:
 - 1. Joints up to 1/2 inch (13 mm) Wide: 1:1 width to depth ratio.
 - 2. Joints Greater than 1/2 inch (13 mm) Wide: 2:1 width to depth ratio; maximum 1/2 inch joint depth.
- C. Install bond breaker where joint backing is not used.
- D. Apply primer where required for sealant adhesion.
- E. Install sealants immediately after joint preparation.
- F. Install sealant free of air pockets, foreign embedded matter, ridges, and sags.
- G. Joining Silicone and Polyurethane Sealants:
 - 1. Install polyurethane sealants first.
 - 2. Join silicone sealant to polyurethane in accordance with manufacturer's instructions.
- H. Tool exposed joint surface concave.

3.5 MANUFACTURER'S FIELD SERVICES

- A. Require sealant manufacturer to be present at project site to:
 - 1. Observe sealant mockup installation and to issue reports of observations.
 - 2. Conduct field pre-construction testing.

3.6 CLEANING

- A. Remove masking tape.
- B. Clean adjacent surfaces soiled by sealant installation.

3.7 SCHEDULE – SEALANT JOINTS

- A. Exterior Sealant Joint [Type A]:
 - 1. Applications:
 - a. Control and expansion joints in cast-in-place concrete.
 - c. Control and expansion joints in unit masonry.
 - d. Control and expansion joints in stone masonry.
 - f. Joints between different materials listed above.
 - g. Perimeter joints between materials listed above and frames of doors, windows, storefronts, louvers and similar openings.
 - h. Control and expansion joints in soffits and overhead surfaces.
 - i. Other exterior joints in vertical surfaces and non-traffic horizontal surfaces for which no other sealant is specified.
 - 2. Single Component Urethane Sealants:
 - a. Dymonic FC

B. EIFS Sealant Joint [Type B]:

1. Applications:
 - a. Control and expansion joints.
 - b. Butt joints between prefabricated panels.
 - c. Joints between EIFS and other materials.
 - d. Perimeter joints between EIFS and frames of doors, windows, storefronts, louvers and similar openings.
 - e. Other joints within or abutting EIFS materials.
2. Single Component Urethane Sealants:
 - a. Dymonic FC
3. Single Component Silicone Sealants:
 - b. Spectrem 3

C. Interior Sealant Joint [Type C]:

1. Applications:
 - a. Control and expansion joints on exposed interior surfaces of exterior walls.
 - b. Perimeter joints on exposed interior surfaces of exterior openings.
 - c. Perimeter joints between interior wall surfaces and frames of interior doors, windows, storefronts, louvers, elevator entrances and similar openings.
 - d. Other interior joints in vertical surfaces and non-traffic horizontal surfaces subject to movement for which no other sealant is specified.
2. Single Component Urethane Sealants:
 - a. Dymonic FC
3. Other Sealants:
 - a. Tremflex 834

D. Traffic Sealant Joint [Type D]:

1. Applications:
 - a. Control, expansion and isolation joints in cast-in-place concrete.
 - b. Control, expansion and isolation joints in structural precast concrete units.
 - c. Joints between architectural precast concrete paving units.
 - d. Tile control and expansion joints.
 - e. Joints between different materials listed above.
 - f. Other interior and exterior traffic bearing joints in horizontal and sloped traffic surfaces
2. Single Component Urethane Sealants:
 - a. Vulkem 45SSL, self leveling

E. Interior Food Contact Sealant Joint [Type F]:

1. Applications:
 - a. Joints in kitchen counter tops and work surfaces.
 - b. Joints between food service equipment and surrounding construction.
 - c. Other interior joints, where incidental food contact may occur.
2. Single Component Urethane Sealants:
 - a. Dymonic FC
3. Single Component Silicone Sealants:
 - a. Tremsil 200

F. Interior Sanitary Sealant Joint [Type G]:

1. Applications:
 - a. Joints in toilet room and bathroom counter tops.
 - b. Joints between plumbing fixtures and adjacent materials.
 - c. Joints between food service equipment and surrounding construction.
 - d. Other interior joints in wet areas where needed to limit mold and mildew growth.
2. Single Component Silicone Sealants:
 - a. Tremsil 200

G. Concealed Metal Lap Sealant Joint [Type J]:

1. Applications:
 - a. Concealed lap and hook joints in sheet metal flashing and trim.
2. Single Component Non-Curing Sealants:
 - a. Tremco Butyl Sealant

H. Concealed Bedding Sealant Joint [Type K]:

1. Applications:
 - a. Bedding joints under metal thresholds and saddles.
 - b. Bedding joints between sheet metal flashing and other materials.
2. Single Component Urethane Sealants:
 - a. Dymonic FC

END OF SECTION

SECTION 08 11 13 - STEEL DOORS AND FRAMES

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Furnishing and installing all hollow metal doors, frames, and trim and related work required for the project.

1.2 RELATED SECTIONS

- A. Section 04 22 00 – Concrete Unit Masonry.
- B. Section 08 14 33 – Stile and Rail Wood Doors.
- C. Section 08 71 00 - Door Hardware.
- D. Section 08 81 00 – Glass and Glazing: Glass for door lights and borrow lights.
- E. Section 09 90 00 - Painting and Coating: Field painting of doors and frames.

1.3 REFERENCES

- A. ANSI A250.8 - SDI-100 Recommended Specifications for Standard Steel Doors and Frames; 1998.
- B. ANSI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames; 1998.
- C. ANSI A250.11, Recommended Erection Instructions for Steel Frames.
- D. ASTM A 366/A 366M - Standard Specification for Commercial Steel (CS) Sheet, Carbon, (0.15 Maximum Percent) Cold-Rolled; 1997.
- E. ASTM A 653/A 653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-coated (Galvannealed) by the Hot-Dip Process; 1998.
- F. ASTM E-90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.
- G. DHI A115.1G - Installation Guide for Doors and Hardware; 1994.
- H. NFPA 80 - Standard for Fire Doors and Windows; 1999.
- I. NFPA 252 - Standard Methods of Fire Tests for Door Assemblies; 1995.
- J. UL 10B - Standard for Fire Tests of Door Assemblies; 1997.
- K. UL 10C - Positive Pressure Fire Tests of Door Assemblies.

1.4 SUBMITTALS

- A. Submit under provisions of Division 01.
- B. Product Data: Manufacturer's data sheets on each product to be used, including:

1. Preparation instructions and recommendations.
 2. Storage and handling requirements and recommendations.
 3. Installation methods.
- C. Shop Drawings: Include schedule identifying each unit, with door marks or numbers referencing drawings. Show layout, profiles, product components and anchorages.
- D. Manufacturer's Certificates: Certify products meet or exceed specified requirements.
- E. Closeout Submittals: Provide manufacturer's maintenance instructions that include recommendations for periodic checking and adjustment of cable tension and periodic cleaning and maintenance of all railing and infill components.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Minimum five years documented experience manufacturing products specified this Section.
- B. Installer Qualifications: Minimum five years documented experience installing products specified this Section.
- C. All products shall conform to the requirements of ANSI A250.8, "SDI 100 Recommended Specifications for Standard Steel Doors and Frames".
- D. Insulated Doors shall have:
1. A "U Factor" of 0.10 for a Polyurethane core.
- E. Fire Rated Doors:
1. Doors shall be tested in accordance with UL 10B, "Fire Tests of Door Assemblies", NFPA 252, "Fire Tests of Door Assemblies", and UL 10C, "Positive Pressure Fire Tests of Door Assemblies".
 2. Doors must have an approved marking or physical label, applied by an authorized facility, in accordance with the procedure set forth by an independent certification agency.
- F. Stairwell Doors shall have a 250 degree F temperature rise rating (30 minute fire test duration.) The fire label on the door shall indicate the specific hourly rating.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Handle, store and protect products in accordance with the manufacturers printed instructions and ANSI/SDI A250.10 and NAAMM/HMMA 840.
- B. Store frames in an upright position with heads uppermost under cover. Place on 4 inch high wood sills to prevent rust and damage. Store assembled frames five units maximum in a stack with 2 inch space between frames to promote air circulation.
- C. Do not store under non-vented plastic or canvas shelters.
- D. Remove wrappers immediately if they become wet.

1.7 SEQUENCING

- A. Ensure that locating templates and other information required for installation of products

of this section are furnished to affected trades in time to prevent interruption of construction progress.

- B. Ensure that products of this section are supplied to affected trades in time to prevent interruption of construction progress.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturer: Republic Doors and Frames, which is located at:
155 Republic Dr.
McKenzie, TN 38201
Toll Free Tel: 800-733-3667
Tel: 731-352-3383
Fax: 731-352-2556
Email: request info (rbplit@republicdoor.com)
Web: www.republicdoor.com
- B. Requests for substitutions will be considered in accordance with provisions of Division 01

2.2 MATERIALS

- A. Uncoated Steel Sheet: Cold rolled commercial steel sheet complying with ASTM A 366/A 366M.

2.3 CONSTRUCTION

- A. Door and Frame Construction: Frames shall have mitered corners and other joints butted and all joints welded. Interior frames shall be 18 gauge hot or cold rolled sheet steel and match profiles indicated on the drawings. Exterior frames shall be 16 gauge zinc-coated sheet steel w/ polyurethane insulated core. Doors shall be seamless 18 gauge construction of the types indicated on the drawings. Tops of exterior doors shall be closed flush to exclude water. All exterior doors shall be zinc coated w/ polyurethane insulated core.

2.4 FINISH

- A. All doors, frames, and stick components shall be cleaned and finished in accordance with ANSI A250.10, "Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames".
- B. Preparation: Clean and phosphatize surfaces of steel doors and frames".
- C. Primer: Apply one coat of a gray, alkyd acrylic enamel primer, forced cured.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared.
- B. Verify that substrate conditions are acceptable for installation of doors and frames in accordance with manufacturer's installation instructions and technical bulletins.
- C. Verify door frame openings are installed plumb, true, and level.

- D. Select fasteners of adequate type, number, and quality to perform intended functions.
- E. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install frames plumb, level, rigid and in true alignment in accordance with ANSI A250.11, "Recommended Erection Instructions for Steel Frames" and ANSI A115.IG, "Installation Guide for Doors and Hardware".
- C. All frames other than slip-on types shall be fastened to the adjacent structure to retain their position and stability. Drywall slip-on frames shall be installed in prepared wall openings, and shall use pressure type and sill anchors to maintain stability.
- D. Where grouting is required in masonry installations, frames shall be braced or fastened to prevent the pressure of the grout from deforming the frame members. Grout shall be mixed to provide a 4 inch maximum slump and hand troweled into place. Grout mixed to a thin "pumpable" consistency shall not be used.
- E. Install fire-rated doors and frames in accordance with NFPA 80 and local code authority requirements.
- F. Install doors to maintain alignment with frames to achieve maximum operational effectiveness and appearance. Adjust to maintain perimeter clearances as required. Shim as needed to assure the proper clearances are achieved.
- G. Install hardware as specified in Section 08 71 00 in accordance with the hardware manufacturer's recommendations and templates. ANSI A115.IG, "Installation Guide for Doors and Hardware" shall be consulted for other pertinent information.

3.4 CLEARANCES

- A. Clearance between the door and frame head and jambs for both single swing and pairs of doors shall be 1/8 inch.
- B. Clearance between the meeting edges of pairs of doors shall be 3/16 inch plus or minus 1/16 inch. For fire rated applications, the clearance between the meeting edges of pairs of doors shall be 1/8 inch plus or minus 1/16 inch.
- C. Bottom clearance shall be 3/4 inch. (Standard)
- D. The clearance between the face of the door and door stop shall be 1/16 inch to 1/8 inch.
- E. All clearances shall be, unless otherwise specified, subject to a tolerance of plus or minus 1/32 inch.

3.5 ADJUSTING AND CLEANING

- A. Adjust doors for free swing without binding.
- B. Adjust hinge sets, locksets, and other hardware. Lubricate using a suitable lubricant compatible with door and frame coatings.
- C. Remove temporary coverings and protection of adjacent work areas. Repair or replace damaged installed products. Clean installed products in accordance with manufacturer's instructions before owner's acceptance.
- D. Remove from project site and legally dispose of construction debris associated with this work.

3.6 PROTECTION

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

3.7 SCHEDULES

- A. See drawings for door and frame schedules

END OF SECTION

SECTION 08 14 33 - STILE AND RAIL WOOD DOORS

PART 1 – GENERAL

1.1 SUMMARY

- A. Related Documents:
 - 1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to the work specified in this section.
- B. Section Includes:
 - 1. Stile and Rail Wood Doors
 - 2. Factory Prefitting and Premachining
- C. Related Sections
 - 1. Section 00 00 00 – Procurement and Contracting Requirements
 - 2. Section 01 00 00 – General Requirements
 - 3. Division 06 – Wood, Plastics and Composites
 - 4. Division 08 – Openings: Specialty Doors and Frames, Metal Doors and Frames, Door Hardware, Glass and Glazing
 - 5. Division 09 – Finishes

1.2 REFERENCES

- A. ASTM D-1037 –91 American Society for Testing and Materials: Standard Methods for Evaluating the Properties of Wood-Based Fiber and Particle Board Panel Materials.
- B. ANSI A208.1 – Urea-formaldehyde Emissions
- C. ASTM E 152-81a – Standard Methods of Fire Tests of Door Assemblies.
- D. WDMA I.S.6-A-07 - Window and Door Manufacturers Association.
- E. Architectural Woodwork Standards, latest edition, published jointly by the Architectural Woodwork Institute, the Architectural Woodwork Manufacturer Association of Canada, and the Woodwork Institute.
- F. NFPA 80 – Fire Doors and Windows
- G. NFPA 252 – Standard Methods of Fire Tests for fire Door Assemblies
- H. International Building Code
- I. UL10-B/ UBC – 43-2 / UBC 7-2-94 (neutral pressure) and UL10-C / UBC – 7-2-97 (positive pressure) – Fire Tests of Door Assemblies as enforced by the local authority having jurisdiction (AHJ)
- J. ITS – Certification Listings for Fire Doors
- K. ADA

1.3 SUBMITTALS

- A. Shop Drawings: Submit in accordance with Specifications. Indicate:
1. Door number
 2. Door Type
 3. Door Sizes
 4. Handing
 5. Fire rating
 - a. Neutral Pressure – UL10-B/ UBC – 43-2/ UBC – 7-2-94
 - b. Positive Pressure – UL10-C / UBC 7-2-97.
 6. Door elevations
 7. Hardware Set Numbers
 8. Details of construction
- B. Samples :
1. Submit 12” x 12” door corner samples as required by the architect showing door construction, panel and sticking details as specified.
- C. Templates: Hardware templates for hardware mounted on doors will be submitted per Specifications directly to door manufacturer immediately after acceptance of hardware schedule. Report failure to receive templates with reasonable promptness to General Contractor.
- D. Product Data: Submit door manufacturer’s product construction data including, core construction, stile and rail details, panel and sticking details and any trim or glazing details as appropriate for doors specified. Product data should indicate compliance with specifications.
- E. Quality Assurance:
1. Manufacturer : Shall be a company specializing in the manufacture of stile and rail doors specified in this section for a minimum of 10 years. All stile and rail doors specified in this section Wood and Fire doors shall be supplied and manufactured by one company. **All details including panels, sticking and profiles shall match. Plant-ons for fire doors will not be accepted.**
 2. Fire Ratings: Fire rated doors shall comply with local building codes as enforced by the AHJ. Doors shall be installed in accordance with NFPA 80. All doors shall bear the appropriate certification labels.
 3. Storage and Handling : Doors shall be stored and handled in accordance with the manufacturer’s recommendations and the WDMA – Appendix Section – “Care and Installation at Job Site”.
 - a. Doors shall be stored on a flat and level surface in a well ventilated dry building. Doors shall not be stored on edge and shall be protected from dirt, water and abuse.
 - b. Protect doors from exposure to light for veneers which are light sensitive.
 - c. Doors shall not be subjected to extreme heat or humidity. HVAC systems should be set to provide a temperature range of 60 -90 degrees F and 25-55% relative humidity.
 - d. Handle doors with clean hands or gloves. Do not drag doors across floors or other surfaces.
 - e. Each Door shall be marked with the opening number.
 4. Preinstallation Meeting
 - a. Prior to the doors being unwrapped from the factory packaging a meeting shall take place with the factory representative or the door manufacturer

and the general contractor, door distributor, installers, finishers and any other trades responsible for the handling of the doors, to review the factory Care and Handling and Finishing Instructions.

5. STC ratings shall be operable and shall have been tested and not estimated. Manufacturers shall have testing lab documentation of STC ratings.
6. Warranty: Submit in accordance with Specifications. For factory finished or prime doors, warranty shall be in effect of the Life of the Installation for interior, interior fire doors and exterior doors.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers, subject to compliance with specifications:

1. TruStile Doors, LLC.
2. Approved equal products, subject to compliance with the design and performance of this specification and as approved by owner and architect in accordance with Specifications.

2.2 DOOR CONSTRUCTION – WOOD STILE AND RAIL DOORS –

A. Description (refer to Door Schedule on Drawing A8.3 for Door Types):

1. Interior Solid Wood Doors
 - a. Interior solid wood doors to be painted. Interior doors to be Rift Cut or Quarter Sawn Poplar
2. Exterior Solid Wood Doors
 - a. Exterior solid wood doors to be painted. To be Rift Cut or Quarter Sawn Paint-Grade Walnut.
 - b. Exterior solid wood doors to be stained. To be Rift Cut or Quarter Sawn Stain-Grade Walnut.
3. Size and Panel Types: See Drawings and specifications.
4. Stile Thickness: 1-3/4”.
5. Profiles and dimensions shall be TruStile standards unless otherwise noted in the drawings and elevations.

B. Stile and Rail (Sticking) Type:

1. Custom – See details on door schedule.

C. Panel Type:

1. Custom – See details on door schedule.
2. Panels shall be constructed of solid wood to match profile specified. Panels shall float inside the sticking in true stile and rail construction. Panels shall be held in place by the sticking and flexible bumper shall be installed inside sticking to keep panel centered.
3. Panel Thickness: As indicated in TruStile specifications for panel selected or as detailed on the drawings.

D. Door Top Type:

1. Square Top

E. Stile Construction

1. Stiles to be constructed of solid wood to match details on door schedule.

2.3 FIRE RATED STILE AND RAIL DOORS

- A. Panel and Sticking types to match Wood Stile and Rail doors in every detail. **Plant ons are not acceptable.**
- B. Core: for 45, 60 and 90 minute rated doors; the core material shall allow panel profiles to match non rated doors.
- C. Stile Construction
 1. Stiles are to be constructed for improved screw holding by use of hardwood "Firewedge", 1-5/8" x 7/8" (1-3/4" doors). "Firewedge" to extend the entire height of door.
- D. Fire doors to be Category A with concealed intumescent strips where positive pressure is required by code.

2.4 FACTORY PREFITTING AND PREMACHINING

- A. Doors: Prefit and premachine doors at factory.
 1. Obtain accurate field measurements of hardware mortised in metal frames to verify dimensions and alignment before proceeding with machining in factory.
 2. Machine doors for hardware requiring cutting of doors.
 3. Comply with accepted hardware schedules, door frame shop drawings and with hardware templates to ensure proper fit of doors and hardware.
- B. Tolerances: Comply with WDMA tolerance requirements for prefitting.

2.5 DOOR FABRICATION

- A. Machining for door hardware: All doors shall be machined for specified hardware that is not surface applied.
- B. Prefit and Bevel Doors 1/8" in 2 at lock stile. Ensure proper gaps are maintained on fire doors to comply with NFPA 80 requirements.
- C. Doors shall be factory glazed with glass as specified unless otherwise indicated.

2.6 FACTORY FINISHING

- A. Wood doors to be factory prime painted.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verification of Conditions: Comply with Specifications.
 1. Before installation, verify that frames are proper size and type for door and are installed plumb and square as required for proper installation of doors.
 2. Inspect doors for any damage, manufacturing defects or prefinish
 3. Inconsistency prior to installation.

4. Notification: Notify General Contractor of unsatisfactory conditions in writing with copy to Architect.
- B. Acceptance: Beginning of work will indicate acceptance of existing conditions by installer.
- 3.2 PREPARATION
- A. Conditioning: Condition doors to average humidity in installation area prior to hanging.
 - B. Prefitting: Prefit doors to frames and machine for hardware to whatever extent not previously worked at factory as required for proper fit and uniform clearance at each edge.
 - C. Sealing: Before installation of hardware brush apply primer to all job site cut or planed surfaces.
 1. Primer: Type recommended by manufacturer.
- 3.3 INSTALLATION
- A. General: Install doors in accordance with manufacturer's recommendations and to comply with WDMA IS 1A and NFPA 80.
 1. Installation: By skilled finish carpenters or factory authorized installers.
 2. Installer: Thoroughly familiar with the requirements of the manufacturer's door warranty as currently in effect and assure compliance with all provisions.
 - B. Hanging:
 1. After sizing doors, fit for hardware as scheduled.
 2. Hang doors to be free of binding with hardware functioning properly.
- 3.4 ADJUSTING AND PROTECTION
- A. Adjustment: At completion of job, adjust doors and hardware as required and leave in proper operating condition.
 - B. Protection: Advise General Contractor of proper procedures required to protect installed wood doors from damages or deterioration until acceptance of entire project.
 - C. Replacement: Refinish or replace doors damaged during installation.
 1. Causes for Rejection: Include chips, scratches or gouges.

END OF SECTION

Section 08 30 11 – HOT-ROLLED STEEL DOORS AND FRAMES

PART 1 – GENERAL

1.1 DESCRIPTION

- A. Work included:
 - 1. Hot-rolled thermal steel triple weatherstripped swing door configurations.
 - 2. All door anchors, mullions, covers and trim.
 - 3. Factory applied finishing system.
- B. Related work specified elsewhere:
 - 1. Section 08 81 00 – Glass and Glazing
 - 2. Section 07 92 00 – Joint Sealants
 - 3. Section 05 10 00 – Structural Metal Framing

1.2 QUALITY ASSURANCE

- A. Manufacturer shall have not less than 10 years experience in the fabrication of heavy intermediate steel doors and be a member of The Steel Window Institute (SWI).
- B. Installation of doors shall be done by experienced window installers.
- C. Allowable tolerances: Size dimensions + 1/16 inch.
- D. Source quality control for out-swing doors:
 - 1. Air infiltration test
 - a. Products must be independently lab tested in accordance with ASTM E283.
 - b. Air infiltration to meet or exceed 0.30 CFM/ SQFT with differential pressure across door unit of 1.57 / 6.24 PSF.
 - 2. Water penetration test
 - a. Products must be independently lab tested in accordance with ASTM E331.
 - b. No water penetration for 15 minutes when door is subjected to a rate of flow of 5 gal./hr./sq.ft. with differential pressure across window unit of 4.50 PSF.
 - c. When weeps are required, ASTM E547 cyclic testing standard with differential pressure across door unit of 4.50 PSF shall be standard.
 - 3. Field Testing
 - a. Field testing criteria (when applicable) shall be in accordance with AAMA 502-12.
 - 4. Structural test
 - a. Meets or exceeds ASTM E330.
 - 5. Thermal performance test
 - a. Products must be independently lab tested, listed and certified for U-value performance in accordance with NFRC-100.
 - b. Products must be independently lab tested, listed and certified for solar heat gain coefficient in accordance with NFRC-200.
 - c. Products must be independently lab tested, listed and certified for air infiltration in accordance with NFRC-400.

- d. Products must be independently lab tested, listed and certified for condensation resistance performance in accordance with NFRC-500.
6. Forced entry test
 - a. Meets or exceeds ASTM F588
 - b. Grade 40 @ 300 pounds
7. Quality of finishing process shall meet or exceed the following ASTM designations:
 - a. ASTM D714- Paint Blistering Test
 - b. ASTM D4585 – Humidity Test
 - c. ASTM B117 – Salt Spray (Fog) Test
 - d. ASTM D1654 – Painted Products in Corrosive Environments
 - e. ASTM G85 – Cyclic Fog/Dry Test (Prohesion)
 - f. ASTM D5894 – Salt Fog/UV Painted Metal
 - g. ASTM D4541 – Pull off Strength of Coating Test
8. Upon request, the door manufacturer shall provide a test report from a qualified independent U.S. testing laboratory regularly engaged in testing doors to verify that products conform to test requirement as outlined.

1.3 SUBMITTALS

- A. Samples (as requested by architect):
 1. Typical 6" long door profile with glazing beads.
 2. Sample of specified muntin, showing welded intersections and glazing beads.
 3. Color sample of finish.
 4. Hardware.
- B. Shop drawings and manufacturer's literature:
 1. Submit for approval shop drawings showing door and installation details, including anchorage, fastening and recommended sealing methods.
 2. Dimensioned elevations showing door opening and door sizes.
 3. The manufacturer shall not commence any work until shop drawings have been approved.
 4. Color charts for finishes.

1.4 PRODUCT, STORAGE AND HANDLING

- A. The General Contractor shall be responsible for the protection and storage of the doors after delivery to the site.
- B. Store in designated areas in an upright position on wood slats or on a dry floor in a manner that will prevent damage. Ventilate canvas or plastic coverings to prevent humidity buildup.

1.5 WARRANTY

- A. Provide manufacturer's standard 10 year Limited Warranty.

PART 2 - PRODUCT AND FABRICATION

2.1 MANUFACTURERS

- A. Furnish all labor and materials to complete the fabrication of doors as shown on architect's drawings and as specified herein. All doors covered by this specification shall be domestically manufactured in the U.S.A.

- B. The drawings and specifications are based on catalog data, specifications and products manufactured by, Hope's Windows, Inc. and designate the type and quality of work intended under this section.

Hope's Windows, Inc.
84 Hopkin's Ave.
P.O. Box 580
Jamestown, NY 14702-0580
Phone: 716-665-5124
Email: sales@hopeswindows.com
Web: www.hopeswindows.com

- C. Requests for substitutions will be considered in accordance with provisions of Division 01.

2.2 MATERIALS

- A. Heavy intermediate triple weatherstripped doors shall be manufactured from solid hot rolled steel profiles with thermal isolator.
1. Profiles made from steel with flanges rolled integrally at the mill.
 2. Perimeter frames and ventilator profiles shall have glazing rebates providing an unobstructed glazing surface of at least 5/8".
 3. Glazing rebate surfaces must be perpendicular to the web or stem of the profile. Applied glazing rebate extensions and rebate surfaces that are tapered will not be acceptable.
 4. Combined weight of frame and door composite profiles shall be a minimum of 4.10 pounds per lineal foot. Frame composite profile alone shall not weigh less than 2.10 pounds per lineal foot.
 5. All steel profiles must be a minimum of 1-3/4" in depth.
 6. The solid hot rolled steel door profile shall have integral groove located at the exterior bedding contact for the reception of weatherstripping.
 7. The isolated composite frame shall provide two additional bedding contacts of weatherstripping to complete triple weatherstripping.
- B. Muntins
1. Simulated Divided Lite muntins
 - a. Interior/exterior muntin - Profiles shall be extruded aluminum Alloy 6063-T5 and to be selected from manufacturer's available designs..
- C. Thermal isolators shall be composite profile with a minimum wall thickness of .080 inches.
- D. Glazing beads shall be composite profile with a minimum wall thickness of .080 inches.
- E. Weatherstripping shall be extruded vinyl, EPDM closed cell sponge, flexible silicone or polyethylene clad urethane foam.
- F. All screws that are furnished by manufacturer for hardware, trim, covers, anchoring, weatherbars, water dams, screens, etc. shall be non-ferrous brass or stainless steel. Glazing bead retainer screws are plated steel.
- G. Finish:

1. Cleaning
2. Pretreatment
3. Epoxy E-Coat primer
4. Epoxy powder primer
5. Ultrathane polyurethane top coat

2.3 FABRICATION

- A. Fabricate steel doors in accordance with approved shop drawings.
- B. Prior to fabrication, all hot rolled steel sections shall be cleaned by shot blasting.
- C. Corners of frame and doors shall be mitered or coped then solidly welded. Exposed and contact surfaces shall be finished smooth flush with the adjacent surfaces. All interior and exterior rail bar and muntin joints shall be face welded and ground smooth.
- D. Lock boxes and Kickpanels
 1. Kickpanels, lock boxes and lock styles shall be custom formed to the profiles shown on the shop drawings and welded to the door leaf. Fabricate widened stile for installation of exit device. Verify kickpanel height with accessibility requirements.
- E. Muntins
 1. Simulated Divided Lite Grids:
 - a. Interior/exterior applied muntins - Profile shall be precut to meet perimeter frame. The intersections shall be milled to the extrusion profile. The muntin components shall be applied to the face of the glass with .045" VHB™ double adhesive tape after glazing.
- F. Thermal Isolators
 1. Corners shall be miter cut and gusseted into frame form.
 2. Thermal isolator frames shall be bonded to solid hot rolled steel door frame.
- G. Glazing
 1. All doors shall be designed for interior glazing.
 2. Provide replaceable continuous glazing beads to suit the glass as specified.
 3. Glazing beads shall be cut and shop fitted to each glass lite prior to shipment.
 4. Manufacturer to provide correct glazing details in accordance with the tested assembly.
- H. Weatherstrip
 1. All doors shall receive continuous triple weatherstripping that shall be applied to the interior and exterior contact surfaces of the frame and door profiles.

2.4 FACTORY FINISHING

- A. Cleaning
 1. All hot-rolled steel profiles must be acid pickled as defined by SSPC – SP8 to ensure a pristine, white metal substrate prior to fabrication.

B. Pretreatment

1. Following welding and all machining operations, hot-rolled products and accessories are subjected to the following pretreatments geared specific to projects proximity to corrosive environment. Cold-rolled, formed sheet steel components are manufactured from A60 galvanized sheet and subjected to applicable processes outlined below.
 - a. Alkaline cleaning spray
 - b. Alkaline cleaning – submersion
 - c. Water immersion rinse combo
 - d. Water immersion rinse clean
 - e. Acid immersion
 - f. Neutralizing rinse
 - g. Water immersion rinse clean
 - h. Conditioner immersion
 - i. Zinc phosphate immersion
 - j. Rinse immersion
 - k. Sealer immersion
 - l. Water reverse osmosis rinse immersion

C. Epoxy E-coat Primer

1. All pickled and pretreated frames and accessories are immersed into an electrostatic (E-coat) bath of PPG epoxy primer to ensure all substrates are encapsulated evenly and completely. Use of spray primers only will not be an acceptable alternative to this process due to benefits from additional cleaning and frame submersion.
2. Permeate spray
3. Permeate rinse
4. Epoxy primer immersion and electrostatic encapsulation
5. Water reverse osmosis rinse
6. Oven-cure, 45 minutes @ 350° F

D. Epoxy Powder Primer

1. Following pre-treatments and E-coat system, all frames and accessories shall receive an abrasion resistant powder coating prior to final top-coat.
2. Powder is applied electrostatically over cured E-coat to a dry film thickness (DFT) of 2.0-3.0 mils.
3. Parts oven baked at 325° F to completely cure prior to final top coat.
4. Powder coat is intended as an intermediate finish applied prior to the final finish top coat.

E. Ultrathane Polyurethane Top Coat

1. Following all pre-treatments, e-coat and powder abrasion layer, all products shall receive Hope's ultrathane polyurethane finish with touch-up capability, low chalking and fading characteristics, unlimited color matching, and 70,000+ standard colors, including metallics.

F. Finish Overview

1. Combined overall dry film thickness shall be a minimum of 4.6 mils (inland locations) and 7.1 mils (coastal locations).

2. Overall process shall provide full documented compliance with the following criteria:
 - a. SSPC-SP8 for acid pickling
 - b. ASTM D714-02 Paint Blistering Test
 - c. ASTM D4585 Humidity
 - d. ASTM D1654-05 Painted Products in Corrosive Environment
 - e. ASTM B117-03 Salt Spray (Fog) Test
 - f. ASTM G85 Cyclic Fog/ Dry Test (Prohesion)
 - g. ASTM D5894-96 Salt Fog/ UV Painted Metal
 - h. ASTM D4541 Pull Off Strength of Coating Test

2.5 OPERABLE HARDWARE

- A. Pivots:
 1. Aluminum-bronze pivot with stainless steel pin.
- B. Thresholds
 1. Threshold shall be as shown on drawings.
 - a. Aluminum (anodized)
- C. Single Leaf (exterior and interior operation):
 1. Steel lock box fitted with exit device and exterior trim. (See Hardware Schedule).

PART 3 – EXECUTION

3.1 INSPECTION

- A. Door openings shall conform to details, dimensions and tolerances shown on the door manufacturer's approved shop drawings.
- B. Conditions which may adversely affect the door installation must be corrected before installation commences.
- C. The wash down of the adjacent masonry or surrounding substrate must be completed before erection commences to prevent damage to the finish by the cleaning materials.

3.2 INSTALLATION

- A. Doors specified under this section shall be installed by experienced personnel.
- B. Install doors in openings in strict accordance with approved shop drawings.
 1. Set sub-sills in sealant making sure they are level in opening, install units plumb, level and true to line, without warp or rack of frames.
 2. Anchor units securely to surrounding construction with approved fasteners.
 3. The exterior joints between the doors, trim and mullions shall be properly sealed watertight with an approved sealant and neatly pointed.
- C. Attach door hardware, as required, and adjust doors to operate smoothly free from twist and to be weathertight when closed.
- D. Attach loose muntin grids per approved shop drawings, if applicable.

E. Repair any abraded areas of the factory finish.

3.3 CLEANING

A. Door installer shall leave door surfaces clean after installation and ready to receive glass and glazing. The window installer will not be responsible for final cleaning.

END OF SECTION

SECTION 08 31 00 – WALL AND CEILING ACCESS PANELS AND FRAMES

PART 1 – GENERAL

1.1 SUMMARY

- A. Section includes:
 - 1. Non-fire rated ceiling access panels.
 - 2. Rated Access Wall Door with Frame
 - 3. Related hardware and attachments.
- B. Related Sections:
 - 1. Section 06 10 00 – Rough Carpentry.
 - 2. Section 06 20 00 – Finish Carpentry.

1.2 REFERENCES

- A. NFPA 80 - Standard for Fire Doors, Fire Windows.
- B. UL - Building Materials Directory.
- C. WH - Certification Listings.

1.3 SYSTEM DESCRIPTION

- A. Design Requirements:
 - 1. Verification: Obtain specific locations and sizes for required access doors and frames from trades, including mechanical and electrical, requiring access to concealed equipment and indicate on submittal schedule.

1.4 SUBMITTALS

- A. Comply with Specifications.
- B. Shop Drawings:
 - 1. Door and panel units: Show types, elevations, thickness of metals, full size profiles of door members.
 - 2. Hardware: Show materials, finishes, locations of fasteners, types of fasteners, locations and types of operating hardware, and details of installation.
 - 3. General: Show connections of units and hardware to other Work. Include schedules showing location of each type and size of door and panel units.
- C. Product Data: Manufacturer's technical data for each type of access door and panel assembly, including setting drawings, templates, fire-resistive characteristics, finish requirements, and details of anchorage devices.
 - 1. Include complete schedule, types, locations, construction details, finishes, latching or locking provisions, and other pertinent data.
- D. Manufacturer's Installation Instructions: Indicate installation requirements and rough-in dimensions.

1.5 QUALITY ASSURANCE

- A. Comply with Specifications.
- B. Size Variations: Obtain Architect's acceptance and approval of manufacturer's standard size units that may vary slightly from sizes indicated on Drawings.
- C. Coordination: Provide inserts and anchoring devices that will be built into other Work for installation of access door assemblies. Coordinate delivery with other Work to avoid delay.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Comply with Specifications.
- B. Package and ship per manufacturer's recommendations.
- C. Store per manufacturer's instructions.
 - 1. Store in dry area out of direct sunlight.

1.7 WARRANTY

- A. Provide manufacturer's written warranty per Specifications.
- B. Warrant materials and workmanship against defects after completion and final acceptance of Work.
 - 1. Repair defects, or replace with new materials, faulty materials or workmanship developed during the guarantee period at no expense to Owner.
 - 2. Access Panel Warranty: 1 year from date of shipment.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with requirements, provide products from the following manufacturer:
Acudor Products, Inc.
80 Little Falls Rd.
Fairfield, NJ 07004
800-722-0501
Fax: 973-575-5160
www.acudor.com
email: info@acudor.com
- B. Substitutions: Comply with Specifications.
- C. Specifications and Drawings are based on manufacturer's proprietary literature from Acudor Products, Inc. Other manufacturers shall comply with minimum levels of material, color selection, and detailing indicated in Specifications or on Drawings. Architect will be sole judge of appropriateness of substitutions.

2.2 MATERIALS

- A. Commercial quality, cold steel sheet with prime coat of white baked on enamel finish.

2.3 CEILING ACCESS DOOR AND FRAME

- A. Non-rated flush upswing ceiling access doors. Acudor FW-5050-UP.
 - 1. Door: Fabricate from 16-gauge cold rolled sheet steel filled with 2" thick insulation.
 - 2. Frame: Fabricate from 16-gauge cold rolled sheet steel with trim 1" wide.
 - 3. Hinge: Concealed with coil spring for dampening.
 - 4. Latching/Locking Devices: Standard L handle operable from both sides.
 - 5. Finish: Factory standard of prime coat of white baked enamel to be field painted.
 - 6. Size: 36" x 36" Clear inside opening.

2.4 WALL ACCESS DOOR AND FRAME

- A. Rated Access Wall Doors with Frames: Acudor FB-5060-DW.
 - 1. Door: Fabricate from 16-gauge cold rolled sheet steel filled with 2" thick insulation.
 - 2. Frame: Fabricate from 16-gauge cold rolled sheet steel with trim 1" wide.
 - 3. Hinge: Concealed with coil spring for dampening.
 - 4. Latch/Locking Devices: Rim Cylinder Lock
 - 5. Finish: Factory standard of prime coat of white baked enamel to be field painted.
 - 6. Size: 22" x 30"

2.5 FABRICATION

- A. Manufacture each access panel assembly as an integral unit ready for installation.
- B. Welded construction: Furnish with a sufficient quantity of 1/4 inch mounting holes to secure access panels to types of supports indicated.
- C. Furnish number of latches required to hold door in flush, smooth plane when closed.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Comply with Specifications.
- B. Verify that rough openings for door and frame are correctly sized and located.
- C. Verify mechanical and electrical requirements for ceiling or wall access panels.

3.2 PREPARATION

- A. Advise installers of work relating to access panel installation including rough opening dimensions, locations of supports, and anchoring methods. Coordinate delivery with other work to avoid delay.

3.3 INSTALLATION

- A. Install access door and frame units per manufacturer's written instructions.
- B. Install frames plumb and level in opening. Secure rigidly in place.
- C. Position units to provide convenient access to concealed Work requiring access.

3.4 ADJUST AND CLEAN

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

END OF SECTION

SECTION 08 31 01 – HORIZONTAL FLOOR ACCESS DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

- A. Work included: Furnishing and installing factory fabricated vault access doors
- B. Related Work:
 - 1. Section 06 10 00 - Rough Carpentry
 - 2. Section 06 20 00 – Finish Carpentry

1.2 REFERENCES

- A. American Society for Testing and Materials (ASTM), 100 Bar Harbor Drive, West Conshocken, PA 19428-2959; (610) 832-9585, fax (610) 832-9555
- B. ASTM A 36-93a: Standard Specification for Structural Steel
- C. International Organization for Standardization (ISO), ISO Central Secretariat, 1, ch. de la Voie-Creuse, CP 56, CH-1211 Geneva 20, Switzerland, phone +41 22 749 01 11, fax +41 22 733 34 30
- D. ISO 9001:2008 Certified

1.3 SUBMITTALS

- A. Product Data: Provide manufacturer's product data for all materials in this specification.
 - 1. Shop Drawings: Show profiles, accessories, location, and dimensions.
- B. Samples: Manufacturer to provide upon request; sized to represent material adequately.
 - 1. Contract Closeout: Vault access door manufacturer shall provide the manufacturer's Warranty prior to the contract closeout.

1.4 PRODUCT HANDLING

- A. All materials shall be delivered in manufacturer's original packaging.
- B. Store materials in a dry, protected, well-vented area. The contractor shall thoroughly inspect product upon receipt and report damaged material immediately to delivering carrier and note such damage on the carrier's freight bill of lading.
- C. Remove protective wrapping immediately after installation.

1.5 SUBSTITUTIONS

- A. Specifications and Drawings are based on manufacturer's proprietary literature from The BILCO Company. Other manufacturers shall comply with minimum levels of material, color selection, and detailing indicated in Specifications or on Drawings. Architect will be sole judge of appropriateness of substitutions.

1.6 JOB CONDITIONS

- A. Verify that other trades with related work are complete before installing vault access door(s).
- B. Mounting surfaces shall be straight and secure; substrates shall be of proper width.
- C. Refer to the construction documents, shop drawings, and manufacturer's installation instructions.
 - 1. Observe all appropriate OSHA safety guidelines for this work.

1.7 WARRANTY/GUARANTEE

- A. Manufacturer's standard warranty: Materials shall be free of defects in material and workmanship for a period of (5) five years from the date of purchase. Should a part fail to function in normal use within this period, manufacturer shall furnish a new part at no charge. Electrical motors, special finishes, and other special equipment (if applicable) shall be warranted separately by the manufacturers of those products.
- B. Manufacturer's Quality System: Registered to ISO 9001:2008 Quality Standards including in-house engineering for product design activities.

PART 2 - PRODUCTS

2.1 MANUFACTURER

The BILCO Company
P.O. Box 1203
New Haven, CT 06505
phone: 1-203-934-6363
fax: 1-203-933-8478
Web: www.bilco.com or approved equal by other manufacturer.

2.2 ACCESS DOOR

- A. Furnish and install where indicated on plans vault access door TER, size width 24" x length 36". Length denotes hinge side. The vault access door shall be single leaf. The vault access door shall be pre-assembled from the manufacturer.
- B. Performance characteristics:
 - 1. Cover: Shall be reinforced to support a minimum live load of 150 psf with a maximum deflection of 1/150th of the span.
 - 2. Operation of the cover shall be smooth and easy with controlled operation throughout the entire arc of opening and closing.
 - 3. Operation of the cover shall not be affected by temperature.
- C. Cover shall have a 1" fillable pan to receive flush wood stage flooring material. All fill material to be furnished and installed by others in the field.
- D. Frame: Shall be 1/4" extruded aluminum with full anchor flange around the perimeter.
- E. Lifting mechanisms: Manufacturer shall provide the required number and size of compression spring operators enclosed in telescopic tubes to provide, smooth, easy, and controlled cover operation throughout the entire arc of opening and to act as a check in

retarding downward motion of the cover when closing. The upper tube shall be the outer tube to prevent accumulation of moisture, grit, and debris inside the lower tube assembly. The lower tube shall interlock with a flanged support shoe fastened to a formed 1/4" gusset support plate.

- F. A removable exterior turn/lift handle with a spring loaded ball detent shall be provided to open the latch release and shall be protected by a flush, gasketed, removable screw plug.
- G. Hardware:
 - 1. Hinges: Shall be a continuous heavy duty Type 316 stainless steel hinge that is accessible only when the cover is in the open position.
 - 2. Cover shall be equipped with an aluminum hold open arm that automatically locks the cover in the open position.
 - 3. Cover shall be fitted with the required number and size of compression spring operators. Springs shall have an electrocoated acrylic finish.
 - 4. A Type 316 stainless steel snap lock with fixed handle shall be mounted on the underside of the cover.
 - 5. Hardware: Compression spring tubes shall be an anti-corrosive composite, all fasteners shall be Type 316 stainless steel material, and all other hardware shall be zinc plated and chromate sealed.
- H. Finishes: Factory finish shall be mill finish aluminum. No bituminous coating to be applied to the exterior of the frame.

PART 3 - EXECUTION

3.2 INSPECTION

- A. Verify that the vault access door installation will not disrupt other trades. Verify that the substrate is dry, clean, and free of foreign matter. Report and correct defects prior to any installation.

3.3 INSTALLATION

- A. Submit product design drawings for review and approval to the architect or specifier before fabrication.
- B. The installer shall check as-built conditions and verify the manufacturer's vault access door details for accuracy to fit the application prior to fabrication. The installer shall comply with the vault access door manufacturer's installation instructions.
- C. The installer shall furnish mechanical fasteners consistent with the vault access door manufacturer's instructions.

END OF SECTION

SECTION 08 33 23 - OVERHEAD COILING FIRE DOORS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Overhead coiling fire service doors.

1.2 RELATED SECTIONS

- A. Section 05 50 00 - Metal Fabrications: Support framing and framed opening.
- B. Section 06 20 00 - Finish Carpentry: Wood jamb and head trim.
- C. Section 08 71 00 - Door Hardware: Product Requirements for cylinder core and keys.
- D. Section 09 90 00 – Painting and Coating: Field applied finish.

1.3 REFERENCES

- A. ASTM A 653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- B. ASTM A 666 - Standard Specification for Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
- C. ASTM A 924 - Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.
- D. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).
- E. NEMA MG 1 - Motors and Generators.
- F. NFPA-80 – Standard for Fire Doors and Fire Windows.

1.4 DESIGN / PERFORMANCE REQUIREMENTS

- A. Fire Rated Assemblies: Provide assemblies complying with NFPA 80 and listed in UL Directory or Intertek Testing Services (Warnock Hersey Listed) Directory.

1.5 SUBMITTALS

- A. Submit under provisions of Specifications.
- B. Product Data: Manufacturer's data sheets on each product to be used, including:
 - 1. Preparation instructions and recommendations.
 - 2. Storage and handling requirements and recommendations.
 - 3. Details of construction and fabrication.
 - 4. Installation methods.
- C. Shop Drawings: Include detailed plans and elevations, details of framing members, anchoring methods, clearances, hardware, and accessories.
- D. Selection Samples: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors and patterns.

- E. Verification Samples: For each finish product specified, two samples, minimum size 6 inches long, representing actual product, color, and patterns.
- F. Manufacturer's Certificates: Certify products meet or exceed specified requirements.
- G. Operation and Maintenance Data: Submit lubrication requirements and frequency, and periodic adjustments required.

1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in performing Work of this section with a minimum of five years experience.
- B. Installer Qualifications: Installer Qualifications: Company specializing in performing Work of this section with minimum three years and approved by manufacturer.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufacturer's unopened packaging until ready for installation.
- B. Protect materials from exposure to moisture. Do not deliver until after wet work is complete and dry.
- C. Store materials in a dry, warm, ventilated weathertight location.

1.8 PROJECT CONDITIONS

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.9 COORDINATION

- A. Coordinate Work with other operations and installation of adjacent materials to avoid damage to installed materials.

1.10 WARRANTY

- A. Manufacturer's Warranty: Provide manufacturer's two year limited warranty.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturer:
Overhead Door Corp.
2501 S. State Hwy. 121
Suite 200
Lewisville, TX 75067
ASD. Tel. Toll Free: (800) 275-3290
Phone: (469) 549-7100
Fax: (972) 906-1499
Web Site: www.overheaddoor.com.
E-mail: info@overheaddoor.com.

- B. Requests for substitutions will be considered in accordance with provisions of Division 01.

2.2 OVERHEAD COILING FIRE SERVICE DOORS

A. Overhead Coiling Fire service Doors: FireKing Series 631 Fire Doors.

1. Label: Provide fire doors certified with the following listing.
 - a. Rolling fire doors up to 152 sf and 13 feet 6 inches in width or height shall be labeled:
UL 1-1/2 Hour Class B Label for non-masonry, masonry and steel fire walls.
 - b. Provide UL labeled smoke protection where indicated. Comply with with UL label for "Leakage Rated Assembly" or "S" label.
 - 1) Comply with NFPA 105 air leakage requirements.
 - 2) Pass UL test procedure 1784.
2. Curtain: Interlocking roll-formed slats as specified following. Endlocks shall be attached to each end of alternate slats to prevent lateral movement.
 - a. Flat profile type F-265 for doors thru 14 feet wide by 12 feet high, fabricated of 24 gauge galvanized steel.
3. Finish:
 - a. Galvanized Steel: Slats and hood galvanized steel to ASTM A 653 finished with a rust-inhibitive roll coating process, including bonderizing, a 0.2 mils thick baked prime paint, and a 0.6 mils thick baked top coat.
 - 1) Polyester Top Coat.
 - (a) Gray polyester.
 - (b) Tan polyester.
 - (c) White polyester.
 - (d) Brown polyester.
 - (e) Non-galvanized exposed ferrous surfaces shall be black powder coated.
4. Bottom Bar: Two black powder coated structural steel angles 1-1/2 inch by 1-1/2 inch by 1/8 inch minimum.
5. Guides: Roll-formed steel shapes attached to continuous steel wall angle for doors through 12 feet wide. Three structural steel angles with minimum thickness of 3/16 inch for doors over 12 feet wide. Guides for between jamb doors shall be structural angles.
 - a. Finish: PowderGuard Weathered finish with iron/black powder.
 - b. Fastening Guides to Masonry Fire Walls: UL listed for fire in accordance with manufacturer's listing.
 - c. Fastening Guides to Masonry Fire Walls: UL listed for fire and smoke in accordance with manufacturer's listing.
 - d. Fastening Guides to Non-Masonry Fire Walls: Comply with the manufacturer's listing.
6. Brackets: To support counterbalance, curtain and hood.
 - a. Hot rolled steel with black powder coated finish.
7. Counterbalance: Helical torsion spring type housed in a steel tube or pipe barrel, supporting the curtain with deflection limited to 0.03 inch per foot of span. Counterbalance is adjustable by means of an adjusting tension wheel.
8. Hood: 24 gauge galvanized primed steel. Provide one intermediate support bracket for wall openings over 13 feet 6 inches wide.
9. Manual Operation:
 - a. Manual push.
10. Automatic Closure Standard Fire Door: UL approved release mechanism equipped with a 165 degree fusible link.

- a. Doors will be equipped with chain hoist release mechanism, requiring only one sash chain to be routed to the operated side (sash chain not required to be routed to adjusting wheel side.)
 - 1) Release mechanism includes planetary gear differential system.
 - 2) Door will close by a thermally actuated link rated @165 degrees F, or by an optional listed releasing device, or by manually activating the release handle.
 - 3) All counterbalance spring tension shall be maintained when the release mechanism is activated.
 - 4) After closing by manual activation of the release handle, the door shall be able to be reset by one person from one side of the door (re-engaging the release handle). No tools shall be required to reset the release mechanism.
 - 5) Model FSXPBB
 - (a) Voltage is universal: 24 VDC, 24 VAC and 120 VAC
 - (b) Voltage output 24 VDC
 - (c) Release time delay: Factory set at 10 seconds can be field adjusted by dipswitch settings to 20, 30 and 60 seconds.
 - (d) Can use normally open proximity switch to detect door is closed or normally open down operator down limit switch.
 - (e) Can support 2 or 4 wire smoke detector system (maximum of 4 Class B Style A detectors). Release devices are normally open contacts. Provided with 4 wire detectors when detectors are specified with an end of line relay.
 - (f) Unit has one 12 VDC battery with 24 VDC output.
 - (g) Power Loss Time delay: 72 hours.
 - (h) Unit can power an optional ADA horn/strobe 24 VDC.
 - (i) Load Rating: Support and Release 40 lbs. maximum.
 - (j) When used with and electric operator, the operator must be modified to accept wiring from Fire Sentinel.
 - (k) Box dimension: 9.7 inches high by 7.5 inches wide by 5 inches deep.
 - (l) Central Fire Alarm: Electric Release Mechanism operated from fire alarm system.
- 11. Locking:
 - a. Cylinder lock for manually operated doors.
 - 12. Wall Mounting Condition:
 - a. Between jambs mounting.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify opening sizes, tolerances and conditions are acceptable.
- B. Examine conditions of substrates, supports, and other conditions under which this work is to be performed.
- C. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

- A. Clean surfaces thoroughly prior to installation.

- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install rolling counter fire doors in compliance with requirements of NFPA 80. Test fire-release system and reset components after testing.
- C. Use anchorage devices to securely fasten assembly to wall construction and building framing without distortion or stress.
- D. Securely and rigidly brace components suspended from structure. Secure guides to structural members only.
- E. Fit and align assembly including hardware; level and plumb, to provide smooth operation.
- F. Coordinate installation of sealants and backing materials at frame perimeter as per Specifications.
- G. Install perimeter trim and closures.

3.4 ADJUSTING

- A. Test for proper operation and adjust as necessary to provide proper operation without binding or distortion.
- B. Adjust hardware and operating assemblies for smooth and noiseless operation.

3.5 CLEANING

- A. Clean curtain and components using non-abrasive materials and methods recommended by manufacturer.
- B. Remove labels and visible markings.
- C. Touch-up, repair or replace damaged products before Substantial Completion.

3.6 PROTECTION

- A. Protect installed products until completion of project.

END OF SECTION

SECTION 08 41 13 - ALUMINUM-FRAMED ENTRANCES & STOREFRONTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Aluminum Storefront, including:
 - 1. Center Set, Exterior Flush Glazed, Thermally Broken Aluminum Storefront System with Custom Painted Finish for Insulated Glazing.
- B. Related Sections:
 - 1. Sealants: Refer to Division 7 Joint Treatment Section for sealant requirements.
 - 2. Glass and Glazing: Refer to Division 8 Glass and Glazing Section for glass and glazing requirements.
 - 3. Single Source Requirement: All products listed below shall be by the same manufacturer.
 - a. Section 08 32 13 Sliding Aluminum-Framed Glass Doors.
 - b. Section 08 51 13 Aluminum Windows.

1.2 DEFINITIONS

- A. Definitions: For fenestration industry standard terminology and definitions refer to American Architectural Manufacturers Association (AAMA) – AAMA Glossary (AAMA AG).

1.3 SYSTEM PERFORMANCE DESCRIPTION

- A. Performance Requirements: Provide aluminum storefront systems that comply with performance requirement indicated, as demonstrated by testing manufacturer's assemblies in accordance with test method indicated.
 - 1. Air Infiltration: Completed storefront systems shall have 0.06 CFM/FT² maximum allowable infiltration when tested in accordance with ASTM E 283 at differential static pressure of 6.24 PSF (299 Pa).
 - 2. Water Infiltration: No uncontrolled water when tested in accordance with ASTM E 331 at test pressure differential of: 10 PSF (479 Pa) (or when required, field tested in accordance with AAMA 503). Fastener Heads must be seated and sealed against Sill Flashing on any fasteners that penetrate through the Sill Flashing.
 - 3. Wind Loads: Completed storefront system shall withstand wind pressure loads normal to wall plane indicated:
 - a. Exterior Walls:
 - 1) Positive Pressure:
 - 2) Negative Pressure:
 - b. Interior Walls (Pressure Acting in Either Direction):
 - 4. Deflection: Maximum allowable deflection in any member when tested in accordance with ASTM E 330 with allowable stress in accordance with AA Specifications for Aluminum Structures.
 - a. Without Horizontals: L/175 maximum.
 - b. With Horizontals: L/175 or L/240 + 1/4" for spans greater than 13'-6" but less than 40'-0".
 - 5. Thermal Movement: Provide for thermal movement caused by 180 degrees F. (82.2 degrees C.) surface temperature, without causing buckling stresses on glass, joint seal failure, undue stress on structural elements, damaging loads on fasteners, reduction of performance, or detrimental effects.

6. Thermal Performance: When tested in accordance with AAMA 507, AAMA 1503 and NFRC 100:
 - a. Condensation Resistance Factor (CRF_f): A minimum of 60.
 - b. Thermal Transmittance -Factor: 0.45 BTU/HR/FT²/°F or less.
7. Acoustical Performance: When tested in accordance with AAMA 1801:
 - a. Sound Transmission Class (STC) shall not be less than 35 laminated.
 - b. Outdoor–Indoor Transmission Class (OITC) shall not be less than 29 laminated.

1.4 SUBMITTALS

- A. General: Prepare, review, approve, and submit specified submittals in accordance with "Conditions of the Contract" and Division 01 Submittals Sections. Product data, shop drawings, samples, and similar submittals are defined in "Conditions of the Contract."
- B. Product Data: Submit product data for each type storefront series specified.
- C. Substitutions: Whenever substitute products are to be considered, supporting technical data, samples, and test reports must be submitted ten (10) working days prior to bid date in order to make a valid comparison.
- D. Shop Drawings: Submit shop drawings showing layout, profiles, and product components, including anchorage, accessories, finish colors and textures.
- E. Samples: Submit verification samples for colors on actual aluminum substrates indicating full color range expected in installed system.
- F. Quality Assurance / Control Submittals:
 1. Test Reports: Submit certified test reports showing compliance with specified performance characteristics and physical properties.
 2. Installer Qualification Data: Submit installer qualification data.
- G. Closeout Submittals:
 1. Warranty: Submit warranty documents specified herein.
 2. Project Record Documents: Submit project record documents for installed materials in accordance with Division 01 Project Closeout (Project Record Documents) Section.

1.5 QUALITY ASSURANCE

- A. Qualifications:
 1. Installer Qualifications: Installer experienced (as determined by contractor) to perform work of this section who has specialized in the installation of work similar to that required for this project. If requested by Owner, submit reference list of completed projects.
 2. Manufacturer Qualifications: Manufacturer capable of providing field service representation during construction process.
- B. Pre-Installation Meetings: Conduct pre-installation meeting to verify project requirements, substrate conditions, manufacturer's installation instructions, and manufacturer's warranty requirements.

1.6 PROJECT CONDITIONS / SITE CONDITIONS

- A. Field Measurements: Verify actual measurements/openings by field measurements before fabrication; show recorded measurements on shop drawings. Coordinate field measurements, fabrication schedule with construction progress to avoid construction delays.

1.7 WARRANTY

- A. Project Warranty: Refer to "Conditions of the Contract" for project warranty provisions.
- B. Manufacturer's Warranty: Submit, for Owner's acceptance, manufacturer's standard warranty document executed by an authorized company official.
 - 1. Warranty Period: Manufacturer's one (1) year standard warranty commencing on the substantial date of completion for the project provided that the warranty, in no event, shall start later than six (6) months from the date of shipment by YKK AP America Inc.

PART 2 - PRODUCTS

2.1 MANUFACTURERS (Acceptable Manufacturers/Products)

- A. The drawings and specifications are based on catalog data, specifications and products manufactured by YKK AP America Inc. and designate the type and quality of work intended under this section.

YKK AP America Inc.
270 Riverside Parkway, Suite A
Austell, GA 30168
Telephone: (678) 838-6000; Fax: (678) 838-6001

- B. Requests for substitutions will be considered in accordance with provisions of Division 01.
- C. Storefront Framing System:
 - 1. YKK AP YES 45 TU Center Set Storefront System.
 - 2. Description: Center set, exterior flush glazed; jambs and vertical mullions continuous; head, sill, intermediate horizontal attached by screw spline joinery or shear block attachment.
 - 3. Components: Manufacturer's standard extruded aluminum mullions, 90 degree corner posts, entrance door framing, and indicated shapes.
 - 4. Thermal Barrier: Provide continuous thermal barrier by means of a poured and debridged pocket consisting of a two-part, chemically curing high density polyurethane which is bonded to the aluminum by YKK ThermaBond Plus®. Systems employing non-structural thermal barriers are not acceptable.
 - 5. Pocket Filler: Install snap in pocket filler to accept ¼" non-insulated glazing where indicated on the drawings.
 - 6. Butt Glazing: Areas with 1" insulated glazing will have no intermediate vertical mullions and glass will be butt glazed with a ½" silicone caulk joint.

2.2 MATERIALS

- A. Extrusions: ASTM B 221 (ASTM B 221M), 6063-T5 Aluminum Alloy.

- B. Aluminum Sheet: Painted Finish: ASTM B 209 (ASTM B 209M), 3003-H14 Aluminum Alloy, 0.080" minimum thickness.
- C. Fasteners: Aluminum, nonmagnetic stainless steel or other materials to be non-corrosive and compatible with aluminum window members, trim hardware, anchors, and other components.
- D. Anchors, Clips, and Accessories: Aluminum, nonmagnetic stainless steel, or zinc-coated steel or iron complying with ASTM B 633 for SC 3 severe service conditions or other suitable zinc coating; provide sufficient strength to withstand design pressure indicated.
- E. Reinforcing Members: Aluminum, nonmagnetic stainless steel, or nickel/chrome-plated steel complying with ASTM B 456 for Type SC 3 severe service conditions, or zinc-coated steel or iron complying with ASTM B 633 for SC 3 severe service conditions or other suitable zinc coating; provide sufficient strength to withstand design pressure indicated.
- F. Sealant: For sealants required within fabricated storefront system, provide permanently elastic, non-shrinking, and non-migrating type recommended by sealant manufacturer for joint size and movement.
- F. Tolerances: Reference to tolerances for wall thickness and other cross-sectional dimensions of storefront members are nominal and in compliance with AA Aluminum Standards and Data.

2.3 ACCESSORIES

- A. Manufacturer's Standard Accessories:
 1. Fasteners: Zinc plated steel concealed fasteners; Hardened aluminum alloys or AISI 300 series stainless steel exposed fasteners.
 2. Glazing: Setting blocks, edge blocks, and spacers in accordance with ASTM C 864, shore durometer hardness as recommended by manufacturer; Glazing gaskets in accordance with ASTM C 864.
 3. 0.050 Aluminum Sill Flashing End Dams must have 3 point attachment.

2.4 GLAZING SYSTEMS

- A. Glass: Refer to Division 08 Glass and Glazing Section for glass materials. Storefront system to have a combination of 1" insulated and ¼" glazing.

2.5 FABRICATION

- A. Shop Assembly: Fabricate and assemble units with joints only at intersection of aluminum members with uniform hairline joints; rigidly secure, and sealed in accordance with manufacturer's recommendations.
 1. Hardware: Drill and cut to template for hardware. Reinforce frames and door stiles to receive hardware in accordance with manufacturer's recommendations.
 2. Welding: Conceal welds on aluminum members in accordance with AWS recommendations or methods recommended by manufacturer. Members showing welding bloom or discoloration on finish or material distortion will be rejected.

2.6 FINISHES AND COLORS

- A. High Performance Organic Coating Finish:

1. Type Factory applied two-coat 70% Kynar resin by Arkema or 70% Hylar resin by Solvay Solexis, fluoropolymer based coating system, Polyvinylidene Fluoride (PVF-2), applied in accordance with YKK AP procedures and meeting AAMA 2605 specifications.
 2. Colors: Selected by Architect from the following:
 - a. Custom coating color charts.
- B. Finishes Testing:
1. Apply 0.5% solution NaOH, sodium hydroxide, to small area of finished sample area; leave in place for sixty minutes; lightly wipe off NaOH; Do not clean area further.
 2. Submit samples with test area noted on each sample.

PART 3 - EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS / RECOMMENDATIONS

- A. Compliance: Comply with manufacturer's product data, including product technical bulletins, installation instructions, and product carton instructions. The latest installation manual is available at www.ykkap.com.

3.2 EXAMINATION

- A. Site Verification of Conditions: Verify conditions (which have been previously installed under other sections) are acceptable for product installation in accordance with manufacturer's instructions.

3.3 PREPARATION

- A. Adjacent Surfaces Protection: Protect adjacent work areas and finish surfaces from damage during product installation.
1. Aluminum Surface Protection: Protect aluminum surfaces from contact with lime, mortar, cement, acids, and other harmful contaminants.

3.4 INSTALLATION

- A. General: Install manufacturer's system in accordance with shop drawings, and within specified tolerances.
1. Protect aluminum members in contact with masonry, steel, concrete, or dissimilar materials using nylon pads or bituminous coating.
 2. Shim and brace aluminum system before anchoring to structure.
 3. Provide sill flashing at exterior storefront systems. Extend extruded flashing continuous with splice joints; set in continuous beads of sealant.
 4. Verify storefront system allows water entering system to be collected in gutters and wept to exterior. Verify metal joints are sealed in accordance with manufacturers installation instructions.
 5. Locate expansion mullions where indicated on reviewed shop drawings.
 6. Seal metal to metal storefront system joints using sealant recommended by system manufacturer.

3.5 FIELD QUALITY CONTROL

- A. Manufacturer's Field Services: Upon request, provide manufacturer's field service consisting of site visit for inspection of product installation in accordance with

manufacturer's instructions.

- B. Field Test: Conduct field test to determine watertightness of storefront system. Conduct test in accordance with AAMA 501.2.

3.6 ADJUSTING AND CLEANING

- A. Adjusting: Adjust swing doors for operation in accordance with manufacturer's recommendations.
- B. Cleaning: The General Contractor shall clean installed products in accordance with manufacturer's instructions prior to owner's acceptance, and remove construction debris from project site. Legally dispose of debris.
- C. Protection: The General Contractor shall protect the installed product's finish surfaces from damage during construction.

END OF SECTION

SECTION 08 50 00 - WOOD WINDOW AND DOOR RESTORATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes
 - 1. Restoring wood windows.
 - 2. Restoring wood doors.
- B. Intent of Restoration for Wood Windows: It is the specific intent of this Section to provide for complete restoration of wood windows to structural soundness, optimum operating condition, and historically consistent appearance. At completion of window restoration work, restored windows shall include all wood and metal components, glass, putty, hardware, and paint. All restored windows shall be fully operable unless determined to be undesirable by Owner or Architect. Restoration shall include stripping paint and coatings, repairing (using consolidation and patching, and dutchman repairs) and replacing all damaged and deteriorated wood elements, preparing surfaces and painting, repairing historic hardware and providing new hardware to provide full complement of hardware and reglazing with existing or historically appropriate glass. All work required to fulfill this intent shall be included as work of this Section.
- C. Intent of Restoration for Wood Doors: It is the specific intent of this Section to provide for complete restoration of wood doors to structural soundness, optimum operating condition, and excellent visual appearance. Restoration shall include removing inappropriate hardware as determined by Architect, repairing holes remaining from hardware removal (using consolidation and patching), removing glass as determined by Architect, removing deteriorated paint and preparing surfaces and painting, and providing new laminated safety glass only where required by building code. All work required to fulfill this intent shall be included as work of this Section.
- D. Related Requirements
 - 1. Section 02 42 93 - Selective Removal and Salvage
 - 2. Section 06 20 00 - Finish Carpentry
 - 3. Section 08 80 00 - Glass and Glazing
 - 4. Section 09 90 00 - Painting and Coating
 - 5. Section 12 24 13 - Roller Window Shades

1.2 QUALITY ASSURANCE

- A. Window and Door Restoration Specialist: Award wood window and door restoration work to a firm regularly engaged in restoring wood windows and doors on historic buildings that can demonstrate to Owner's satisfaction that, within previous five years, it has successfully performed and completed in a timely manner at least three projects similar in scope and type to work required on this Project involving buildings that meet one or more of the following: designated as Landmarks by local governmental authorities, buildings listed in the National Register of Historic Places, or buildings listed in a State Register of Historic Places under the direction of preservation authorities.
 - 1. Foreman: Wood window and door restoration shall be directly supervised by a full-time foreman with experience equal to or greater than that required of Window and Door Restoration Specialist. Foreman shall read and speak English fluently. Foreman shall be on site daily for duration of work of this Section. Same foreman shall remain on Project throughout work unless his performance is

- deemed unacceptable.
2. Mechanics: Wood window and door restoration shall be carried out by skilled mechanics who are thoroughly experienced with materials and methods specified and have a minimum of three years' experience with work on restoration of windows and doors of historic buildings similar to that required by this Section. In acceptance or rejection of work of this Section, no allowance will be made for workers' inattention or lack of skill.
- B. Manufacturer of New Window Elements: Cabinet shop regularly engaged in fabrication of wood millwork with at least ten years' experience in the fabrication of windows to match windows on historic buildings.
- C. Laws, Codes, and Regulations: Work of this Section shall comply with all applicable federal, state, and local laws, codes, and regulations.
- E. Referenced Standards: Work of this Section shall comply with applicable requirements and recommendations of latest editions of the documents listed herein, except as modified by more stringent requirements of the Contract Documents and of applicable laws, codes, and regulations of authorities having jurisdiction. In each case in which there is a conflict between requirements of referenced standards; requirements of laws, codes, and regulations; and requirements of this Section, the most stringent or restrictive requirement shall govern as well as the Secretary of Interior's Standards.
1. Architectural Woodwork Institute (AWI), *Architectural Woodwork Quality Standards*, latest edition. Except as otherwise indicated, provide "Premium Grade" materials and workmanship for all wood window work of this Section.
 2. U.S. Department of the Interior. National Park Service, Preservation Briefs, 9: John H. Myers, *The Repair of Historic Wooden Windows*.
- E. Sources of Materials: Obtain each type of material required for wood window and door restoration from a single source to ensure a match in quality, performance, and appearance.
- F. Knowledge of Site and Project Conditions: Before submitting bid, Bidders shall make themselves thoroughly familiar with the Drawings and Specifications, with the scope of this Project, and with all conditions at the Project site relating to requirements of this Section and limitations under which the work will be performed and shall determine or verify dimensions and quantities. Submission of a bid shall be considered conclusive evidence that Contractor is thoroughly familiar with Project requirements and site conditions and limitations.

1.3 SUBMITTALS

- A. General: Submit the following in compliance with the requirements of the Contract Documents. Revise and resubmit each item as required to obtain Architect's approval.
- B. Qualification Data: Qualification data for firms and personnel specified in "Quality Assurance" Article that demonstrates that both firm and personnel have capabilities and experience complying with requirements specified. For firms and foreman, provide a list of at least three completed projects similar in size and scope to the work required on this Project. For each project list project name, address, architect, conservator, supervising preservation agency, scope of contractor's work, and other relevant information. Submit this information with the bid.
- C. Product Data: Manufacturer's published technical data for each product to be used in work of this Section including material description, chemical composition (ingredients and proportions), physical properties, recommendations for application and use, test

reports and certificates verifying that product complies with specified requirements, and Material Safety Data Sheets (MSDS).

- D. Work Description: Detailed written description for each phase of wood window and door restoration work required by this Section. Submit new written descriptive information. Photocopies of Contract Documents, excerpts from Contract Documents, and/or duplication of text in Contract Documents will not be accepted for Work Description. Description for each condition shall include, but not be limited to:
1. Materials and Procedure: Materials, methods and procedures, tools, and equipment to be used.
 2. Protection: Description, including drawings, of proposed materials and methods of protection for preventing harm, damage, and deterioration caused by work of this Section to persons (whether involved in the Work or not), building elements, materials, and finishes, surrounding landscape and site, and the environment (including air and water).
 3. Alternate Methods and Materials (If Any): Proposed alternate methods and materials (if any) to those specified for wood window and door restoration work. Provide evidence of successful use on comparable projects and demonstrate effectiveness for use on this Project.
- F. Shop Drawings: Detailed dimensioned drawings produced from accurate examination and measurement of existing windows as specified herein. Clearly label all dimensions and identify site- and shop-confirmed dimensions. Submit newly prepared drawings showing site-verified conditions and materials. Photocopies of Contract Documents and/or electronic scans of Contract Documents will not be accepted for Shop Drawing submittals.
1. Each Window To Be Restored: Elevations showing scope of member repair (consolidation, consolidation and patching, and dutchman repair) and replacement. Indicate hardware to be restored and hardware to be replaced.
 2. Each Configuration and Size of Window: Elevation, horizontal, and vertical sections (minimum scale 1-1/2 inch equals 1 foot), profiles of each type and size of member (full-size), and details of all types of joints (full-size). Show glazing details, hardware, and methods of securing and fastening members to adjacent work.
- G. Samples: Submit the following:
1. Wood for Repair and Replacement: 6-inches wide x 12-inches long x 1-inch thick.
 2. Wood Member Profiles: 12-inch length of each profile required for repair and replacement.
 3. Window Identification Tags: Tags and tie wire.
- G. Certification: Certification by window and door restoration specialist that all wood window restoration work of this Section complies with requirements for Premium Grade work as specified in Architectural Woodwork Institute's *Architectural Woodwork Quality Standards*.

1.4 MOCK-UPS

- A. General: Before beginning general wood window and door restoration work, prepare mock-ups to provide standards for work of this Section. Do not proceed with wood window and door restoration work until Architect has approved mock-ups.
1. Locate mock-ups as directed by Architect.

2. Notify Architect 48 hours prior to start of each mock-up
3. Use crew that will execute the work and follow requirements of this Section.
4. Repeat mock-ups as necessary to obtain Architect's approval.
5. Protect approved mock-ups to ensure that they are without damage, deterioration, or alteration at time of Substantial Completion.
6. Approved mock-ups in undamaged condition at time of Substantial Completion may be incorporated into the Work.
7. Approved mock-ups will represent minimum standards for wood window and door restoration work. Subsequent wood window and door restoration work that does not meet standards of approved mock-ups will be rejected.

B. Prepare the Following Mock-Ups

1. Wood Consolidation: One location.
2. Wood Consolidation and Patching: One location.
3. Dutchman Repair within Member: One repair.
4. Dutchman Repair at End of Member: One repair.
5. Restored and Glazed Sash: One sash.
6. Restored Window: One complete unit.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle all products to avoid damage and deterioration. Remove damaged and deteriorated products from site and replace with new products complying with requirements of this Section.

1.6 PROJECT CONDITIONS

- A. Safety: Take all necessary precautions to protect all persons, whether engaged in work of this Section or not, from all hazards associated with the work of this Section.
1. Hazardous Materials: Protect all persons, whether engaged in the Work or not, from harm caused by contact with hazardous materials. Remove, handle, transport, and dispose of hazardous materials in a legal manner complying with all federal, state, and local laws, codes, and regulations.
 2. Dust: Protect all persons from dust caused by work of this Section.
- B. Protection of Buildings: Protect building elements and finishes from damage and from deterioration caused by work of this Section. Repair all damage to materials and finishes to Architect's satisfaction at no additional cost to Owner.
1. Take all necessary precautions to prevent fire and spread of fire. Do not use heat to remove paint. Keep all solvent soaked cloths in closed metal containers.
- C. Protection of Adjacent Construction and the Environment: Use all means necessary to prevent damage and deterioration caused by or resulting from work of this Section to adjacent construction and to the environment, including the atmosphere, bodies of water, and the water table.
- D. Contractor's Responsibility for Dimensions: Dimensions in Contract Documents, whether numerical, tabular, or graphic, are provided for bidding purposes and for Contractor's information and are not guaranteed. Contractor shall measure existing elements in field and in shop before preparing shop drawings or starting restoration and shall certify on shop drawings that all dimensions have been field verified. Contractor is responsible for all dimensions and for preparation of work matching existing construction.

1.7 ENVIRONMENTAL CONDITIONS

- A. General: Perform work only when temperature of products being used, temperatures of existing and new materials, and air temperature and humidity comply with product manufacturer's requirements and requirements of this Section. In case of conflict, the most stringent requirements shall govern.
- B. Use of Epoxy Resins: Mix and apply epoxy resins only when temperatures are between 50 deg F and 80 deg F.

1.8 LEAD-CONTAINING PAINT (LCP)

- A. General: Perform all work that disturbs lead-containing paint (LCP), handle all material that involves lead-containing paint, and transport and dispose of all lead-containing paint and residue in compliance with all applicable federal, state, and local laws and regulations for identification, removal, labeling, handling, containerization, transportation, and disposal of lead- containing material including, but not limited to, those referenced herein.
- B. U.S. Department of Labor OSHA Regulations: Including but not limited to: Title 29, Code of Federal Regulations (CFR) Section 1926.62: "Lead Exposure in Construction" and Title 29, CFR Section 1910.1200: "Hazard Communication Standard."
- C. U.S. Environmental Protection Agency (USEPA) Regulations: Including but not limited to: Title 40 CFR Part 262: "Standards Applicable to Generators of Hazardous Waste" and Part 263: "Standards Applicable to Transporters of Hazardous Waste."
- D. U.S. Department of Transportation (USDOT) Regulations: Including but not limited to: 49 CFR Parts 172, 173, 174, 175, 177, 178, 179, and 180.

PART 2 - PRODUCTS

2.1 WOOD

- A. General
 - 1. Grades of wood materials used in work of this Section shall be as defined by rules of recognized association of lumber manufacturers producing materials specified. Materials for millwork shall meet or exceed requirements for "Premium Grade" work as established by Architectural Woodwork Institute's *Architectural Woodwork Quality Standards*. Where conflicts occur between these standards and requirements of this Section, the more stringent or restrictive requirement shall govern in each case. Door stiles over 6'-6" in length require high-grade straighter-grade heart wood.
 - 2. Lumber shall bear grade and trademark of association under whose rules it is produced and a mark of mill identification.
 - 3. Lumber shall be of sound stock, thoroughly seasoned, and kiln-dried to a moisture content not exceeding 12 percent.
 - a. Lumber shall be solid stock without finger joints or other types of joints within individual elements.
 - 4. Work that is to be painted shall be free from defects and from blemishes on surfaces exposed to view that will show after finish coat of paint is applied. Materials that are in any way defective and not up to specifications for quality and grade, or otherwise not in proper condition, shall be rejected.

- B. Wood for Repairs, Replacements, and New Elements of Windows: Match existing specie with grade that complies with requirements of AWI's *Architectural Woodwork Quality Standards* for Premium Grade window fabrication.

2.2 ADHESIVES AND CONSOLIDANTS

- A. Adhesive for Dutchman Repairs, Member Replacement, and New Element Fabrication: Epoxy resin glue designed for use with wood and slightly flexible when dry. Provide West System as manufactured by West System, Inc., 102 Patterson Ave., Bay City, Michigan 48707 (866-937-8797), or approved equal. Provide the following materials: 105 Resin and 206 Slow Hardener.
- B. Wood Consolidation and Patching System: System of epoxy resins and fillers designed for consolidating and patching deteriorated wood. Provide West System as manufactured by West System, Inc., 102 Patterson Ave., Bay City, Michigan 48707 (866-937-8797), or approved equal. Provide the following materials as appropriate to each condition requiring patching: 105 Resin; 205 Fast Hardener; 206 Slow Hardener; 209 Extra Slow Hardener; 403 Filler: Microfibers; 406 Filler: Coloidal Silica; 407 Filler: Microballoons; and 409 Filler: Microspheres.
 - 1. General: Prepare epoxy resins using accurate measuring containers, calibrated pumps, or other means approved by Architect to ensure proper proportioning of resins and hardeners. Mix each batch in clean container without traces of cured resins. Mix components thoroughly following manufacturer's instructions. Do not mix more epoxy resin than can be applied before it thickens sufficiently to affect its use.
 - 2. Wood Consolidant: Mix resin and hardener as recommended by manufacturer to provide material of a viscosity that will thoroughly penetrate deteriorated wood.
 - 3. Wood Filler: Mix resin, hardener, and fillers as recommended by manufacturer and as determined by testing to provide appropriate properties for filling in each case. Composition of filler will vary depending on surface area of patch, depth of patch, whether patch is on vertical or horizontal surface, temperature of wood and surrounding air at time of application, and other conditions affecting action of epoxy resin and fillers. Adjust ingredients and proportions within limits recommended by manufacturer to provide optimum filler for each condition.

2.3 FASTENERS FOR WINDOW CONSTRUCTION

- A. General: Comply with requirements of referenced standards for fabrication and with millwork shop's recommendations and standard industry practices for type and size of installation fasteners.
 - 1. Use stainless steel nails and screws for window fabrication and installation.

2.4 HARDWARE

- A. Window Hardware: Provide each restored window with full complement of hardware and fasteners matching that on original windows as approved by Owner or Architect. Provide restored existing hardware insofar as possible and new, historically reproduced or Architect approved hardware to match existing hardware where hardware is missing or existing hardware is damaged or deteriorated so as to be unsalvageable.
- B. Door Hardware: Clean and lubricate existing door hardware to proper and full working order.

2.5 GLASS AND GLAZING MATERIALS

- A. Windows: Provide cleaned existing glass or where necessary historically appropriate to matched glass where existing glass is damaged and provide new glass to match.
- B. Door: Provide new laminated safety glass only in areas as required by current building codes.

2.6 MISCELLANEOUS MATERIALS

- A. Paint Removers: Comply with requirements of Section 09 90 00 – Painting and Coating.

2.7 FABRICATION OF NEW WINDOW ELEMENTS

- A. General: Work shall comply with requirements of AWI Section 1000 for “Premium Grade” work.
- B. Profiles and Dimensions: Provide window members of profiles and dimensions matching profiles and sizes of original elements or as specifically indicated otherwise on Drawings.
- C. Joinery: Fabricate joints between members to match existing joinery. Cope, miter, peg and otherwise fabricate members at joints to match original construction.

PART 3 - EXECUTION

3.1 FIELD CONDITIONS

- A. Take all necessary field measurements and verify all installation conditions prior to ordering and fabricating material.

3.2 WOOD WINDOW RESTORATION - GENERAL

- A. General: Repair all elements of windows indicated to remain and provide new elements as required to provide completely restored windows.
- B. Wood Components: Replace missing wood members and severely deteriorated wood members only upon approval of Architect. Patch holes, indentations, gouges, etc. as indicated using epoxy consolidation, epoxy wood filler, and wood dutchmen patches. Restored wood windows shall be fully intact, structurally sound windows matching original configurations.

3.3 SASH AND FRAME REMOVAL AND RESTORATION

- A. Interior Trim: Carefully remove existing wood stops at window openings as required to remove sash; label each member using approved identification system; and stack neatly in area designated by Architect. Contractor shall be responsible for safe removal and storage of wood trim. Contractor shall replace all material that is damaged or lost at no additional cost to Owner.
- B. Sash Identification: Before removing sash from the site, affix a tag to each sash to ensure that all sashes are re-installed in their same location. Tags shall be metal or plastic, engraved or embossed with the window number and sash number. Attach tag to sash with metal wire. Tag shall remain in place throughout the restoration process and shall only be removed when the restored sash is installed.

- C. Sash Preparation:
1. Remove dirt and debris from sash.
 2. Remove extraneous nails, staples, etc. from window sash.
 3. Strip all paint from sash per 09 90 00; including following any hazardous material removal requirements.
 4. Dry all wood to moisture content below 17 percent.
- D. Sash Repair Procedure: Inspect all sash components for condition. Test wood using an ice pick and moderate hand pressure to determine extent and depth of deterioration. Extent of wood deterioration shall be recorded and reported to Architect for determination of repair versus replacement. Upon direction of Architect, repair and/or replace wood elements as required to provide sound frame with all members having original planes and profiles.
1. Member Replacement: Disassemble sash as required to remove severely deteriorated components. Provide new wood members matching original members as specified in Article "Member Replacement," below.
 2. Member Repair: Repair sash members as scheduled using epoxy consolidation, epoxy consolidation and patching, and dutchman repair. Follow requirements of Article "Wood Element Restoration," below.
- E. Preparation for Finishing and Finishing: Sand all wood sash elements. Remove sanding dust and dirt using tack cloths. Finish as described in Section 09 90 00 Painting and Coating.

3.4 FRAME RESTORATION (SOUTH FAÇADE)

- A. Preparation:
4. Remove dirt and debris from frame.
 5. Remove extraneous nails, staples, etc. from window frame and wood trim.
 6. Strip all paint from frames following requirements of Section 090190 – "Paint and Coating Removal."
 4. Dry all wood to moisture content below 17 percent.
- B. Frame Repair Procedure: Inspect all frame components for condition. Test wood using an ice pick and moderate hand pressure to determine extent and depth of deterioration. Extent of wood deterioration shall be recorded and reported to Architect for determination of repair versus replacement. Upon direction of Architect, repair and/or replace wood elements as required to provide sound frame with all members having original planes and profiles.
1. Member Replacement: Disassemble frame as required to remove severely deteriorated components. Provide new wood members matching original members as specified in Article "Member Replacement," below.
 2. Member Repair: Repair frame members as scheduled using epoxy consolidation, epoxy consolidation and patching, and dutchman repair. Follow requirements of Article "Wood Element Restoration," below.
- C. Preparation for Finishing and Finishing: Sand all wood frame and trim elements. Remove sanding dust and dirt using tack cloths. Finish as described in Section 09 90 00 Painting and Coating.

3.5 INSTALLATION OF RESTORED SASH AND FRAMES

- A. General: Install restored sashes in restored, primed original frames. Ensure that sashes

are returned to their original locations.

- B. Hardware: Install sashes using restored existing hardware and new hardware matching existing hardware as described in this Section. Accurately fit and adjust hardware as required for proper operation.

3.7 PAINTING AND FINISHING

- A. Prime and paint all window exteriors, including frames, sash, and trim, and provide specified finish on all window interiors as specified in Section 09 90 00 – Painting and Coating.

3.8 SCREEN RESTORATION

- A. General: Strip paint, patch and/or replace deteriorated wood using epoxy consolidation, epoxy consolidation and patching, dutchman repair and member replacement, prepare and finish.

3.9 WOOD DOOR RESTORATION

- A. General: Restore wood door by removing glass, removing all loose and flaking paint, priming bare wood, glazing with new laminated safety glass only if required by building code, and painting.
- B. Surface Preparation and Painting: Prepare surfaces, prime, and paint to comply with requirements of Section 09 90 00 – Painting and Coating.
- C. Installation: Install restored door with cleaned and lubricated original hardware.

3.10 WOOD ELEMENT RESTORATION

- A. General: Repair wood elements using epoxy consolidation, epoxy consolidation and patching, dutchman repairs, and/or member replacement as appropriate to each individual member to ensure that sound existing material is saved and that at completion of work, all wood elements are free of rotted and deteriorated wood and solid and true to original profiles and edges.
- B. Protection: Where wood elements are restored in situ, protect surrounding building elements and surfaces from contact with epoxy resins using polyethylene sheets and tape or other approved methods. Contractor shall restore or replace building elements and surfaces damaged or deteriorated by epoxy resins to condition of elements and surfaces before work of this Section was begun at no additional cost to Owner.
- C. Epoxy Consolidation and Patching
 1. Preparation: Following paint removal to bare wood, remove dirt, dust, and other contaminants that might interfere with effectiveness of epoxy consolidation and patching using soft bristle brushes and clean oil-free compressed air.
 2. Manufacturer's Recommendations: Follow epoxy resin manufacturer's instructions for mixing of components, application temperatures, and material handling and manufacturer's recommendations for selection of resins, hardeners, and fillers for each type of consolidation and patching required.
 3. Consolidation of Deteriorated Wood: Consolidate deteriorated wood to provide sound surface. Sand to provide surface matching adjacent wood surface.
 - a. Brush apply a heavy coat of epoxy wood consolidant onto clean wood surfaces and allow it to soak into wood. Apply additional coats while

- previous coats are uncured to completely saturate deteriorated areas of wood.
- b. Thoroughly sand cured epoxy resin to provide proper surface for bond of paint without altering wood profile. (Curing time varies with ambient temperature and product used.) Sand surfaces smooth. No scratches from sanding shall be visible after wood element has been painted.
 - c. Protect epoxy resin from prolonged exposure to ultraviolet light. Apply primer within 48 hours after resin has cured.
4. Consolidation and Patching of Wood with Deterioration Less Than 3/4-Inch Deep: Consolidate deteriorated wood, fill surface to restore profile, and sand to provide surface matching adjacent wood surface.
 - a. Brush apply a heavy coat of epoxy wood consolidant onto clean wood surfaces and allow it to soak into wood. Apply an additional coat while previous coat is uncured to completely saturate deteriorated areas of wood.
 - b. Fill depressions, voids, gouges, and cracks with epoxy wood filler to restore original planes and profiles. Apply wood filler before consolidant has completely cured.
 - c. Thoroughly sand cured epoxy resin to provide proper surface for bond of paint without altering wood profile. (Curing time varies with ambient temperature and product used.) Sand surfaces smooth. No scratches from sanding shall be visible after wood element has been painted.
 - d. Protect epoxy resin from prolonged exposure to ultraviolet light. Apply primer within 48 hours after resin has cured.
 5. Consolidation and Patching of Wood with Deterioration 3/4-Inch or Greater in Depth: Prepare wood to receive consolidant, consolidate deteriorated wood, fill surface to restore profile, and sand to provide surface matching adjacent wood surface.
 - a. Drill 3/8-inch-diameter holes from surface of deteriorated wood member through deteriorated wood and into sound wood on approximately 3-inch centers. Stagger holes.
 - 1) On sills, drill from top of sill through approximately 90 percent of sill thickness.
 - b. Pour low modulus, low viscosity epoxy wood consolidant into each hole until hole has been filled. As epoxy is absorbed into wood, top off holes with epoxy until no hole will accept additional consolidant. (If the wood being treated contains water, the water will be forced out by the epoxy without affecting the procedures.)
 - c. Brush apply a heavy coat of epoxy wood consolidant on remaining weathered portions of wood element. Repeat brush application until all surfaces being treated are saturated with epoxy wood consolidant and are flush and smooth.
 - d. Fill depressions, voids, gouges, and cracks with epoxy wood filler to restore original planes and profiles. Apply wood filler before consolidant has completely cured.
 - e. Thoroughly sand cured epoxy resin to provide proper surface for bond of paint without altering wood profile. (Curing time varies with ambient temperature and product used.) Sand surfaces smooth. No scratches from sanding shall be visible after wood element has been painted.
 - f. Protect epoxy resin from prolonged exposure to ultraviolet light. Apply primer within 48 hours after resin has cured.
- D. Dutchman Repairs: Prepare substrate and provide dutchman to fill hole or replace deteriorated portion of member matching plane and profile of adjacent surface.
 1. Substrate: Neatly cut out defective wood and enough sound wood to ensure that dutchman will bond to sound substrate and to form a

prismatic void. Mortise for dutchman shall have square corners and edges. End joints shall be scarf joints.

- a. Where end of a component is to be replaced by dutchman, use interlocking diagonal scarf joint or interlocking joint (such as open mortise and tenon joint) or both for end-to-end joint between dutchman and existing wood member to provide maximum bonding surface at the joint and increase the structural strength of completed assembly.
2. Dutchman: Cut dutchman to exactly fit void with exposed portion slightly proud of adjacent original wood surface. Grain of dutchman shall run parallel to grain of existing wood member.
3. Installation: Secure dutchman with specified adhesive and clamp (or for frames, nail) in place until adhesive is set.
4. Finishing: Plane or scrape top of dutchman to match plane and profile of adjacent surface. Sand to provide uniformly smooth surface without sandpaper marks or other imperfections. Dutchman shall not be detectable to the naked eye at a distance of 3 feet after surface has been painted.

3.11 ADJUST AND CLEAN

- A. General: Within one week of date set for inspection to establish Substantial Completion, examine windows and door and adjust for optimum operation.
- B. Adjust and check each window and door and each operating item of hardware to ensure proper operation and function of every unit.
- C. Lubricate moving metal parts including pulleys and hinges with machine oil and moving wood parts with beeswax. Replace elements that cannot be adjusted and lubricated to operate freely and smoothly for the application made.
- D. Clean hardware.
- E. Clean glass.

3.12 PROTECTION

- A. Protect windows from damage and from deterioration until completion of the Contract.
- B. Protect doors from damage and from deterioration until completion of the Contract.

END OF SECTION

SECTION 08 58 10 – CUSTOM STORM WINDOWS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Removable panel storm windows for interior application.

1.2 RELATED SECTIONS

- A. Section 07 92 00 - Joint Sealants.
- B. Section 08 81 00 – Glass and Glazing.

1.3 REFERENCES

- A. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum; 1998.
- B. AAMA 2603 - Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels; 1998.

1.4 SUBMITTALS

- A. Submit under provisions of Division 01.
- B. Product Data: Manufacturer's data sheets on each product to be used, including:
 - 1. Preparation instructions and recommendations.
 - 2. Storage and handling requirements and recommendations.
 - 3. Installation methods.
- C. Shop Drawings: Show dimensions, layout, profiles and product components; details of anchoring and fastening; sealants and weather stripping; and recorded field measurements.
- D. Finish Samples: Submit color samples, for approval by Architect, that represent the allowable range of finish established from production material specified.
- E. Component Samples: If requested by Architect, submit samples of anchors, fasteners, hardware, assembled corner sections and other materials and components.
- F. Operation and Maintenance Data: Include methods for maintaining installed products and precautions against cleaning materials and methods detrimental to finishes and performance.
- G. Executed warranty documents specified.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufacturer's unopened packaging until ready for installation.
- B. Store materials protected from exposure to harmful weather conditions and at temperature conditions recommended by manufacturer.
 - 1. Store inside, if possible, in a clean, well-drained area free of dust and corrosive fumes.

2. Stack vertically or on edge so that water cannot accumulate on or within materials. Use non-staining wood or plastic shims between components to provide water drainage and air circulation.
3. Cover materials with tarpaulins or plastic hung on frames to provide air circulation.
4. Keep water away from stored assemblies.

1.6 WARRANTY

- A. Manufacturer's Warranty: Submit warranty against defects in materials and workmanship for period of 5 years from the date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturer: Allied Window, Inc., which is located at:
11111 Canal Rd.
Cincinnati, OH 45241-1861
Toll Free Tel: 800-445-5411
Tel: 513-559-1212
Fax: 513-559-1883
Email: request info (info@alliedwindow.com)
Web: www.alliedwindow.com
- B. Substitutions: Not permitted.
- C. Requests for substitutions will be considered in accordance with provisions of Division 01.

2.2 STORM WINDOWS

- A. Storm Windows - General: Provide units that fit existing windows without gaps of more than 1/8 inch in each unit.
 1. Verify actual measurements of openings by field measurement before fabrication; show recorded measurements on shop drawings.
 2. Allow for out-of-square and irregular conditions.
 3. Verify frame and sill conditions of each opening before fabrication; provide appropriate fabrication details to suit existing conditions.
- B. Removable Panel Storm Windows: Aluminum framed removable panel(s) in aluminum master frame, Allied Window One Lite (AOL).
 1. Frame Thickness: 7/16 inch.
 2. Style: Single removable panel (AOL-A).
 3. Removable Panels: Easily removable, held in place with cam-action clips providing positive seal between master frame and panel frame; with full width bottom rail lift handle.
 4. Mounting: Interior.
- C. Monumental Magnetically Attached Storm Windows: Interior mounted, aluminum framed removable panel magnetically secured and sealed at jambs and sill and in aluminum channel at head; Allied Window Monumental Magnetic One Lite (MMOL):

1. Frame Sightline: 1-3/8 inch maximum, except at meeting stiles.
2. Frame Thickness: 3/8 inch.
3. Head Channel: 1/2 inch by 5/8 inch; 0.046 inch minimum wall thickness.
4. Style: Two stacked panels with horizontal mullion supporting top panel; both panels magnetically attached.
5. Magnets: Permanent, continuous magnetic tape on panel frame.
 - a. Existing Steel Windows: Magnetically attach to steel window frame, or provide steel tape for magnet to attach to, with aluminum channel or angle for attachment to window frame.
 - b. Existing Wood Windows: Provide steel tape for magnet to attach to, with aluminum channel or angle, or steel angle, for attachment to window frame.
 - c. Existing Aluminum Windows: Provide steel tape for magnet to attach to, with aluminum channel or angle for attachment to window frame.
6. Sill: Full width heavy duty lift rail; flexible sill-seal weather stripping.

2.3 COMPONENTS

- A. Master Frame and Panel and Sash Frame Members: Extruded aluminum with wall thickness not less than 0.062 inches; miter corners and join with corner keys.
 1. Aluminum: 6063-T5 alloy and temper with minimum ultimate strength of 22,000 psi (152 MPa) and yield strength of 16,000 psi (110 MPa).
 2. Corner Keys: Extruded aluminum.
 3. Sill Expander: Where necessary to fit existing sloping sill, provide H-shaped member below master frame with weep holes.
 4. Finish: Fluoropolymer; 70 percent Kynar 500 or Hylar 5000 resin coating complying with AAMA 2604; color selected by Architect from manufacturer's range of standard colors.
- B. Screens: Extruded aluminum frame of same type of construction and finish as panel frames; screen cloth held in place with vinyl splines.
 1. Frame Dimensions: 3/8 inch thick by 1-1/16 inches wide.
- C. Type: Annealed float glass with Low-E pyrolytic hard coating.
 1. Thickness: 3/16 inch.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared.
- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION

- A. Install in accordance with manufacturer's instructions.

3.4 PROTECTION

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

END OF SECTION

Section 08 71 00 - DOOR HARDWARE

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. Mechanical door hardware for the following:
 - a. Swinging doors.
 - 2. Cylinders for door hardware specified in other Sections.
 - 3. Electrified door hardware.
- B. Related Sections:
 - 1. Section 08 11 13 "Steel Doors and Frames"
 - 2. Section 08 14 33 "Stile and Rail Wood Doors"
 - 3. Section 08 31 13 "Access Doors and Frames" including cylinders.
 - 4. Section 08 33 23 "Overhead Coiling Doors"
 - 5. Section 08 41 13 "Aluminum-Framed Entrances and Storefronts" for installation of entrance door hardware, including cylinders.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction and installation details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Shop Drawings: Details of electrified door hardware, indicating the following:
 - 1. Wiring Diagrams: For power, signal, and control wiring and including the following:
 - a. Details of interface of electrified door hardware and building safety and security systems.
 - 2. Operation Narrative: Describe the operation of doors controlled by electrified door hardware.
- C. Samples for Verification: For exposed door hardware of each type required, in each finish specified, prepared on Samples of size indicated below. Tag Samples with full description for coordination with the door hardware schedule. Submit Samples before, or concurrent with, submission of door hardware schedule.
 - 1. Sample Size: Full-size units or minimum 2-by-4-inch Samples for sheet and 4-inch long Samples for other products.
 - a. Full-size Samples will be returned to Contractor. Units that are acceptable and remain undamaged through submittal, review, and field comparison process may, after final check of operation, be incorporated into the Work, within limitations of keying requirements.
- D. Other Action Submittals:

1. Door Hardware Schedule: Prepared by or under the supervision of Installer, detailing fabrication and assembly of door hardware, as well as installation procedures and diagrams. Coordinate final door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
 - a. Submittal Sequence: Submit door hardware schedule concurrent with submissions of Product Data, Samples, and Shop Drawings. Coordinate submission of door hardware schedule with scheduling requirements of other work to facilitate the fabrication of other work that is critical in Project construction schedule.
 - b. Format: Use same scheduling sequence and format and use same door numbers as in the Contract Documents.
 - c. Content: Include the following information:
 - 1) Identification number, location, hand, fire rating, size, and material of each door and frame.
 - 2) Locations of each door hardware set, cross-referenced to Drawings on floor plans and to door and frame schedule.
 - 3) Complete designations, including name and manufacturer, type, style, function, size, quantity, function, and finish of each door hardware product.
 - 4) Description of electrified door hardware sequences of operation and interfaces with other building control systems.
 - 5) Fastenings and other pertinent information.
 - 6) Explanation of abbreviations, symbols, and codes contained in schedule.
 - 7) Mounting locations for door hardware.
 - 8) List of related door devices specified in other Sections for each door and frame.
2. Keying Schedule: Prepared by or under the supervision of Installer, detailing Owner's final keying instructions for locks. Include schematic keying diagram and index each key set to unique door designations that are coordinated with the Contract Documents.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Product Certificates: For electrified door hardware, from the manufacturer.
 1. Certify that door hardware approved for use on types and sizes of labeled fire-rated doors complies with listed fire-rated door assemblies.
- C. Warranty: Special warranty specified in this Section.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For each type of door hardware to include in maintenance manuals. Include final hardware and keying schedule.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: Supplier of products and an employer of workers trained and approved by product manufacturers and an Architectural Hardware Consultant who is available during the course of the Work to consult with Contractor, Architect, and Owner about door hardware and keying.

1. Warehousing Facilities: In Project's vicinity.
 2. Scheduling Responsibility: Preparation of door hardware and keying schedules.
 3. Engineering Responsibility: Preparation of data for electrified door hardware, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.
 4. Architectural Hardware Consultant Qualifications: A person who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project and who is currently certified by DHI:
 5. For door hardware, an Architectural Hardware Consultant (AHC) who is also an Electrified Hardware Consultant (EHC).
- B. Source Limitations: Obtain each type of door hardware from a single manufacturer.
- C. Fire-Rated Door Assemblies: Where fire-rated door assemblies are indicated, provide door hardware rated for use in assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C, unless otherwise indicated.
- D. Smoke- and Draft-Control Door Assemblies: Where smoke- and draft-control door assemblies are required, provide door hardware that meet requirements of assemblies tested according to UL 1784 and installed in compliance with NFPA 105.
1. Air Leakage Rate: Maximum air leakage of 0.3 cfm/sq. ft. at the tested pressure differential of 0.3-inch wg of water.
- E. Electrified Door Hardware: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.
- F. Means of Egress Doors: Latches do not require more than 15 lbf to release the latch. Locks do not require use of a key, tool, or special knowledge for operation.
- G. Accessibility Requirements: For door hardware on doors in an accessible route, comply with ICC/ANSI A117.1.
1. Provide operating devices that do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than 5 lbf.
 2. Comply with the following maximum opening-force requirements:
 - a. Interior, Non-Fire-Rated Hinged Doors: 5 lbf applied perpendicular to door.
 - b. Sliding or Folding Doors: 5 lbf applied parallel to door at latch.
 - c. Fire Doors: Minimum opening force allowable by authorities having jurisdiction.
 3. Bevel raised thresholds with a slope of not more than 1:2. Provide thresholds not more than 1/2 inch high.
 4. Adjust door closer sweep periods so that, from an open position of 70 degrees, the door will take at least 3 seconds to move to a point 3 inches from the latch, measured to the leading edge of the door.
 5. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 6. Inspect and discuss preparatory work performed by other trades.
 7. Inspect and discuss electrical roughing-in for electrified door hardware.
 8. Review sequence of operation for each type of electrified door hardware.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Inventory door hardware on receipt and provide secure lock-up for door hardware delivered to Project site.
- B. Tag each item or package separately with identification coordinated with the final door hardware schedule, and include installation instructions, templates, and necessary fasteners with each item or package.
- C. Deliver keys and permanent cores to Owner by registered mail or overnight package service.

1.8 COORDINATION

- A. Coordinate layout and installation of floor-recessed door hardware with floor construction.
- B. Installation Templates: Distribute for doors, frames, and other work specified to be factory prepared. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.
- C. Security: Coordinate installation of door hardware, keying, and access control with Owner's security consultant.
- D. Electrical System Roughing-In: Coordinate layout and installation of electrified door hardware with connections to power supplies and building safety and security systems.
- E. Existing Openings: Where hardware components are scheduled for application to existing construction or where modifications to existing door hardware are required, field verify existing conditions and coordinate installation of door hardware to suit opening conditions and to provide proper door operation.

1.9 MAINTENANCE SERVICE

- A. Maintenance Tools and Instructions: Furnish a complete set of any specialized tools and maintenance instructions for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

PART 2 - PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

- A. Provide door hardware for each door as scheduled in Part 3 "Door Hardware Schedule" Article to comply with requirements in this Section.
 - 1. Door Hardware Sets: Provide item, size, finish or color indicated, and named manufacturers' products or products equivalent in function and comparable in quality to named products.
 - 2. Sequence of Operation: Provide electrified door hardware function, sequence of operation, and interface with other building control systems indicated.
- B. Designations: Requirements for design, grade, function, finish, size, and other distinctive qualities of each type of door hardware are indicated in Part 3 "Door Hardware Schedule" Article. Products are identified by using door hardware designations, as follows:
 - 1. Named Manufacturers' Products: Manufacturer and product designation are listed for each door hardware type required for the purpose of establishing

minimum requirements. Manufacturers' names are abbreviated in Part 3 "Door Hardware Schedule" Article.

2.2 HINGES

- A. Hinges: BHMA A156.1. Provide template-produced hinges for hinges installed on hollow-metal doors, wood doors, and hollow-metal frames.
1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated in schedule or comparable product by one of the following:
 - a. Hager Companies.
 - b. McKinney Products Company; an ASSA ABLOY Group company.
 2. Description:
 - a. Bearings are to be fully hardened.
 - b. Bearing shell is to consistent shape with barrel.
 - c. Minimum of 2 permanently lubricated non-detachable bearings on standard weight hinges and 4 permanently lubricated bearing on heavy weight hinges.
 - d. Equip with easily seated, non-rising pins.
 - e. Non Removable Pin screws shall be slotted stainless steel screws.
 - f. Hinges shall be full polished, front, back, and barrel.
 - g. Hinge pin is to be fully plated.
 - h. Bearing assembly is to be installed after plating.
 - i. Sufficient size to allow 180-degree swing of door.
 - j. Furnish five knuckles or three knuckles with flush ball bearings as listed in schedule.
 - k. Provide hinge type as listed in schedule.
 - l. Furnish 3 hinges per leaf to 7 foot - 6 inch height. Add one to each additional 30 inches in height, or fraction thereof.
 - m. Tested and approved by BHMA for all applicable ANSI Standards for type, size, function, and finish.
 - n. UL10C listed for fire.

2.3 SELF-CLOSING HINGES

- A. Self-Closing Hinges: BHMA A156.17.
1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated in schedule or comparable product by one of the following:
 - a. Hager Companies.
 - b. McKinney Products Company; an ASSA ABLOY Group company.

2.4 CENTER-HUNG AND OFFSET PIVOTS

- A. Center-Hung and Offset Pivots: BHMA A156.4.
1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on schedule or comparable product by one of the following:
 - a. DORMA Architectural Hardware; Member of The DORMA Group North America.
 - b. Rixson Specialty Door Controls; an ASSA ABLOY Group company.
- B. Pin-and-Barrel-Type Hinges:
1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated in schedule or comparable product by one of the following:
 - a. Hager Companies.

- b. Markar Architectural Products, Inc.; a subsidiary of Adams Rite Manufacturing Co.
2. Description:
- a. Tested and approved by BHMA for ANSI A156.26-1996 Grade 1.
 - b. Fabricated from 14 gauge material.
 - c. UL and ULC listed for fire-rated 4 ft x 8 ft single doors and 8 ft x 8 ft pairs up to 3 hour.
 - d. Slim barrel design.
 - e. Twin nylon self lubricating bearing located between all knuckles except top and bottom.
 - f. Two stainless steel bearings top and bottom, to prevent sagging if nylon bearings degrade during a fire.
 - g. Limited lifetime warranty.

2.5 MECHANICAL LOCKS AND LATCHES

- A. Lock Functions: As indicated in door hardware schedule.
- B. Lock Throw: Comply with testing requirements for length of bolts required for labeled fire doors, and as follows:
 - 1. Bored Locks: Grade 1 minimum 1/2-inch latchbolt throw.
 - a. Tested and approved by BHMA for ANSI A156.2, Series 4000, Operational Grade 1, Extra-Heavy Duty, and be UL/cUL Listed (3 hours).
 - b. ANSI A117.1 Accessibility Code (ADA Compliant).
 - c. UL/cUL listed (3 hours) for "A" label single door applications, 4 ft x 8 ft.
 - d. UL10C/UBC 7-2 (1997) positive pressure rated.
 - e. UL10B pressure rated.
 - f. Standard clutching mechanism for resistance for damage caused by physical force.
 - g. Thru-bolted design and heavy-duty spring tension.
 - h. Backset: 2 3/4 inch.
 - 2. Cylindrical Locks & Tubular Levers: Grade 2 minimum 1/2 inch bolt throw.
 - a. Tested and approved by BHMA for ANSI A 156.2, Series 4000, Grade 2.
 - b. UL/cUL listed (3 hours) for "A" label single door applications, 4 ft x 8 ft.
 - c. Fits modified ANSI A115.3 door preparation.
 - d. Backset: 2 3/4 inch.
 - 3. Mortise Locks: Minimum 3/4-inch latchbolt throw.
 - a. ANSI/BHMA A156.13-Grade 1
 - b. Fit ANSI A115.1 door preparation
 - c. Functions and designs as indicated in the hardware groups
 - d. Three-piece anti-friction latchbolt 3/4 inch throw.
 - e. 1 inch stainless steel dead bolt with 1 inch throw.
 - f. Thru-bolt design and heavy duty spring tension to prevent lever sag.
 - g. UL10C/UBC 7-2 (1997) Positive pressure Rated.
 - h. UL10B Pressure Rated.
 - i. Pre-assembled trims and spring loaded spindles automatically adjusts to door thickness.
 - j. Mortise case is field reversible.
- C. Lock Trim:
 - 1. Description: As indicated in the hardware sets.
- D. Strikes: Provide manufacturer's standard strike for each lock bolt or latchbolt complying with requirements indicated for applicable lock or latch and with strike box and curved lip extended to protect frame; finished to match lock or latch.

1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
 2. Extra-Long-Lip Strikes: For locks used on frames with applied wood casing trim.
 3. Aluminum-Frame Strike Box: Manufacturer's special strike box fabricated for aluminum framing.
 4. Rabbet Front and Strike: Provide on locksets for rabbeted meeting stiles.
- E. Bored Locks: BHMA A156.2; Grade 1 Series 4000.
1. Basis-of-Design Product: Subject to compliance with requirements, provide product as indicated on schedule or comparable product by one of the following:
 - a. Arrow USA; an ASSA ABLOY Group company.
 - b. Best Access Systems; Div. of Stanley Security Solutions, Inc.
 - c. Corbin Russwin Architectural Hardware; n ASSA ABLOY Group Company.
 - d. SARGENT Manufacturing Company; an ASSA ABLOY Group company.
 - e. Schlage Commercial Lock Division; an Ingersoll-Rand company.
- F. Mortise Locks: BHMA A156.13; Operational Grade 1; stamped steel case with steel or brass parts; Series 1000.
1. Basis-of-Design Product: Subject to compliance with requirements, provide product as indicated on schedule or comparable product by one of the following:
 - a. Arrow USA; an ASSA ABLOY Group company.
 - b. Best Access Systems; Div. of Stanley Security Solutions, Inc.
 - c. Corbin Russwin Architectural Hardware; an ASSA ABLOY Group company.
 - d. SARGENT Manufacturing Company; an ASSA ABLOY Group company.
 - e. Schlage Commercial Lock Division; an Ingersoll-Rand company.

2.6 AUXILIARY LOCKS

- A. Mortise Auxiliary Locks: BHMA A156.5; Grade 1; with strike that suits frame.
1. Basis-of-Design Product: Subject to compliance with requirements, provide product as indicated on schedule or comparable product by another manufacturer.

2.7 ELECTRIC STRIKES

- A. Electric Strikes: BHMA A156.31; Grade 1 with faceplate to suit lock and frame.
1. Basis-of-Design Product: Subject to compliance with requirements, provide comparable product by one of the following:
 - a. Adams Rite Manufacturing Co.; an ASSA ABLOY Group company.
 - b. Dortronics Systems, Inc.
 - c. DynaLock Corp.
 - d. Folger Adam Electric Door Controls; an ASSA ABLOY Group company.
 - e. HES, Inc.; an ASSA ABLOY Group company.
 - f. Rutherford Controls Int'l. Corp.
 - g. Security Door Controls.
 - h. Trine Access Technology.
 - i. Von Duprin; an Ingersoll-Rand company.

2.8 MANUAL FLUSH BOLTS

- A. Manual Flush Bolts: BHMA A156.16; minimum 3/4-inch throw; designed for mortising into door edge.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide product as indicated on schedule or comparable product by one of the following:
 - a. Adams Rite Manufacturing Co.; an ASSA ABLOY Group company.
 - b. Burns Manufacturing Incorporated.
 - c. Don-Jo Mfg., Inc.
 - d. Door Controls International, Inc.
 - e. Hiawatha, Inc.
 - f. IVES Hardware; an Ingersoll-Rand company.
 - g. Trimco.

2.9 EXIT DEVICES AND AUXILIARY ITEMS

- A. Exit Devices and Auxiliary Items: BHMA A156.3.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide product as indicated on schedule or comparable product by one of the following:
 - a. Corbin Russwin Architectural Hardware; an ASSA ABLOY Group company.
 - b. Monarch Exit Devices & Panic Hardware; an Ingersoll-Rand company.
 - c. Precision Hardware, Inc.; Division of Stanley Security Solutions, Inc.
 - d. SARGENT Manufacturing Company; an ASSA ABLOY Group company.
 - e. Von Duprin; an Ingersoll-Rand company.
 - f. Yale Security Inc.; an ASSA ABLOY Group company.
 - 2. Description:
 - a. Tested and approved by BHMA for ANSI 156.3, Grade 1.
 - b. Provide deadlocking latchbolt.
 - c. Touchpad shall be "T" style.
 - d. Exposed components shall be of architectural metals and finish.
 - e. Lever design shall match lockset lever design.
 - f. Provide strikes as required by application.
 - g. UL/cUL listed (3 hours) for "A" label single door application, 4 ft x 8 ft.
 - h. UL listed for Accident Hazard.
 - i. Shall consist of a cross bar or push pad, the actuating portion of which extends across, shall not less than one half the width of the door leaf.
 - j. Head cap and end cap - Zinc die-cast.

2.10 LOCK CYLINDERS

- A. Lock Cylinders: Tumbler type, constructed from brass or bronze, stainless steel, or nickel silver.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide product as indicated on schedule or comparable product by one of the following:
 - a. Arrow USA; an ASSA ABLOY Group company.
 - b. Best Access Systems; Div. of Stanley Security Solutions, Inc.
 - c. Corbin Russwin Architectural Hardware; an ASSA ABLOY Group company.
 - d. SARGENT Manufacturing Company; an ASSA ABLOY Group company.
 - e. Schlage Commercial Lock Division; an Ingersoll-Rand company.
- B. Standard Lock Cylinders: BHMA A156.5; Grade 1.

- C. Construction Master Keys: Provide cylinders with feature that permits voiding of construction keys without cylinder removal. Provide 10 construction master keys.

2.11 KEYING

- A. Keying System: Factory registered, complying with guidelines in BHMA A156.28, Appendix A. Incorporate decisions made in keying conference. Verify with owners requirements.
 - 1. Master Key System: Change keys and a master key operate cylinders.
- B. Keys:
 - 1. Stamping: Permanently inscribe each key with a visual key control number and include the following notation:
 - a. Notation: Information to be furnished by Owner.
 - 2. Quantity: In addition to one extra key blank for each lock, provide the following:
 - a. Cylinder Change Keys: Three.
 - b. Master Keys: Five.

2.12 KEY CONTROL SYSTEM

- A. Key Control Cabinet: BHMA A156.5; metal cabinet with baked-enamel finish; containing key-holding hooks, labels, 2 sets of key tags with self-locking key holders, key-gathering envelopes, and temporary and permanent markers; with key capacity of 150 percent of the number of locks.
 - 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. American Key Boxes and Cabinets.
 - b. GE Security, Inc.
 - c. HPC, Inc.
 - d. Lund Equipment Co., Inc.
 - e. MMF Industries.
 - f. Tri Palm International.
 - 2. Wall-Mounted Cabinet: Cabinet with hinged-panel door equipped with key-holding panels and pin-tumbler cylinder door lock.
- B. Key Lock Boxes: (As indicated in Door Schedule) Designed for storage of two keys.
 - 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. GE Security, Inc.
 - b. HPC, Inc.
 - c. Knox Company.

2.13 OPERATING TRIM

- A. Operating Trim: BHMA A156.6; as indicated.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on schedule or comparable product by one of the following:
 - a. Burns Manufacturing Incorporated.
 - b. Don-Jo Mfg., Inc.
 - c. Forms + Surfaces.

- d. Hager Companies.
- e. Hiawatha, Inc.
- f. IVES Hardware; an Ingersoll-Rand company.
- g. Rockwood Manufacturing Company.
- h. Trimco.

2.14 SURFACE CLOSERS

- A. Surface Closers: BHMA A156.4; rack-and-pinion hydraulic type with adjustable sweep and latch speeds controlled by key-operated valves and forged-steel main arm. Comply with manufacturer's written recommendations for size of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Provide factory-sized closers, adjustable to meet field conditions and requirements for opening force.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on schedule or comparable product by one of the following:
 - a. Corbin Russwin Architectural Hardware; an ASSA ABLOY Group company.
 - b. LCN Closers; an Ingersoll-Rand company.
 - c. Norton Door Controls; an ASSA ABLOY Group company.
 - d. Rixson.
 - 2. Description:
 - a. Tested and approved by BHMA for ANSI 156.4, Grade 1 heavy duty or standard duty.
 - b. UL10C and UL10B certified.
 - c. Conforming to ANSI 117.1.
 - d. Mount closers on non-public side of door, unless otherwise noted.
 - e. Provide adapter plates, shim spacers, and blade stop spacers as required by frame and door conditions.
 - f. Closers shall be non-handed, non-sized, and multi-sized.

2.15 CONCEALED CLOSERS

- A. Concealed Closers: BHMA A156.4; rack-and-pinion hydraulic type with adjustable sweep and latch speeds controlled by key-operated valves. Comply with manufacturer's written recommendations for size of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Provide factory-sized closers, adjustable to meet field conditions and requirements for opening force.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on schedule or comparable product by one of the following:
 - a. LCN Closers; an Ingersoll-Rand company.
 - b. Norton Door Controls; an ASSA ABLOY Group company.
 - c. Rixson Specialty Door Controls; an ASSA ABLOY Group company.
 - d. SARGENT Manufacturing Company; an ASSA ABLOY Group company.

2.16 CLOSER HOLDER RELEASE DEVICES

- A. Closer Holder Release Devices: BHMA A156.15; Grade 1; closer connected with separate or integral releasing and fire- or smoke-detecting devices. Door shall become self-closing on interruption of signal to release device. Automatic release is activated by smoke detection system.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on schedule or comparable product by one of the following:
 - a. Corbin Russwin Architectural Hardware; an ASSA ABLOY Group company.

- b. DORMA Architectural Hardware; Member of The DORMA Group North America.
- c. LCN Closers; an Ingersoll-Rand company.
- d. Norton Door Controls; an ASSA ABLOY Group company.
- e. Rixson Specialty Door Controls; an ASSA ABLOY Group company.
- f. SARGENT Manufacturing Company; an ASSA ABLOY Group company.

2.17 MECHANICAL STOPS AND HOLDERS

- A. Wall- and Floor-Mounted Stops: BHMA A156.16; Base metal as indicated.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on schedule or comparable product by one of the following:
 - a. Architectural Builders Hardware Mfg., Inc.
 - b. Baldwin Hardware Corporation.
 - c. Burns Manufacturing Incorporated.
 - d. Cal-Royal Products, Inc.
 - e. Don-Jo Mfg., Inc.
 - f. Door Controls International, Inc.
 - g. Hager Companies.
 - h. Hiawatha, Inc.
 - i. IVES Hardware; an Ingersoll-Rand company.
 - j. Rockwood Manufacturing Company.
 - k. Stanley Commercial Hardware; Div. of The Stanley Works.
 - l. Trimco.

2.18 ELECTROMAGNETIC STOPS AND HOLDERS

- A. Electromagnetic Door Holders: BHMA A156.15, Grade 1; wall-mounted electromagnetic single unit with strike plate attached to swinging door; coordinated with fire detectors and interface with fire alarm system for labeled fire-rated door assemblies.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on schedule or comparable product by one of the following:
 - a. Architectural Builders Hardware Mfg., Inc.
 - b. DORMA Architectural Hardware; Member of The DORMA Group North America.
 - c. SARGENT Manufacturing Company; an ASSA ABLOY Group company.
 - d. Rixson

2.19 DOOR GASKETING

- A. Door Gasketing: BHMA A156.22; air leakage not to exceed 0.50 cfm per foot of crack length for gasketing other than for smoke control, as tested according to ASTM E 283; with resilient or flexible seal strips that are easily replaceable and readily available from stocks maintained by manufacturer.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on schedule or comparable product by one of the following:
 - a. Hager Companies.
 - b. M-D Building Products, Inc.
 - c. National Guard Products.
 - d. Pemko Manufacturing Co.; an ASSA ABLOY Group company.
 - e. Reese Enterprises, Inc.
 - f. Sealeze; a unit of Jason Incorporated.
 - g. Zero International.

2.20 THRESHOLDS

- A. Thresholds: BHMA A156.21; fabricated to full width of opening indicated.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Hager Companies.
 - b. M-D Building Products, Inc.
 - c. National Guard Products.
 - d. Pemko Manufacturing Co.; an ASSA ABLOY Group company.
 - e. Reese Enterprises, Inc.
 - f. Rixson Specialty Door Controls; an ASSA ABLOY Group company.
 - g. Sealeze; a unit of Jason Incorporated.
 - h. Zero International.

2.21 METAL PROTECTIVE TRIM UNITS

- A. Metal Protective Trim Units: BHMA A156.6; fabricated from 0.050-inch- thick metal as indicated with manufacturer's standard machine or self-tapping screw fasteners.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on schedule or comparable product by one of the following:
 - a. Baldwin Hardware Corporation.
 - b. Burns Manufacturing Incorporated.
 - c. Don-Jo Mfg., Inc.
 - d. Hiawatha, Inc.
 - e. IPC Door and Wall Protection Systems, Inc.; Div. of InPro Corporation.
 - f. IVES Hardware; an Ingersoll-Rand company.
 - g. Pawling Corporation.
 - h. Rockwood Manufacturing Company.
 - i. Trimco.

2.22 AUXILIARY DOOR HARDWARE

- A. Auxiliary Hardware: BHMA A156.16.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on schedule or comparable product by one of the following:
 - a. Baldwin Hardware Corporation.
 - b. Cal-Royal Products, Inc.
 - c. Don-Jo Mfg., Inc.
 - d. Hager Companies.
 - e. Rockwood Manufacturing Company.
 - f. Stanley Commercial Hardware; Div. of The Stanley Works.
 - g. Trimco.

2.23 AUXILIARY ELECTRIFIED DOOR HARDWARE

- A. Auxiliary Electrified Door Hardware:
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on schedule or comparable product by one of the following:
 - a. DynaLock Corp.
 - b. GE Security, Inc.
 - c. SARGENT Manufacturing Company; an ASSA ABLOY Group company.

- d. Schlage Commercial Lock Division; an Ingersoll-Rand company.
- e. Securitron Magnalock Corporation; an ASSA ABLOY Group company.
- f. Security Door Controls.

2.24 FABRICATION

- A. Base Metals: Produce door hardware units of base metal indicated, fabricated by forming method indicated, using manufacturer's standard metal alloy, composition, temper, and hardness. Furnish metals of a quality equal to or greater than that of specified door hardware units and BHMA A156.18.
- B. Fasteners: Provide door hardware manufactured to comply with published templates prepared for machine, wood, and sheet metal screws. Provide screws that comply with commercially recognized industry standards for application intended, except aluminum fasteners are not permitted. Provide Phillips flat-head screws with finished heads to match surface of door hardware, unless otherwise indicated.
 - 1. Concealed Fasteners: For door hardware units that are exposed when door is closed, except for units already specified with concealed fasteners. Do not use through bolts for installation where bolt head or nut on opposite face is exposed unless it is the only means of securely attaching the door hardware. Where through bolts are used on hollow door and frame construction, provide sleeves for each through bolt.
 - 2. Fire-Rated Applications:
 - a. Wood or Machine Screws: For the following:
 - 1) Hinges mortised to doors or frames; use threaded-to-the-head wood screws for wood doors and frames.
 - 2) Strike plates to frames.
 - 3) Closers to doors and frames.
 - b. Steel Through Bolts: For the following unless door blocking is provided:
 - 1) Surface hinges to doors.
 - 2) Closers to doors and frames.
 - 3) Surface-mounted exit devices.
 - 3. Spacers or Sex Bolts: For through bolting of hollow-metal doors.
 - 4. Fasteners for Wood Doors: Comply with requirements in DHI WDHS.2, "Recommended Fasteners for Wood Doors."
 - 5. Gasketing Fasteners: Provide noncorrosive fasteners for exterior applications and elsewhere as indicated.

2.25 FINISHES

- A. Provide finishes complying with BHMA A156.18 as indicated in door hardware schedule.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire-rated door assembly construction, wall and floor construction, and other conditions affecting performance.
- B. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Steel Doors and Frames: For surface applied door hardware, drill and tap doors and frames according to ANSI/SDI A250.6.
- B. Wood Doors: Comply with DHI WDHS.5 "Recommended Hardware Reinforcement Locations for Mineral Core Wood Flush Doors."

3.3 INSTALLATION

- A. Mounting Heights: Mount door hardware units at heights to comply with the following unless otherwise indicated or required to comply with governing regulations.
 - 1. Standard Steel Doors and Frames: ANSI/SDI A250.8.
 - 2. Custom Steel Doors and Frames: HMMA 831.
 - 3. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."
- B. Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing. Do not install surface-mounted items until finishes have been completed on substrates involved.
 - 1. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.
 - 2. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.
- C. Hinges: Install types and in quantities indicated in door hardware schedule but not fewer than the number recommended by manufacturer for application indicated or one hinge for every 30 inches of door height, whichever is more stringent, unless other equivalent means of support for door, such as spring hinges or pivots, are provided.
- D. Intermediate Offset Pivots: Where offset pivots are indicated, provide intermediate offset pivots in quantities indicated in door hardware schedule but not fewer than one intermediate offset pivot per door and one additional intermediate offset pivot for every 30 inches of door height greater than 90 inches.
- E. Lock Cylinders: Install construction cores to secure building and areas during construction period.
 - 1. Replace construction cores with permanent interchangeable cores in keyway as directed by owner.

- F. Key Control System: Tag keys and place them on markers and hooks in key control system cabinet, as determined by final keying schedule.
- G. Boxed Power Supplies: Locate power supplies as indicated or, if not indicated, above accessible ceilings or equipment rooms. Verify location with Architect.
 - 1. Configuration: Provide least number of power supplies required to adequately serve doors with electrified door hardware.
- H. Thresholds: Set thresholds for exterior doors and other doors indicated in full bed of sealant complying with requirements specified in Section 07 92 00 "Joint Sealants."
- I. Stops: Provide stops for doors as indicated in door hardware schedule. Do not mount floor stops where they will impede traffic.
- J. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.
- K. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.
- L. Door Bottoms: Apply to bottom of door, forming seal with threshold when door is closed.

3.4 FIELD QUALITY CONTROL

- A. Independent Architectural Hardware Consultant: Will inspect door hardware and state in each report whether installed work complies with or deviates from requirements, including whether door hardware is properly installed and adjusted.

3.5 ADJUSTING

- A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.
 - 1. Spring Hinges: Adjust to achieve positive latching when door is allowed to close freely from an open position of 30 degrees.
 - 2. Electric Strikes: Adjust horizontal and vertical alignment of keeper to properly engage lock bolt.
 - 3. Door Closers: Adjust sweep period to comply with accessibility requirements and requirements of authorities having jurisdiction.

3.6 CLEANING AND PROTECTION

- A. Clean adjacent surfaces soiled by door hardware installation.
- B. Clean operating items as necessary to restore proper function and finish.
- C. Provide final protection and maintain conditions that ensure that door hardware is without damage or deterioration at time of Substantial Completion.

HARDWARE SCHEDULE

Door hardware is based on the following manufacturers:

Butts – Stanley
Locksets – PDQ/Baldwin Entrance
Exterior Mortise Locksets & Trim – Baldwin
Deadlocks – Adams Rite
Concealed Closers - Rixon
Closers/Operators – Dorma
Exit Devices – Dorma
Electro Mag Holders – Rixon
Weatherstrip/Thresholds/Sweeps – NGP
Stops/Bolts/Push-Pulls- Rockwood
Exterior Gate Hardware – DAC Industries
DA Spring Hinges – Bommer

NOTE: All cylinders to be removable core (IC). Verify keyway with owner.

HARDWARE SET #1 (101B)

(Weatherstripping by Aluminum Storefront Mfg)
3.0 pr. Butts FBB199x41/2x41/2xUS10B
2.0 Closers AW0608xNx690x613
1.0 Deadlock MS1850SNx313
1.0 Strike 4001x313
2.0 Set Push/Pull 11147xUS10B
1.0 Set Flush Bolts 557xUS10B
1.0 Set Astragal
Weatherstrip 144PDKB
1.0 Threshold See Door Schedule
2.0 Door Bottom Seal 116NDKB
1.0 Cylinder 4036ICx313
1.0 Thumbturn 4066x313

HARDWARE SET #2 (101A, 101C)

(Weatherstripping by Aluminum Storefront Mfg)
1.5 pr. Butts FBB199x41/2x41/2xUS10B
1.0 Closer AW0608xNx690x613
1.0 Deadlock MS1850SNx313
1.0 Strike 4000x313
1.0 Set Push/Pull 11147xUS10B
1.0 Threshold See Door Schedule
1.0 Door Bottom Seal 116NDKB
1.0 Cylinder 4036ICx313
1.0 Thumbturn 4066x313

HARDWARE SET #3 (102A, 104A,104C)

3.0 pr Butts FBB199x41/2x41/2xUS10B
1.0 Entrance Trim 6552.102
1.0 Full Dummy Trim 6552DM.102.
1.0 Mortise Lock 6075.102
1.0 Door Strike As Required
1.0 Cylinder IC As Required
2.0 Closers 8616xAF86PxUS10BxFMC
1.0 Set Flush Bolts 557xUS10B
2.0 Door Stops 409xUS10B As Required
1.0 Set Astragal
Weatherstrip 144PDKB
1.0 Set Weatherstrip 284Q
1.0 Threshold See Door Schedule
2.0 Door Bottom Seal 116NDKB

HARDWARE SET #4 (102B)

1.5 pr Butts FBB191x41/2x41/2xUS10B
1.0 Closer 8616xAF86PxUS10BxFMC
1.0 Deadlock MS1850SNx313
1.0 Strike 4001x313
1.0 Set Weatherstrip 284Q
1.0 Threshold See Door Schedule
1.0 Door Bottom Seal 116NDKB
1.0 Cylinder 4036x313
1.0 Thumbturn 4066x313

HARDWARE SET #5 (103A)

(Glass Door Hardware) See Glazing Specifications
1.0 Set Push/Pull 11147xUS32D
1.0 Floor Closer BTS75VBFxUS26D

HARDWARE SET #6 (102C,103B,103C)

| | |
|-------------------|------------------------|
| 1.5 pr. Butts | FBB199x41/2x41/2xUS10B |
| 1.0 Closer | AW0608xNx690x613 |
| 1.0 Deadlock | MS1850SNx313 |
| 1.0 Strike | 4000x313 |
| 1.0 Set Push/Pull | 11147xUS10B |
| 1.0 Cylinder | 4036ICx313 |
| 1.0 Thumbturn | 4066x313 |
| 1.0 Door Stop | As required x US10B |

HARDWARE SET #7 (104B Reception Window)

(Sliding Glass Hardware) See Glazing Specifications

HARDWARE SET #8 (105B)

| | |
|----------------------|----------------------|
| 1.5 pr Butts | F179x41/2x41/2xUS10B |
| 1.0 Closer | 7414xARPx690xFC |
| 1.0 Fire Exit Device | F9308xYC08xUS10B |
| 1.0 Door Stop | 409xUS10B |

HARDWARE SET #8A (105A, 105C)

| | |
|----------------------|------------------------|
| 1.5 pr Butts | FBB191x41/2x41/2xUS10B |
| 1.0 Lockset | GT116xBSNxUS10B |
| 1.0 Closer | 7414xARPx690xFC |
| 1.0 Door Stop | As Required x US10B |
| 1.0 Set Weatherstrip | 5025B |
| 1.0 Threshold | See Door Schedule |
| 1.0 Door Sweep | 196DKB |

HARDWARE SET #9 (105D)

| | |
|------------------------|---------------------|
| 1.5 pr DA Spring Hinge | 3029-6x4-1/2x640 |
| 2.0 Push Plates | 71ExUS10B 6"x16" |
| 2.0 Kickplates | K1062xUS10B 12"x34" |

HARDWARE SET #10 (Exterior Gate 105E)

(Note: All Hardware to be Black Finish)

| | |
|--------------------------|----------------------------|
| 1.0 Set Gate Hinges | Self Closing Spring Hinges |
| 1.0 Exit Device Gate Kit | 6045-S36 |
| 1.0 Outside Trim Kit | 6100-S |

HARDWARE SET #11 (109D, 106A)

| | |
|---------------|------------------------|
| 1.5 Butts | FBB179x41/2x41/2xUS10B |
| 1.0 Lockset | GT148xBSNxUS10B |
| 1.0 Closer | 8616xAF86PxUS10BxFMC |
| 1.0 Door Stop | 409xUS10B |

HARDWARE SET #12 (107A, 108A, 204A)

| | |
|----------------|------------------------|
| 1.5 pr Butts | FBB179x41/2x41/2xUS10B |
| 1.0 Pull Plate | 111x70CxUS10B |
| 1.0 Push Plate | 70CxUS10B |
| 1.0 Closer | 8616xAF86PxUS10BxFMC |
| 1.0 Door Stop | 409xUS10B |

HARDWARE SET #13 (109A)

(Glass Door Hardware) See Glazing Specifications

| | |
|-------------------|-----------------|
| 2.0 Floor Closers | BTS80FEMBxUS26D |
|-------------------|-----------------|

HARDWARE SET #14 (109B)

| | |
|----------------------|------------------------|
| 3.0 pr Butts | FBB199x41/2x41/2xUS10B |
| 2.0 Exit Devices | 9108xYC08xUS10B |
| 2.0 Top Strike | 419xUS10B |
| 2.0 Bottom Strike | As Required |
| 2.0 Closers | 8616xAF86PxUS10BxFMC |
| 2.0 Door Stops | As RequiredxUS10B |
| 1.0 Set Weatherstrip | 284Q |
| 1.0 Set Astragal | |
| Weatherstrip | 144PDKB |
| 1.0 Threshold | See Door Schedule |
| 2.0 Door Bottom Seal | 116NDKB |

HARDWARE SET #15 (109E)

| | |
|--------------------|------------------------|
| 1.5 pr Butts | FBB179x41/2x41/2xUS10B |
| 1.0 Lockset | GT148xBSNxUS10B |
| 1.0 Closer | 8616xAF86PxUS10BxFMC |
| 1.0 Door Stops | 409xUS10B |
| 1.0 Mag. Hold Open | 998x120Vx690 |

HARDWARE SET #16 (202A)

| | |
|----------------------|------------------------|
| 1.5 pr Butts | FBB191x41/2x41/2xUS10B |
| 1.0 Exit Device | 9308xYC08xUS10B |
| 1.0 Closer | 8616xAR86PxUS10BxFMC |
| 1.0 Door Stop | As RequiredxUS10B |
| 1.0 Set Weatherstrip | As Required |
| 1.0 Threshold | See Door Schedule |

HARDWARE SET #17 (202B)

| | |
|-----------------|------------------------|
| 1.5 pr Butts | FBB179x41/2x41/2xUS10B |
| 1.0 Exit Device | 9308xYC08xUS10B |
| 1.0 Closers | 8616xAR86PxUS10BxFMC |
| 1.0 Door Stop | 409xUS10B |

HARDWARE SET #18 (203A)

2.0 pr. Butts FBB168x41/2x6xUS10B
 Note: Verify hinge size required for door to swing clear. Restore existing Mortise Lockset for appearance.

HARDWARE SET #19 (203B)

| | |
|----------------|------------------------|
| 1.5 pr. Butts | FBB179x41/2x41/2xUS10B |
| 1.0 Lockset | SX115xBSNxUS10B |
| 1.0 Closer | 7414xARPx695xFC |
| 1.0 Floor Stop | 442x10B |

HARDWARE SET #20 (203C)

Existing Door -(All equip./power supplies/
relays/wall switches/etc. to make complete
functional system)

1.0 Door Operator ED900TxSWx689
1.0 Elect. Strike As Required

HARDWARE SET #21 (109C)

(Glass Door Hardware) See Glazing Specifica-
tions

1.0 Set Push/Pull 11147xUS32D
1.0 Floor Closer BTS75VBFxUS26D

HARDWARE SET #22 (205A)

1.5 pr Butts F179x41/2x41/2xUS10B
1.0 Lockset GT176xBSNxUS10B
1.0 Door Stop 409xUS10B

HARDWARE SET #23 (302A)

1.5 pr. Butts FBB179x41/2x41/2xUS10B
1.0 Closer 8616xAF86PxUS10BxFMC
1.0 Lockset GT137xBSNxUS10B
1.0 Set Weatherstrip 5025B
1.0 Threshold See Door Schedule
1.0 Door Sweep 198DKB

END OF SECTION

SECTION 08 80 00 - GLASS AND GLAZING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

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

1.2 DESCRIPTION OF WORK:

- A. Furnish all labor, materials and equipment necessary to complete all glass and glazing work as indicated on the drawings and specified herein.

1.3 REFERENCES:

- A. ASCE-7-98 – Minimum Design Loads for Buildings and other Structures.
- B. ANSI Z97.1 - Safety Performance Specifications and Methods of Test for Safety Glazing Used in Buildings.
- C. ASTM C-162 – Standard Terminology of Glass and Glass Products.
- D. ASTM C864 – Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers.
- E. ASTM C920 – Standard Specification for Elastomeric Joint Sealants.
- F. ASTM C1036 – Standard Specification for Flat Glass.
- G. ASTM C1048 – Standard Specification for Heat-Treated Flat Glass - Kind HS, Kind FT Coated and Uncoated Glass.
- H. ASTM C1172 – Standard Specification for Laminated Architectural Safety Glass.
- I. ASTM E84 – Standard Test Method for Surface Burning Characteristics of Building Materials.
- J. ASTM E152 – Methods for Fire Test of Door Assemblies.
- K. ASTM E283 – Standard Test Method For Rate of Air leakage Through Exterior Windows, Curtain Walls and Doors.
- L. ASTM E330 – Standard Test Method for Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.
- M. FGMA - Glazing Manual.
- N. FGMA - Sealant Manual.
- O. Laminators Safety Glass Association - Standards Manual.
- P. CPSC 16 CFR 1201 Safety Standards for Architectural Glazing Materials.

- Q. NFPA 80 – Fire Doors and Windows.
- R. NFPA 252 – Fire Test of Doors Assemblies.
- S. NFPA 257 – Fire Test of Window Assemblies

1.4 LABELS:

- A. Glass shall bear labels indicating the manufacturer, type and thickness. Do not remove labels until inspected and approved.
- B. All safety glass shall have at least a temporary (permanent is preferred) label indicating manufacturer, type, thickness, and compliance with CPSC 16 CFR 1201 or ANSI Z97.1.
- C. If temporary label, label is to remain on glass until Inspection is complete, then removed and turned over to the owner.

1.5 GLASS BREAKAGE:

- A. The glazing subcontractor shall be responsible for all glass broken, scratched, damaged or defective and shall replace same at his expense.

1.6 SUBMITTALS:

- A. Manufacturer's Data:
 - 1. Submit five copies of manufacturer's specifications, and installation instruction for each type of glass, glazing sealant and compound, gasket and associated miscellaneous material required.
 - 2. Include manufacturer's published data, or letter of certification, or certified test laboratory report indicating that each material complies with the requirements and is intended generally for the applications shown.
 - 3. Show by transmittal that the Glazer distributed one copy of each recommendation and instruction.
 - 4. If Safety glass, provide two copies of manufacturer certification of the glass meeting the requirements of CPSC 16 CFR 1201.
- B. Samples: Submit two-samples 12" x 12" in size illustrating glass coloration.

1.7 QUALITY ASSURANCE

- A. Perform Work in accordance with FGMA Glazing Manual, FGMA Sealant Manual, SIGMA and Laminators Safety Glass Association - Standards Manual for glazing installation methods.
- B. Installer Qualifications: Company specializing in performing the work of this section with minimum five years documented experience.

1.8 WARRANTY

- A. Provide a ten year warranty to include coverage for sealed glass units from seal failure.

- B. Provide a ten year warranty to include coverage for delamination of laminated glass and replacement.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Tempered Glass: Glass to be heat-strengthened by Manufacturer's standard process (after cutting to final size), to achieve a flexural strength of four times normal glass strength; provide temp glass where required by code, generally 4' horizontally from doors and within 18" of floor to comply with Federal Specification DD-6-1403, or as scheduled.

2.2 GLASS TYPES: (Referenced on Drawings)

- A. Interior Window Glazing: Aluminum Frames

- 1. 1/4" Tempered Glass: ASTM C1048, Kind FT fully tempered, Condition A uncoated, Type 1 transparent flat, Class 1 clear, Quality q3 glazing select; conforming to ANSI Z97.1. Silicone Butt Glazed.

- B. Exterior Window and Door Glazing: Aluminum Frames & Steel Door System

- 1. 1" Insulating-Glass Units: Clear units and Acid Etched Translucent units. Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified according to ASTM E 2190, and complying with other requirements specified.
 - a. Sealing System: Dual seal.
 - b. Manufacturer's standard spacer material and construction

- C. Interior Glass Wall and Door Systems

- 1. 3/8" Tempered Glass: ASTM C1048, Kind FT fully tempered, Condition A uncoated, Type 1 transparent flat, Class 1 clear, Quality q3 glazing select; conforming to ANSI Z97.1. Polished edges.

- D. Miscellaneous Glazing in Interior Doors:

- 1. 1/4" Tempered Glass: ASTM C1048, Kind FT fully tempered, Condition A uncoated, Type 1 transparent flat, Class 1 clear, Quality q3 glazing select; conforming to ANSI Z97.1.
- 2. 1/4" Laminated Glass: ASTM C 1172, and complying with testing requirements in 16 CFR 1201 for Category II materials, and with other requirements specified. Use materials that have a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after fabrication and installation.
- 3. 1/4" Acid Etched Translucent Glass: ASTM C 1036, Type I, Quality-Q3, Class I, and complying with other requirements specified.
 - a. Glass: Clear float.
 - b. Etching Type: Classic Etching One Side
- 4. 3/16" Fire Protection Rated Glazing: Monolithic Clear Ceramic flat glass listed and labeled by a testing agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 252 for door assemblies.

- E. 1/2" Insulated Glass for Exterior Doors

- 1. Spacer bar to be black

- F. Glazing in Millwork: 1/4" clear, tempered glass.

- G. Provide and install glass mirrors as indicated on plans, minimum thickness of ¼" tempered or laminated safety glass and labeled as such.

2.3 SLIDING GLASS RECEPTION WINDOW SYSTEM

- A. **Opening 104B** – Reception Sliding Window
(Provide complete system as required to match elevation per drawings)
1. Dorma Manet Compact Set 6.1 (Satin Stainless Finish)
 2. Tubular Track w/ End Caps 821.436
 3. Recessed Pull Grip 821.291
 4. Sliding Door Lock w/ Ratchet Brace 821.446
 5. Guides as Required 807.316

2.4 INTERIOR GLASS WALL AND DOOR SYSTEMS

- A. **Opening 103A** (Also Refer to Door Hardware Schedule)
(Provide all parts as required to match elevation per drawings)
1. Dorma Universal Patch Fittings (Satin Stainless Finish) Door Bottom Patch PT10 as required
 - a. Door Top Patch PT20 as required
 2. Dorma Manet Concept Connection System For Arched Transoms (Satin Stainless Finish)
 - a. Corner Connector Fitting 829.145
 - b. Bottom Patch Lock AR20
 - c. Push/Pulls (See Door Hardware Schedule)
 - d. Floor Closer (See Door Hardware Schedule)
 3. Aluminum 'U' Channels to Receive Glass: (Refer to elevations and details on drawings)
 - a. 1"x1" Channel at floor
 - b. 1"x2" Black Finished Channel at top & sides of opening
 - c. 1-3/4" x1" Channel at Transom
- B. **Opening 109A** (Also Refer to Hardware Schedule)
(Provide all parts as required to match elevation per drawings)
1. Dorma Universal Patch Fittings (Satin Chrome Finish)
 - a. Door Bottom Patches PT10 as required
 - b. Door Top Patches PT20 as required
 - c. Transom Patches PT30 w/ Wall Plate as required
 - d. Floor Closers w/ Elect. Hold Open (See Hardware Schedule)
 - e. Dorma Glass Panic Hardware DG1100PKSx700 (Strike as required)
 2. Aluminum 'U' Channels to Receive Glass: (Refer to elevations and details on drawings)
 - a. 1"x1" Channel at floor, top & sides of opening
- C. **Opening 109C** (Also Refer to Hardware Schedule)
(Provide all parts as required to match elevation per drawings)
1. Dorma Universal Patch Fittings (Satin Chrome Finish)
 - a. Door Bottom Patch PT10as required
 - b. Door Top Patch PT20 as required
 - c. Top Plate as required
 2. Bottom Patch Lock AR20
 - a. Push/Pulls (See Hardware Schedule)
 - b. Floor Closer (See Hardware Schedule)

3. Aluminum 'U' Channels to Receive Glass: (Refer to elevations and details on drawings)
 - a. 1"x1" Channel at floor
 - b. 1"x2" Recessed Channel at top & sides

2.4 GLAZING SEALANTS/COMPOUNDS

- A. General: Provide materials as recommended by the manufacturer for the required application and condition of installation in each case. Provide only compounds that are proven to be fully compatible with surfaces contacted.

2.5 MISCELLANEOUS GLAZING MATERIALS

- A. Setting Blocks: Neoprene, 70-90 Durometer hardness, with proven compatibility with sealants used.
- B. Spacers: Neoprene, 40-50 Durometer hardness, with proven compatibility with sealants used.
- C. Cleaners, Primers and Sealers: Type recommended by sealant or gasket manufacturer.

2.6 OTHER MATERIALS

- A. Provide other materials not specifically described but required for a complete and proper installation.

PART 3 - EXECUTION

3.1 INSTALLATION OF GLASS

- A. General Requirements:
 1. Comply with combined printed recommendations of glass manufacturers, of manufacturer of sealants, gaskets and glazing materials, except where more stringent requirements are indicated, including those of referenced glazing standards.
 2. Where a combination of sealing materials is required for glazing in the same frame, the manufacturer must certify that all glazing materials furnished are compatible with each other.
 3. Where setting blocks and spacer shims are required to be set into a glazing compound or sealant, they may be buttered with the compound or sealant, placed in position and allowed to set firmly prior to installation of glass.
- B. Sash and Frame Preparation and Acceptance
 1. Inspect all sash, frames and surrounds to be glazed under this section and notify the Contractor of any defects, improper materials or workmanship of other conditions that will affect the satisfactory installation of glass. Do not proceed with glazing until such conditions have been corrected. Absence of notification, or the beginning of glazing, will indicate acceptance of all previously placed related work executed by other trades.
 2. Other trades will execute the following work; but before starting glazing work, the glazier shall verify compliance with the requirements listed.
 - a) That sash and frames are firmly anchored in proper position, plumb and square within 1/8" nominal dimensions on approved shop drawings.
 - b) That the rivet, screw, bolt or nail heads, welding fillets and other projections are removed from glazing rabbets to provide the specified clearances.

- c) That all corners and fabrication intersections are sealed and sash and frames are weather-tight.
 - d) That rabbets at seals weep to outside and all rabbets are of sufficient depth and width to receive the glass and provide the required overlap of the glass.
 - e) That all sealing surfaces of steel sash and frames are primer painted.
- C. Preparation of Glass and Rabbets: Clean the sealing surfaces of glass and the sealing surfaces of rabbets and stop beads before applying any glazing compound or gaskets. Use only the approved solvents and cleaning agents recommended by the compound manufacturer.
- D. Positioning Glass: Center in glazing rabbet to maintain specified clearances at perimeter on all four sides. Maintain centered position of glass in rabbet and provide the required sealer thickness ($\frac{1}{8}$ " maximum) on both sides of glass. Whenever glass dimensions are larger than 50 united inches, provide setting blocks at the sill and spacer shims on all four sides; locate setting blocks one-quarter way in from each end of glass.
- E. Stop Bead Glazing - Using Putty and/or Elastic Glazing Compound: Except where other materials or methods are specified hereinafter, use putty for bedding glass in hollow metal frames.
- 1. Apply ample back putty or compound to rabbet so that it will ooze out when pressing glass into position and completely cover glass in rabbet. Place setting blocks and spacer shims as required. Press glass into position.
 - 2. Secure glass in place by the application of stop beads. Bed stop beads against glass and bottom of rabbet with compound and/or putty, leaving proper thickness between glass and stop beads. Secure stop beads in place with suitable fastenings. Strip surplus compound or putty from both sides of glass and tool to provide clean sight lines.
- F. Glazing - Using Glazing Gaskets
- 1. Glass stops with glazing gaskets shall be used for securing glass in frames of all storefront type entrance doors and in such other locations as indicated on the drawings.
 - 2. Glazing gaskets without stops shall be used for glazing glass in all storefront type sash and frames, except where otherwise indicated on the drawings. Glazing of storefront type sash and frames using glazing gaskets without stops shall be done in strict accordance with the manufacturer's directions. Provide and place setting blocks as required. Gaskets shall be of the proper size for the thickness of glass being used. After glazing, seal gaskets to glass continuously with a clear elastic and watertight sealant similar to G.E. Silicon Sealant. Seal gaskets to glass on exterior face only.
- G. Silicone Butt Glazing: Where butted glass without mullions is indicated, seal with silicone sealant in strict accord with sealant and glass manufacturer's directions. Set glass so that joint is plumb and glass edges are aligned to provide for a uniform joint width of $\frac{3}{8}$ " (max.). Mask edges of glass to confine sealant to joints and to avoid contact with either face. Use primers where so required. Neatly tool joints to slightly concave surface using recommended tooling agent. Remove masking from glass and clean glass surfaces completely free of sealant material

3.2 REPLACEMENT AND CLEANING

- A. Upon completion of work all glass shall be free from cracks and other defects. Any defective or broken glass that may appear before acceptance or within the one-year warranty period shall be removed and replaced with new glass without additional cost to the Owner; excepting glass which is broken by a specific cause relating to building occupancy

not relating to this contract. Upon completion of the work and just prior to occupancy of the building, all glass shall be thoroughly washed and cleaned.

END OF SECTION

SECTION 09 20 00 – WALL AND CEILING PLASTER RESTORATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. This procedure includes guidance on re-securing loose plaster by injecting adhesive behind the loose plaster and securing it with plaster washers.
2. Plaster is in need of re-securing when sound plaster has lost its keys and is floating away from the lath or when the plaster and lath are no longer attached to stud or joist.
3. If wood lath strips are placed too close together, or the lath is nailed directly over planks, keys do not form properly and the plaster may eventually sag away from the lath. Other factors contributing to sagging plaster include wood shrinkage, weight of plaster or broken vertical ties (see 09210-06-R).
4. Pulled plaster cornice restoration and replication.
5. Plaster chandelier medallion.
6. See 01100-07-S for general project guidelines to be reviewed along with this procedure. These guidelines cover the following sections: This procedure includes guidance on duplicating plaster ornament that is damaged or has deteriorated. It also includes plaster ornament in areas that is completely missing. Plaster of Paris is the most common casting material.
 - a. Safety Precautions
 - b. Historic Structures Precautions
 - c. Submittals
 - d. Quality Assurance
 - e. Delivery, Storage and Handling
 - f. Project/Site Conditions
 - g. Sequencing and Scheduling
 - h. General Protection (Surface and Surrounding)
6. These guidelines should be reviewed prior to performing this procedure and should be followed, when applicable, along with recommendations from the State Historic Preservation Officer (SHPO).

B. Related Requirements

1. Section 02 42 93 - Selective Removal and Salvage
2. Division 06 - Wood, Plastics, Composite
3. Section 09 21 00 – Gypsum Board

1.2 QUALITY ASSURANCE

- A. Plaster Restoration Specialist: Award plaster restoration work to firm regularly engaged in restoring historic plaster similar to the work required by this Section that can demonstrate to Owner's satisfaction that, within previous five years, the firm has successfully performed and completed in a timely manner at least three projects similar in scope and type to work required on this Project involving buildings designated as Landmarks by local governmental authorities, buildings listed in the National Register of Historic Places, or buildings listed in a State Register of Historic Places under the direction of preservation authorities.
 1. Foreman: Plaster restoration work shall be directly supervised by a full-time foreman with experience equal to or greater than that required of Plaster

Restoration Specialist. Foreman shall read and speak English fluently. Foreman shall be on site daily for duration of work of this Section. Same foreman shall remain on Project throughout work of this Section unless Owner deems foreman's performance unacceptable.

2. Mechanics: Plaster restoration work shall be carried out by skilled mechanics who are thoroughly experienced in the restoration of historic plaster and who have a minimum of three years' experience with installation of tile work on historic buildings similar to the work required by this Section. In acceptance or rejection of work of this Section, no allowance will be made for workers' inattention or lack of skill.
 3. Conservator: Award finishes analysis work to a Conservator regularly engaged in, and with at least eight years' experience in, analyzing architectural materials and finishes similar to the material to be analyzed and conserved as work of this Section that can demonstrate to Owner's satisfaction that, within previous three years, the Conservator has successfully performed and completed in a timely manner at least three projects similar in scope and type to work required on this Project.
 - a. Affiliation: Conservator shall be a Professional Associate or Fellow of the American Institute for Conservation of Historic & Artistic Works.
- B. Laws, Codes, and Regulations: Work of this Section shall comply with all applicable federal, state, and local laws, codes, and regulations.
- C. Referenced Standards: Work of this Section shall comply with applicable requirements and recommendations of latest editions of the documents listed herein, except as modified by more stringent requirements of the Contract Documents and of applicable laws, codes, and regulations of authorities having jurisdiction. Where the language in any of the documents referred to herein is in the form of a recommendation or suggestion, such recommendations or suggestions shall be deemed to be mandatory under this Contract unless specifically indicated otherwise in Contract Documents. Provide a reference copy of each of the following standards at Project site during all periods when work of this Section is being performed. In each case in which there is a conflict between requirements of referenced standards; requirements of laws, codes, and regulations; and requirements of this Section, the most stringent or restrictive requirement shall govern.
1. American National Standards Institute (ANSI)
 - a. ANSI A137.1, *American National Standard Specifications for Ceramic Tile*.
 - b. ANSI A108, A118, & A136, *American National Standard for Installation of Ceramic Tile*.
 2. Tile Council of America (TCA), *Handbook for Ceramic Tile Installation*
 3. The *Secretary of the Interior's Standards for the Treatment of Historic Properties (Standards for Rehabilitation and/or Standards for Restoration)*.
- D. Sources of Materials: Obtain each type of material to be used for tile restoration from a single source to ensure a match in quality, performance, and appearance.

1.3 SUBMITTALS

- A. General: Submit the following in compliance with the requirements of the Contract Documents. Revise and resubmit each item as required to obtain Architect's approval.
- B. Qualification Data: Submit qualification data for firm and personnel specified in "Quality Assurance" Article that demonstrates that both firm and personnel have

capabilities and experience complying with requirements specified. For firm and foreman, provide a list of at least three completed projects similar in size and scope to work required on this Project. For each project list project name, address, architect, conservator, supervising preservation agency, scope of contractor's work, and other relevant information. Submit this information with the bid.

- C. Product Data: Manufacturer's published technical data for each product to be used in work of this Section including material description, chemical composition (ingredients and proportions), physical properties, recommendations for application and use, test reports and certificates verifying that product complies with specified requirements, and Material Safety Data Sheets (MSDS).
- D. Shop Drawings: Dimensioned drawings showing major areas of loose plaster to be re-secured, conserved, restored and/or replicated.

1.4 MOCK-UPS

- A. General: Before beginning general tile restoration work, prepare mock-ups to provide standards for work of this Section. Do not proceed with tile restoration work until Architect has approved mock-ups.
 - 1. Locate mock-ups as directed by Architect.
 - 2. Notify Architect 48 hours prior to start of each mock-up.
 - 3. Use crew that will execute the work and follow requirements of this Section.
 - 4. Repeat mock-ups as necessary to obtain Architect's approval.
 - 5. Protect approved mock-ups to ensure that they are without damage, deterioration, or alteration at time of Substantial Completion.
 - 6. Approved mock-ups in undamaged condition at time of Substantial Completion may be incorporated into the Work.
 - 7. Approved mock-ups will represent minimum standards for plaster restoration work. Subsequent plaster restoration work that does not meet standards of approved mock-ups will be rejected.
- B. Prepare the Following Mock-Ups
 - 1. 8 feet square area of any loose plaster to be re-secured.
 - 2. 8 lineal feet of any plaster cornice or trim to be replicated.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle all products and materials to prevent damage, deterioration, degradation, and intrusion of foreign material.
- B. Discard and remove from site deteriorated materials, contaminated materials, and products that have exceeded their expiration dates. Replace with fresh materials.

1.6 PROJECT CONDITIONS

- A. Safety: Protect all persons, whether involved with work of this Section or not, from all hazards resulting from work of this Section.
- B. Protection of Building: Protect building elements and finishes from damage and from deterioration caused by work of this Section. Repair all damage to materials and damage to finishes to Architect's satisfaction at no additional cost to Owner.

- C. Contract Drawings: Dimensions on Drawings are for bidding purposes. Field measure all dimensions of existing and in-place elements before preparing shop drawings or beginning work.

1.7 ENVIRONMENTAL REQUIREMENTS

- A. Install plaster only when temperature is at or above 50 deg F and when it is expected to remain at or above 50 deg F for at least 48 hours after plaster has been installed.

PART 2 - PRODUCTS

2.1 PLASTER PRODUCTS

A. MANUFACTURERS

- 1. Rubber Casting Materials:
 - a. Abatron, Inc.
5501 95th Ave.
Kenosha, WI 53144
800/445-1754 or 414/653-2000
 - b. Industrial Plastic Supply
309 Canal Street
New York, NY 10013
212/226-2010
 - c. Perma-Flex Mold Company
1919 Livingston Avenue
Columbus, OH 43209
614/252-8034
 - d. Polytek Development Corp.
P.O. Box 384
Lebanon, NJ 08833
908/534-5990
 - e. Smooth-On, Inc.
1000 Valley Road
Gillette, NJ 07933
908/647-5800

B. Rubber Latex: #660:

- 1. Cementex Co.
336 Canal St.
New York, NY 10013
212/741-1770

C. Plaster:

- 1. Gold Bond Building Products Division
National Gypsum Co.
P.O. Box 25884
Charlotte, NC 28229
704/536-0023
- 2. U.S. Gypsum Association
810 First Street NE, #510
Washington, DC 20002
202/289-5440, FAX 202/289-3707

3. Tuff-Kote Company, Inc.
210 Seminary Avenue
Woodstock IL 60098
815/338-2006

2.2 MATERIALS:

NOTE: When the common name of a chemical is used on the label, it is usually a sign that the substance is not as pure as the same chemical sold under its chemical name. However, the grade of purity of the common-name substance is almost certain to be adequate for stain removal work, and because it is likely to be less expensive, the common-name product should be purchased when available. Common names are indicated by an asterisk (*).

- A. Denatured Alcohol:
 1. Other chemical or common names include Methylated spirit*.
 2. Potential hazards: TOXIC AND FLAMMABLE.
 3. Available from hardware store, paint store or printer's supply distributor.
 4. Denatured alcohol should be a satisfactory substitute for ethyl alcohol for stain removing purposes.
- B. Plaster Washers (Charles Street Supply Co.), or approved equal.
- C. Acrylic, latex or polymer emulsion adhesive (all water-based) such as "Big Stick" Construction Adhesive (DAP), "Liquid Nails", or approved equal.
- D. Foam carpet pad
- E. Wood shingles
- F. Plywood
- G. Cheese Cloth or burlap strips
- H. Joint compound such as "Durabond Wallboard Compound" (U.S. Gypsum Co. or comparable), "Krack-kote" (Tuff-Kote Co.), or approved equal.
- I. Flat head wood screws or drywall screws and plaster washers
- J. Clean, potable water

2.3 EQUIPMENT:

- A. Electric drill
- B. Bent wire tool
- C. Vacuum
- D. Ladder
- E. ½- inch plywood
- F. 1 x 2 or 2 x 4 wood braces
- G. Caulking gun

- H. Phillips head screwdriver

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Determine the extent of the damage and evaluate work requirements and causes before proceeding.
 1. Thumping with a finger makes a solid, snappy sound on good plaster; it makes a hollow and dull sound on loose plaster.
 2. Gently press the plaster surface with palm of hand or with a T-brace made from 2x4s; If plaster moves in relation to the studs and lath, then the keys are broken; With more pressure, a similar movement indicates that the plaster is well keyed to the lath, but the lath is loose from the studs.

3.2 ERECTION/INSTALLATION/APPLICATION

- A. Re-securing Plaster by Injected Adhesive Bonding:
 1. Determine the areas of loose plaster and mark them out with chalk (see section 3.01 EXAMINATION)
 2. Ceilings (accessible backside):
 - a. From the backside of the surface to be repaired, drill 1/4 inch injection holes through the lath 3-6 inches apart and at the center of the lath (use a drill stop on the bit to keep from drilling into the plaster).
 - b. Using a bent wire tool and a vacuum, loosen and suck dust out through the injection holes.
 3. Ceilings (inaccessible backside) and Walls:
 - a. Drill through plaster and lath with holes 3-6 inches apart, and if possible, through the center of the lath.
 - b. In walls, break-the plaster open at the bottom of loose areas and vacuum up debris left by broken keys.
 4. Have 1/2-inch plywood as big as the patch area and enough 1x2 wood braces on hand.
 5. Trim the tip of the caulking-gun cartridge so that it fits in the wood-lath holes.
 6. If selected adhesive has an adhesive primer, squirt into pre-drilled holes according to manufacturer's instructions.
 7. If adhesive has no primer, mix 4 parts water, 2 parts denatured alcohol and 1 part adhesive (water- based only).
 8. Pre-wet both the plaster and lath.
 9. Inject adhesive into the pre-drilled holes, giving the adhesive enough time to flow into the space between the plaster and the lath.
 10. T-brace a 1/2-inch layer of foam carpet between the plywood and the plaster; Add additional braces as necessary or drive screws through washers and wood shingles to draw the plaster up against the lath.
 11. When the adhesive has set, carefully remove the plywood (it may need to be twisted gently to break the bond).
 12. Fill holes and/or tape and mud cracks and finish as required.
- B. Re-securing Loose Plaster with Plaster Washers:

Use plaster washers (also called repair discs or ceiling buttons) to pull sound plaster back up to the lath (when the keys have broken), or to pull plaster and lath back to the studs or joists.

1. If the lath was nailed directly to the joists or rafters, find the joists, then measure and mark their locations with chalk lines snapped across the ceiling.
2. From below, drive 1-1/2 to 2 inch gyp-board screws, fitted with plaster washers, through the plaster and lath up into the joists. Space every 4 inches on each joist where sagging is apparent, or as often as necessary, and 1-1/2 inches from the edge of the loose Section (only screws that hit lath will hold).
3. Tighten the screws gradually all along the edge.
4. Patch the holes with spackling or joint compound and finish with a skim coat of joint (taping) compound.

3.3 CLEANING AND PROTECTION

- A. Cleaning: Clean plaster surfaces free of foreign matter.
- B. Finished Plaster Work: Leave finished installation clean and free of cracked, chipped, broken, un-bonded and otherwise defective plaster.
- C. Protection: When required, protect plaster from adjacent work during construction period to prevent damage.
- D. Before project completion, remove any protective coverings.

END OF SECTION

SECTION 09 21 00 - GYPSUM BOARD

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Standard Gypsum Board.
- B. Fire-Resistance Rated Gypsum Board.
- C. Mold and Moisture Resistant Gypsum Board.
- D. Fire-Resistance Rated Gypsum Board with Enhanced Mold and Mildew Resistance.
- E. Mold and Mildew Resistant Tile Backer.
- F. Cement Board.

1.2 REFERENCE STANDARDS

- A. American National Standards Institute (ANSI)
 - 1. ANSI A 108.11 - Interior Installation of Cementitious Backer Units
 - 2. ANSI A 118.9 - American National Standard Specification for Test Methods and Specifications for Cementitious Backer Units
- B. ASTM International
 - 1. ASTM C 473 - Standard Test Methods for Physical Testing of Gypsum Panel Products
 - 2. ASTM C 840 - Standard Specification for Application and Finishing of Gypsum Board
 - 3. ASTM C 919 - Standard Practice for Use of Sealants in Acoustical Applications
 - 4. ASTM C 920 - Standard Specification for Elastomeric Joint Sealants.
 - 5. ASTM C 1002 - Standard Specification for Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs
 - 6. ASTM C 1177 - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing
 - 7. ASTM C 1178 - Standard Specification for Coated Glass Mat Water Resistant Gypsum Backing Panel
 - 8. ASTM C 1280 - Standard Specification for Application of Gypsum Sheathing
 - 9. ASTM C 1325 - Standard Specification for Non-Asbestos Fiber-Mat Reinforced Cementitious Backer Units
 - 10. ASTM C 1396 - Standard Specification for Gypsum Board
 - 11. ASTM C 1629 - Standard Classification for Abuse Resistant Nondecorated Interior Gypsum Panel Products and Fiber reinforced Cement Panels
 - 12. ASTM C 1658 - Standard Specification for Glass Mat Gypsum Panels
 - 13. ASTM D 3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber
 - 14. ASTM E 72 - Standard Test Methods of Conducting Strength Tests of Panels for Building Construction
 - 15. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials
 - 16. ASTM E 90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements
 - 17. ASTM E 96 - Standard Test Methods for Water Vapor Transmission of Materials

18. ASTM E 119 - Standard Test Methods for Fire Tests of Building Construction and Materials
19. ASTM E 136 - Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750 176; C.
20. ASTM G 21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi

C. Gypsum Association (GA)

1. GA-214 - Recommended Levels of Gypsum Board Finish
2. GA-216 - Application and Finishing of Gypsum Panel Products
3. GA-253 - Application of Gypsum Sheathing

1.3 SUBMITTALS

PART 2 - PRODUCTS

2.1 MANUFACTURER

- A. Products of National Gypsum Company

2.2 STANDARD GYPSUM BOARD

- A. Basis of Design: Gold Bond® BRAND Gypsum Board or comparable.

1. Panel Physical Characteristics
 - a. Core: Regular gypsum core
 - b. Surface Paper: 100 percent recycled content paper on front, back and long edges
 - c. Long Edges: Tapered
 - d. Overall thickness: ½"
 - e. Panel complies with requirements of ASTM C 1396

2.3 FIRE-RESISTANCE RATED GYPSUM BOARD

- A. Basis of Design: Gold Bond® BRAND Fire-Shield® Gypsum Board

1. Type X, Panel Physical Characteristics
 - a. Core: Fire-resistance rated gypsum core
 - b. Surface paper: 100 percent recycled content paper on front, back and long edges
 - c. Long Edges: Tapered
 - d. Overall thickness: 5/8 inch
 - e. Panel complies with Type X requirements of ASTM C 1396

- B. Basis of Design: Gold Bond® BRAND Fire-Shield C™ Gypsum Board

1. Type C, Panel Physical Characteristics
 - a. Core: Enhanced fire-resistance rated (Type C) gypsum core
 - b. Surface paper: 100 percent recycled content paper on front, back and long edges
 - c. Long Edges: Tapered
 - d. Overall thickness: 5/8"
 - e. Panel complies with Type X requirements of ASTM C 1396

2.4 MOLD AND MOISTURE RESISTANT GYPSUM BOARD

- A. Basis of Design: Gold Bond® BRAND XP Gypsum Board

1. Panel Physical Characteristics
 - a. Core: Mold and moisture resistant gypsum core
 - b. Surface paper: 100 percent recycled content moisture/mold/mildew resistant paper on front, back, and long edges
 - c. Long Edges: Tapered
 - d. Overall thickness: 1/2 inch
 - e. Panel complies with requirements of ASTM C 1396
 - f. Mold/Mildew Resistance: 10 when tested in accordance with ASTM D 3273
 - g. Environmental Requirements: Provide products that comply with testing and product requirements for low emitting materials

2.5 FIRE-RESISTANCE RATED GYPSUM BOARD WITH ENHANCED MOLD AND MILDEW RESISTANCE

A. Basis of Design: Gold Bond® BRAND XP® Fire-Shield® Gypsum Board

1. Type X, Panel Physical Characteristics
 - a. Core: Mold and moisture resistant, fire-resistance rated gypsum core
 - b. Surface paper: 100 percent recycled content moisture/mold/mildew resistant paper on front, back and long edges
 - c. Long Edges: Tapered
 - d. Overall thickness: 5/8 inch
 - e. Panel complies with Type X requirements of ASTM C 1396
 - f. Mold/Mildew Resistance: 10 when tested in accordance with ASTM D 3273

B. Basis of Design: Gold Bond® BRAND XP® Fire-Shield® C Gypsum Board

1. Type C, Panel Physical Characteristics
 - a. Core: Mold and moisture resistant gypsum core with enhanced fire-resistance (Type C)
 - b. Surface paper: 100 percent recycled content moisture/mold/mildew paper on front, back and long edges
 - c. Long Edges: Tapered
 - d. Overall thickness: 5/8 inch
 - e. Panel complies with requirements Type X of ASTM C 1396
 - f. Mold/Mildew Resistance: 10 when tested in accordance with ASTM D 3273

2.6 MOLD AND MILDEW RESISTANT TILE BACKER

A. Basis of Design: Gold Bond® BRAND eXP® Tile Backer

1. Panel Physical Characteristics
 - a. Core: Mold and moisture resistant, gypsum core
 - b. Thickness: 5/8 inch
 - c. Facer: Fiberglass Mat; moisture resistant, acrylic coated water barrier on front
 - d. Long Edges: Square
Water Absorption: less than 5 percent when tested in accordance with ASTM C 473
 - e. Combustibility: Noncombustible when tested in accordance with ASTM E 136
 - f. Flame spreads/Smoke Developed: 0/0 when tested in accordance with ASTM E 84

- g. Mold/Mildew Resistance: 10 when tested in accordance with ASTM D 3273
- h. Environmental Requirements: Provide products that comply with testing and product requirements for low emitting materials
- i. Panel complies with requirements of ASTM C 1178.

2.7 CEMENT BOARD

A. Cement Backerboard Basis of Design: PermaBase® BRAND Cement Board

- 1. Panel Physical Characteristics
 - a. Core: Cementitious, water-durable
 - b. Surface: Fiberglass mesh on front and back
 - c. Long Edges: Tapered
 - d. Overall Thickness: 5/8 inch
 - e. Panel complies with requirements of ASTM C 1325 and ANSI A 118.9
 - f. Density: 72 lbs. per cu. ft.
 - g. Water Absorption: Not greater than 8 percent when tested for 24 hours in accordance with ASTM C 473

2.8 ACCESSORY PRODUCTS

A. Fasteners for use with tile backer

- 1. Fasteners for 1/2 inch thick panels:
 - a. Wood Framing: 1-1/2 inch minimum galvanized roofing nail or 1-1/4 inch minimum corrosion resistant course thread bugle head.
 - b. Metal Framing: 1 inch minimum corrosion resistant sharp point or drill point bugle head screw.
- 2. Fasteners for 5/8 inch thick panels:
 - a. Wood Framing: 1-3/4 inch minimum galvanized roofing nail or 1-1/4 inch minimum corrosion resistant course thread bugle head. As required in specified fire-rated assembly.
 - b. Metal Framing: 1-1/4 inch minimum corrosion resistant sharp point or drill point bugle head screw. As required in specified fire-rated assembly.

B. Fasteners for use with cement board

- 1. PermaBase Cement Board Hi-Lo thread screws (No. 8)
 - a. Wafer head, corrosion-resistant
 - b. Overall Thickness: 1-5/8 inch
 - c. For use with wood framing and complying with ASTM C 1002
- 2. PermaBase Cement Board drill point screws (No. 8)
 - a. Wafer head, corrosion-resistant
 - b. Overall Thickness: 1-5/8 inch
 - c. For use with 20 to 14 ga. Steel framing and complying with ASTM C 1002

C. Joint Treatment

- 1. Tape:
 - a. Paper Tape: 2-1/16 inches wide (ProForm BRAND Joint Tape or comparable).
 - b. Paper Tape: 2 inches wide with metal strips laminated along the center crease to form inside and outside corners (ProForm BRAND Multi-Flex Tape Bead or comparable).

- c. Fiberglass Tape: Nominal 2 inches wide self-adhering tape (ProForm BRAND Fiberglass Mesh Tape or comparable).
- d. Alkali-resistant Fiberglass Tape: Nominal 2 inches wide polymer coated alkali-resistant mesh tape (PermaBase BRAND Tape or comparable).
- 2. Drying Type Compound:
 - a. Ready Mix vinyl base compound (ProForm BRAND All Purpose Ready Mix Joint Compound; ProForm Lite-Blue Ready Mix Joint Compound; ProForm BRAND Lite Ready Mix Joint Compound; ProForm BRAND Multi-Use Ready Mix Joint Compound or comparable).
 - b. Ready Mix vinyl base compound formulated for enhanced mold and mildew resistance (ProForm BRAND XP Ready Mix Joint Compound or comparable).
 - c. Ready Mix vinyl base compound formulated to reduce airborne dust during sanding (ProForm BRAND Lite Ready Mix Joint Compound with Dust-Tech or comparable).
 - d. Ready Mix vinyl base topping compound for finish coating (ProForm BRAND Topping Compound or comparable).
 - e. Ready Mix vinyl base compound for embedding joint tape, cornerbeads or other accessories (ProForm BRAND Taping Joint Compound or comparable).
 - f. Field Mix vinyl base compound (ProForm BRAND Triple-T Compound or comparable).
- 3. Setting Compound: Field mixed hardening compound (ProForm BRAND Quick Set Setting Compound; ProForm BRAND Quick Set Lite Setting Compound or comparable).
 - a. Field mixed hardening compound for fire resistance rated construction and penetrations (ProForm BRAND Fire Shield 90 or comparable).
- 4. Joint Sealant:
 - a. Conform to ASTM C 920
 - b. VOC content less than 2 g/L
- 5. Outside Corner Bead – Bare Metal: 1 ¼” metal corner bead.
 - a. Aluminum-zinc coated steel, coated for additional corrosion resistance and joint compound adhesion.
 - b. ASTM Specification C-1047-94 except for Section 4.1.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Install in accordance with manufacturer recommendations

3.2 INSTALLATION, CEMENT BOARD

- A. Install in accordance with manufacturer recommendations and ANSI A 108.11

3.3 INSTALLATION, ACOUSTICALLY ENHANCED GYPSUM BOARD

- A. Install in accordance with manufacturer recommendations and GA-214

3.4 INSTALLATION, INTERIOR EXTENDED EXPOSURE GYPSUM PANELS

- A. General: Install in accordance with manufacturer recommendations, ASTM C 840 and GA-216
- B. Unenclosed Building Envelope:

1. To allow for installation of gypsum panels prior to fully enclosing the building envelope, install interior extended exposure gypsum panels in lieu of gypsum board in accordance with manufacturer recommendations
- C. Interior Face of Exterior Wall:
1. To assist in moisture control within exterior building walls, install interior extended exposure gypsum panels in lieu of gypsum board on interior face, in accordance with manufacturer recommendations
- D. Adjacent to Wet Walls:
1. To assist in the moisture and mold control on walls adjacent to wet walls or within 8 feet of a plumbing fixture, install interior extended exposure gypsum panels in lieu of gypsum board, as a tile backer or a substrate for other wall finish. Apply Level 5 finish in accordance with Gypsum Association GA-214 where panels will be located in critical lighting conditions or will receive a gloss, semi-gloss, or enamel paint finish.
- E. Fire-Resistance Rated:
1. Install in accordance with manufacturer recommendations, ASTM C 840 and GA-216

3.5 INSTALLATION, TILE BACKER

- A. General:
1. Install in accordance with manufacturer recommendations, ASTM C 840 and GA-216
 2. Install with acrylic coated water barrier side facing away from the framing, so that finishes shall be applied to the coated side.
 3. Caulk or seal penetrations and abutments to dissimilar materials.
- B. Tile Backer Installation for countertops:
1. Apply backer over minimum 23/32 inch exterior grade plywood sub-base using a bed of thin set mortar.
 2. Fasten using 1 ¼ inch corrosion resistant roofing nails or coarse thread bugle head screws spaced no more than 8 inches on center in both directions. Drive fasteners flush with the panel surface, do not countersink.
- C. Tile Backer Installation for walls:
1. Install panels horizontal or vertical to supports spaced a maximum of 16 inches on center without blocking or 24 inches on center with blocking at all joints for ½ inch thick panels and 24 inches on center for 5/8" inch thick panels.
 2. Space fasteners 8 inches on center along all support members. Drive fasteners flush with the panel surface, do not countersink.
 3. Dry Non-Tile Applications
 - a. Tape joints with fiberglass mesh tape and embed with setting type joint compound.
 - b. Skim the surface with a setting or ready-mix joint compound.
 4. Wet Non-Tile Applications
 - a. Finish walls with a direct applied finish systems, or materials suitable for humid environments.
 - b. Seal transitions and abutments to dissimilar materials with flexible joint sealant.

3.6 INSTALLATION, GYPSUM SHEATHING

- A. Install in accordance with manufacturer recommendations and ASTM C 1280 GA-253.

END OF SECTION

SECTION 09 30 00 – TILING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Tile and Accessories:
 - 1. Thru-Color Finish Porcelain.
 - 2. Trim and Accessories.
 - 3. Setting Materials.
- B. Existing Tile Restoration
 - 1. Clean all tile, including salvaged tile and stockpiled, previously removed original tile.
 - 2. Furnish new tile matching original tile to replace missing tile and damaged tile.
 - 3. Prepare substrate to receive tile.
 - 4. Install all tile, including stockpiled, previously removed original tile, salvaged tile, and new replacement tile.
 - 5. Grout joints in tile work.

1.2 RELATED SECTIONS

- A. Section 02 42 93 - Selective Removal and Salvage
- B. Section 07 92 00 - Joint Sealants

1.3 REFERENCES

- A. American National Standards Institute (ANSI):
 - 1. ANSI A108.5 - Specifications for Ceramic Tile Installed with Dry-Set Portland Cement Mortar or Latex-Portland Cement Mortar.
 - 2. ANSI A118.6 - Standard Ceramic Tile Grouts.
 - 3. ANSI A118.7 - Polymer Modified Cement Grouts
 - 4. ANSI A137.1 - Specifications for Ceramic Tile.
- B. ASTM International (ASTM):
 - 1. ASTM C 50 - Standard Practice for Sampling, Sample Preparation, Packaging, and Marking of Lime and Limestone Products.
 - 2. ASTM C 144 - Standard Specification for Aggregate for Masonry Mortar.
 - 3. ASTM C 207 - Standard Specification for Hydrated Lime for Masonry Purposes.
- C. Tile Council of North America (TCNA): TCA Handbook for Ceramic Tile Installation, Latest Edition.

1.4 SUBMITTALS

- A. Submit under provisions of Division 01.
- B. Product Data: Manufacturer's data sheets on each product to be used, including:
 - 1. Preparation instructions and recommendations.
 - 2. Storage and handling requirements and recommendations.
 - 3. Installation methods.

- C. Shop Drawings: Indicate tile layout, patterns, color arrangement, perimeter conditions, junctions with dissimilar materials, control and expansion joints, thresholds, ceramic accessories, and setting details.
- D. Selection Samples
 - 1. Cleaned Salvaged Tile (Including Stockpiled Tile): Each type (color, finish, surface reflectance).
 - 2. New Tile: Each type (size, color, finish, surface reflectance) required for replacement of damaged tile and missing tile.
 - 3. Grout: Sample in channel 1/2 inch wide by 6 inches long of each color required for grouting.
- E. Manufacturer's Certificate:
 - 1. Certify that products meet or exceed specified requirements.
 - 2. For each shipment, type and composition of tile provide a Master Grade Certificate signed by the manufacturer and the installer certifying that products meet or exceed the specified requirements of ANSI A137.1.
- F. Maintenance Data: Include recommended cleaning methods, cleaning materials, stain removal methods, and polishes and waxes.

1.5 MOCK UPS

- A. General: Before beginning general tile restoration work, prepare mock-ups to provide standards for work of this Section. Do not proceed with tile restoration work until Architect has approved mock-ups.
 - 1. Locate mock-ups as directed by Architect.
 - 2. Notify Architect 48 hours prior to start of each mock-up.
 - 3. Use crew that will execute the work and follow requirements of this Section.
 - 4. Repeat mock-ups as necessary to obtain Architect's approval.
 - 5. Protect approved mock-ups to ensure that they are without damage, deterioration, or alteration at time of Substantial Completion.
 - 6. Approved mock-ups in undamaged condition at time of Substantial Completion may be incorporated into the Work.
 - 7. Approved mock-ups will represent minimum standards for tile restoration work. Subsequent tile restoration work that does not meet standards of approved mock-ups will be rejected.
- B. Prepare the Following Mock-Ups
 - 1. Cleaning Salvaged and Stockpiled Tile: Five tile of each type (size, color, finish).
 - 2. Installing Tile Work: One area in each type of tile work, minimum 25 sq. ft.
 - 3. Grouting Tile Work: One area in each combination of tile and grout color, minimum 25 sq. ft.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in performing the work of this section with minimum two years experience.
- B. Single Source Responsibility: Obtain each type and color of tile from a single source. Obtain each type and color of mortar, adhesive and grout from the same source.

- C. Tile Restoration Specialist: Award tile restoration work to firm regularly engaged in restoring historic tile installations similar to the work required by this Section that can demonstrate to Owner's satisfaction that, within previous five years, the firm has successfully performed and completed in a timely manner at least three projects similar in scope and type to work required on this.
1. Foreman: Tile restoration work shall be directly supervised by a full-time foreman with experience equal to or greater than that required of Tile Restoration Specialist. Foreman shall read and speak English fluently. Foreman shall be on site daily for duration of work of this Section. Same foreman shall remain on Project throughout work of this Section unless Owner deems foreman's performance unacceptable.
 2. Mechanics: Tile restoration work shall be carried out by skilled mechanics who are thoroughly experienced in the restoration of historic tilework and who have a minimum of three years' experience with installation of tile work on historic buildings similar to the work required by this Section. In acceptance or rejection of work of this Section, no allowance will be made for workers' inattention or lack of skill.
- D. Replacement Tile Manufacturers: Each type of replacement tile shall be manufactured by a manufacturer with a minimum of 15 years' experience in the manufacturer of the type of tile being provided and with experience matching historic tile similar to the tile to be replaced as work of this Section in all respects.
- E. Laws, Codes, and Regulations: Work of this Section shall comply with all applicable federal, state, and local laws, codes, and regulations.
- F. Referenced Standards: Work of this Section shall comply with applicable requirements and recommendations of latest editions of the documents listed herein, except as modified by more stringent requirements of the Contract Documents and of applicable laws, codes, and regulations of authorities having jurisdiction. Where the language in any of the documents referred to herein is in the form of a recommendation or suggestion, such recommendations or suggestions shall be deemed to be mandatory under this Contract unless specifically indicated otherwise in Contract Documents. Provide a reference copy of each of the following standards at Project site during all periods when work of this Section is being performed. In each case in which there is a conflict between requirements of referenced standards; requirements of laws, codes, and regulations; and requirements of this Section, the most stringent or restrictive requirement shall govern.
1. American National Standards Institute (ANSI)
 - a. ANSI A137.1, *American National Standard Specifications for Ceramic Tile*.
 - b. ANSI A108, A118, & A136, *American National Standard for Installation of Ceramic Tile*.
 2. Tile Council of America (TCA), *Handbook for Ceramic Tile Installation*
 3. The *Secretary of the Interior's Standards for the Treatment of Historic Properties (Standards for Rehabilitation and/or Standards for Restoration)*.
- G. Sources of Materials: Obtain each type of material to be used for tile restoration from a single source to ensure a match in quality, performance, and appearance.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store products in manufacturer's unopened packaging until ready for installation.

- B. Protect adhesives and liquid additives from freezing or overheating in accordance with manufacturer's instructions.
- C. Store tile and setting materials on elevated platforms, under cover and in a dry location and protect from contamination, dampness, freezing or overheating.

1.8 ENVIRONMENTAL REQUIREMENTS

- A. Do not install adhesives in an unventilated environment.
- B. Maintain minimum ambient and substrate temperature of 40 degrees F (10 degrees C) during tiling and for a minimum of 7 days after completion.

1.9 EXTRA MATERIALS

- A. Provide for Owner's use a minimum of 2 percent of the primary sizes and colors of tile specified, boxed and clearly labeled.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturer: Stonepeak Ceramics, Inc., which is located at:
314 West Superior
Chicago, IL 60610
Tel: 312-506-2800
Fax: 312-335-0533
Email: info@stonepeakceramics.com
Web: www.stonepeakceramics.com
- B. Acceptable Manufacturer (Black and White Hexagonal Floor Tile): American Restoration Tile, which is located at:
11416 Otter Creek South Road
Mabelvale, AR 72103
Tel: 501-455-1000
Fax: 501-455-1004
Email: bebyrd@restorationtile.com
Web: www.restorationtile.com
- C. Requests for substitutions will be considered in accordance with provisions of Division 01.

2.2 TILE

- A. General: Provide tile that complies with ANSI A137.1 for types, compositions and other characteristics indicated. Provide tile in the locations and of the types colors and pattern indicated on the Drawings and identified in the Schedule and the end of this Section. Tile shall also be provided in accordance with the following:
 - 1. Factory Blending: For tile exhibiting color variations within the ranges selected under Submittal of samples, blend tile in the factory and package so tile taken from one package shows the same range of colors as those taken from other packages.
 - 2. Factory Applied Temporary Protective Coatings: Where indicated under tile type,

protect exposed surfaces of tile against adherence of mortar and grout by precoating with a continuous film of petroleum paraffin wax applied hot. Do not coat unexposed tile surfaces.

- B. Thru-Color Porcelain Tile:
 - 1. Product: Parkland Collection.
 - 2. Moisture Absorption: Less than .5 percent.**
 - 3. Size and Shape: Wall Tile: 12 inch x 24 inch x 3/8" nominal.
 - 4. Colors: To be selected from manufacturer's standard range.
 - 5. Pattern: As indicated on the Drawings.
 - 6. Trim Units: Matching 3 inch x 12 inch x 3/8" bullnose, and 6 inch x 12 inch x 3/8" cove base with inside and outside corners coordinated with field tile.
- C. Black and White Hexagonal Floor Tile:
 - 1. Provide tile in shape, color, size, and thickness to match existing tile in area as indicated on the drawings.

2.3 SETTING MATERIALS

- A. Mortar Bond Coat Materials:
 - 1. Dry-Set Portland Cement type: ANSI A118.1.
 - 2. Latex-Portland Cement type: ANSI A118.4.
- B. Polymer modified cement grout, sanded or unsanded, as specified in ANSI A118.7; color as selected.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that wall surfaces are free of substances which would impair bonding of setting materials, smooth and flat within tolerances specified in ANSI A137.1, and are ready to receive tile.
- B. Verify that sub-floor surfaces are dust-free, and free of substances which would impair bonding of setting materials to sub-floor surfaces, and are smooth and flat within tolerances specified in ANSI A137.1.

3.2 PREPARATION

- A. Protect surrounding work from damage.
- B. Remove any curing compounds or other contaminants.
- C. Vacuum clean surfaces and damp clean.
- D. Seal substrate surface cracks with filler. Level existing substrate surfaces to acceptable flatness tolerances.
- E. Prepare substrate surfaces for adhesive installation in accordance with adhesive manufacturer's instructions.

3.3 INSTALLATION – GENERAL

- A. Install tile and grout in accordance with applicable requirements of ANSI A108.1 through A108.13, manufacturer's instructions, and TCA Handbook recommendations.
- B. Lay tile to pattern indicated.
- C. Cut and fit tile to penetrations through tile, leaving sealant joint space. Form corners and bases neatly. Align floor joints.
- D. Place tile joints uniform in width, subject to variance in tolerance allowed in tile size. Make joints watertight, without voids, cracks, excess mortar, or excess grout.
- E. Form internal angles square and external angles bullnosed.

3.4 INSTALLATION - WALL TILE

- A. Over gypsum wallboard on wood studs install in accordance with TCA Handbook Method W243, thin-set with dry-set or latex-portland cement bond coat, unless otherwise indicated.

3.5 EXISTING TILE RESTORATION RE-INSTALLATION

- A. General: Install tilework to exactly match original pattern and joint lines.
- B. Accurately form intersections and returns. Cut and drill 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 penetrations so that plates, collars, or covers overlap tile.
- C. Set tile using Latex Thin-Set Adhesive Mortar System.
- D. Apply thin-set mortar and tap tile firmly into place, true and even to form smooth planes. Tile shall be fully bedded in mortar.

3.5 CLEANING

- A. Clean tile and grout surfaces.

3.6 SCHEDULE

- A. Wall Tile:
 - 1. Tile Type: Stonepeak Ceramics Parkland Collection
 - 2. Installation Method: TCA W243
 - 3. Bond Coat Mortar Type: ANSI A108.5
 - 4. Grout Type/Color: As selected by Architect.

END OF SECTION

SECTION 09 65 43 - LINOLEUM FLOORING

PART 1 – GENERAL

1.1 THIS SECTION INCLUDES

- A. Flooring and accessories as shown on the drawings and schedules and as indicated by the requirements of this section.

1.2 RELATED DOCUMENTS

- A. Drawings and General Provisions of the Contract (including General and Supplementary Conditions and Division 1 sections) apply to the work of this section.

1.3 RELATED SECTIONS

- A. Other Division 9 sections for floor finishes related to this section but not the work of this section.
- B. Division 3 Concrete; not the work of this section.
- C. Division 6 Wood, Plastics, and Composites; not the work of this section.
- D. Division 7 Thermal and Moisture Protection; not the work of this section.

1.4 QUALITY ASSURANCE AND REGULATORY REQUIREMENTS

- A. Select an installer who is competent in the installation of Armstrong MARMORETTE™ Linoleum sheet flooring using heat-welded seams.
- B. If required, provide types of flooring and accessories supplied by one manufacturer, including leveling and patching compounds, and adhesives.
- C. If required, provide flooring material to meet the following fire test performance criteria as tested by a recognized independent testing laboratory:

1.5 ASTM E 648 Critical Radiant Flux of 0.45 watts per sq. cm. or greater, Class I.

1.6 ASTM E 662 (Smoke Generation) Maximum Specific Optical Density of 450 or less.

1.7 SUBMITTALS

- A. Submit shop drawings, seaming plan, manufacturer's technical data, installation and maintenance instructions (latest edition of "Armstrong Guaranteed Installation System," F-5061) for flooring and accessories.
- B. Submit the manufacturer's standard samples showing the required colors for flooring, welding rods, and applicable accessories.
- C. If required, submit the manufacturer's certification that the flooring has been tested by an independent laboratory and complies with the required fire tests.

1.8 ENVIRONMENTAL CONDITIONS

- A. Deliver materials in good condition to the jobsite in the manufacturer's original unopened containers that bear the name and brand of the manufacturer, project identification, and

shipping and handling instructions.

- B. Store materials in a clean, dry, enclosed space off the ground, and protected from the weather and from extremes of heat and cold. Protect adhesives from freezing. Store flooring, adhesives and accessories in the spaces where they will be installed for at least 48 hours before beginning installation.
- C. Maintain a minimum temperature in the spaces to receive the flooring and accessories of 65°F (18°C) and a maximum temperature of 100°F (38°C) for at least 48 hours before, during, and for not less than 48 hours after installation. Thereafter, maintain a minimum temperature of 55°F (13°C) in areas where work is completed. Protect all materials from the direct flow of heat from hot-air registers, radiators, or other heating fixtures and appliances.
- D. Install flooring and accessories after the other finishing operations, including painting, have been completed. Close spaces to traffic during the installation of the flooring. Do not install flooring over concrete slabs until they are sufficiently dry to achieve a bond with the adhesive, in accordance with the manufacturer's recommended bond and moisture tests.

PART 2 – PRODUCTS

2.1 LINOLEUM SHEET FLOORING MATERIALS

- A. Provide Armstrong MARMORETTE™ with NATURCote™ Linoleum Sheet Flooring manufactured by Armstrong World Industries, Inc, in color selected from the range currently available from Armstrong World Industries, Inc., 6.5 feet (2.0 m) wide, having a nominal total thickness of 0.100in. The wear surface shall consist of a polyurethane-coated homogeneous mixture of linoleum cement (linseed oil, natural tree resins, drying oil catalysts), wood flour, cork flour, color pigments and filler calendared onto a jute fabric backing. Colors and pattern detail shall be dispersed throughout the thickness of the wear layer. Linoleum sheet shall conform to the requirements of ASTM F 2034, Type I, "Standard Specification for Sheet Linoleum Floor Covering."
- B. Provide solid color linoleum weld rod as produced by Armstrong World Industries, Inc., and intended for heat welding of linoleum seams. Color shall be compatible with field color of flooring or as selected by Architect to contrast with field color of flooring. Color selected from the range currently available from Armstrong World Industries, Inc.
- C. Specifications and Drawings are based on manufacturer's proprietary literature from Armstrong World Industries, Inc. Other manufacturers shall comply with minimum levels of material, color selection, and detailing indicated in Specifications or on Drawings. Architect will be sole judge of appropriateness of substitutions.

2.2 ADHESIVES

- A. Provide Armstrong S-780 Linoleum Adhesive for field areas.

2.3 ACCESSORIES

- A. For patching, smoothing, and leveling monolithic subfloors (concrete, terrazzo, quarry tile, ceramic tile, and certain metals), provide Armstrong S-183 Fast-Setting Cement-Based Underlayment, S-184 Fast-Setting Cement-Based Patch and Skim Coat, or S-194 Fast-Setting Cement-Based Patch and Underlayment as recommended by manufacturer.
- B. Provide transition/reducing strips tapered to meet abutting materials.

- C. Provide threshold of thickness and width as required.
- D. Provide resilient edge strips of width shown on the drawings, of equal gauge to the flooring, homogeneous vinyl or rubber composition, tapered or bullnose edge, with color to match or contrast with the flooring, or as selected by the Architect from standard colors available.

PART 3 – EXECUTION

3.1 INSPECTION

- A. Examine subfloors prior to installation to determine that surfaces are smooth and free from cracks, holes, ridges, and other defects that might prevent adhesive bond or impair durability or appearance of the flooring material.
- B. Inspect subfloors prior to installation to determine that surfaces are free from curing, sealing, parting and hardening compounds; residual adhesives; adhesive removers; and other foreign materials that might prevent adhesive bond. Visually inspect for evidence of moisture, alkaline salts, carbonation, dusting, mold, or mildew.
- C. Report conditions contrary to contract requirements that would prevent a proper installation. Do not proceed with the installation until unsatisfactory conditions have been corrected.
- D. Failure to call attention to defects or imperfections will be construed as acceptance and approval of the subfloor. Installation indicates acceptance of substrates with regard to conditions existing at the time of installation.

3.2 PREPARATION

- A. Smooth concrete surfaces, removing rough areas, projections, ridges, and bumps, and filling low spots, control or construction joints, and other defects as recommended by the flooring manufacturer.
- B. Remove paint, varnish, oils, release agents, sealers, and waxes. Remove residual adhesives as recommended by the flooring manufacturer. Remove curing and hardening compounds not compatible with the adhesives used, as indicated by a bond test or by the compound manufacturer's recommendations for flooring. Avoid organic solvents.
- C. Perform subfloor moisture testing in accordance with [ASTM F 2170, "Standard Test Method for Determining Relative Humidity in Concrete Slabs Using *in-situ* Probes"] [ASTM F 1869, "Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride"] and Bond Tests as described in publication F-5061, "Armstrong Guaranteed Installation System," to determine if surfaces are dry; free of curing and hardening compounds, old adhesive, and other coatings; and ready to receive flooring. [Relative humidity shall not exceed 80%.] [MVER shall not exceed 5 lbs./1000 sq. ft./24 hrs.] On installations where both the Percent Relative Humidity and the Moisture Vapor Emission Rate tests are conducted, results for both tests shall comply with the allowable limits listed above. Do not proceed with flooring installation until results of moisture tests are acceptable. All test results shall be documented and retained.
- D. Perform pH tests on concrete floors regardless of their age or grade level. All test results shall be documented and retained.

- E. Vacuum or broom-clean surfaces to be covered immediately before the application of flooring. Make subfloor free from dust, dirt, grease, and all foreign materials.

3.3 INSTALLATION OF SHEET FLOORING

- A. Install flooring in strict accordance with the latest edition of "Armstrong Guaranteed Installation System", F-5061.
- B. Install flooring wall to wall before the installation of floor-set cabinets, casework, furniture, equipment, movable partitions, etc. Extend flooring into toe spaces, door recesses, closets, and similar openings as shown on the drawings.
- C. If required, install flooring on pan-type floor access covers. Maintain continuity of color and pattern within pieces of flooring installed on these covers. Adhere flooring to the subfloor around covers and to covers.
- D. Scribe, cut, and fit or flash cove to permanent fixtures, columns, walls, partitions, pipes, outlets, and built-in furniture and cabinets.
- E. Adhere flooring to the subfloor without cracks, voids, raising and puckering at the seams. Roll with a 100-pound (45.36 kilogram) roller in the field areas. Hand-roll flooring at the perimeter and the seams to assure adhesion. Refer to specific rolling instructions of the flooring manufacturer.
- F. Lay flooring to provide a minimum number of seams. Avoid cross seams, filler pieces, and strips. Match edges for color shading and pattern at the seams in compliance with the manufacturer's recommendations.
- G. Install flooring with adhesives, tools, and procedures in strict accordance with the manufacturer's written instructions. Observe the recommended adhesive trowel notching, open times, and working times.
- H. Prepare heat-welded seams with special routing tool supplied for this purpose and heat weld with linoleum welding rod in seams. Use methods and sequence of work in conformance with written instructions of the flooring manufacturer. Finish all seams flush and free from voids, recesses, and raised areas.
- I. Seal edge of linoleum flooring to ceramic tile cove base with color matched sealant as recommended by the flooring manufacturer. Color as selected by architect.

3.4 INSTALLATION OF ACCESSORIES

- A. Apply top set wall base to walls, columns, casework, and other permanent fixtures in areas where top-set base is required. Install base in lengths as long as practical, with inside corners fabricated from base materials that are mitered or coped. Tightly bond base to vertical substrate with continuous contact at horizontal and vertical surfaces.
- B. Fill voids with plastic filler along the top edge of the resilient wall base or integral cove cap on masonry surfaces or other similar irregular substrates.
- C. Place resilient edge strips tightly butted to flooring, and secure with adhesive recommended by the edge strip manufacturer. Install edge strips at edges of flooring that would otherwise be exposed.
- D. Apply butt-type or overlap metal edge strips where required. Secure units to the substrate, complying with the edge strip manufacturer's recommendations.

3.5 CLEANING AND PROTECTION

- A. Perform initial and ongoing maintenance according to the F-7796 Installation & Maintenance Tip Sheet or the latest edition of "Armstrong Guaranteed Installation System," F-5061.
- B. Protect installed flooring as recommended by the flooring manufacturer against damage from rolling loads, other trades, or the placement of fixtures and furnishings. (See Finishing The Job in "Armstrong Guaranteed Installation System," F-5061.)

END OF SECTION

SECTION 09 90 00 - PAINTING AND COATING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes

1. Preparation of surfaces as specified and as required to provide sound, even, uniform substrates free of coatings, corrosion, and contaminants and suitable for optimum application of coatings.
2. Application of paint and coating systems specified.
3. Determine colors of all existing finishes through finishes analysis.

B. Extent of Painting Work

1. Prepare, prime, and paint structural steel
2. Prepare, prime, and paint exterior woodwork including wood windows.
3. Prepare, prime, and paint sheet metal roof
4. Prepare, prime, and paint new metal door.
5. Prepare, prime, and paint gutters and downspouts.
6. Prepare and restore existing interior woodwork.
7. Prepare and prime new interior woodwork.
8. Prepare, stain and seal new interior woodwork.
9. Prepare, prime, and paint interior gypsum board walls and ceilings.
9. Prepare and paint or finish other elements as indicated on Drawings.

C. Related Requirements

1. Section 06 20 00 – Finish Carpentry
2. Section 07 62 13 – Sheet Metal Gutter and Downspouts
3. Section 08 50 00 – Wood Window and Door Restoration

1.2 QUALITY ASSURANCE

A. Painting Specialist: Award painting work to a firm regularly engaged in painting elements of historic buildings that can demonstrate to Owner's satisfaction that, within previous five years, the firm has successfully performed and completed in a timely manner at least three projects similar in scope and type to work required on this Project involving state-reviewed work on buildings listed in the National Register of Historic Places, or buildings listed in a State Register of Historic Places under the direction of preservation authorities, or buildings designated as Landmarks by a local historical commission where construction was regulated by local governmental authorities,.

1. Foreman: Painting work shall be directly supervised by a full-time foreman with experience equal to or greater than that required of Painting Specialist. Foreman shall read and speak English fluently. Foreman shall be on site daily for duration of work of this Section. Same foreman shall remain on Project throughout work unless his performance is deemed unacceptable.
2. Painters: Painting shall be carried out by skilled journeyman painters who are thoroughly experienced with materials and methods specified and have a minimum of three years' experience painting elements of historic buildings similar to work required by this Section. In acceptance or rejection of work of this Section, no allowance will be made for workers' inattention or lack of skill.

- B. Conservator: Award finishes analysis work to a Conservator regularly engaged in, and with at least eight years' experience in, analyzing finishes similar to the finishes to be analyzed as work of this Section that can demonstrate to Owner's satisfaction that, within previous three years, the Conservator has successfully performed and completed in a timely manner at least three projects similar in scope and type to work required on this Project.
1. Affiliation: Conservator shall be a Professional Associate or Fellow of the American Institute for Conservation of Historic & Artistic Works.
- C. Laws, Codes, and Regulations: Work of this Section shall comply with all applicable federal, state, and local laws, codes, and regulations.
1. VOC Standards: Paints shall conform to all applicable Volatile Organic Compounds (VOC) standards.
- D. Referenced Standards: Work of this Section shall comply with applicable requirements and recommendations of latest editions of the documents listed herein, except as modified by more stringent requirements of the Contract Documents and of applicable laws, codes, and regulations of authorities having jurisdiction. Where the language in any of the documents referred to herein is in the form of a recommendation or suggestion, such recommendations or suggestions shall be deemed to be mandatory under this Contract unless specifically indicated otherwise in Contract Documents. Provide a reference copy of each of the following standards at Project site during all periods when work of this Section is being performed. In each case in which there is a conflict between requirements of referenced standards; requirements of laws, codes, and regulations; and requirements of this Section, the most stringent or restrictive requirement shall govern.
1. Society for Protective Coatings (SSPC)
 - a. PA 1, Paint Application Specification No. 1, *Shop, Field and Maintenance Painting*.
 - b. SP 1, Surface Preparation Specification No. 1, *Solvent Cleaning*.
 - c. SP 6, Surface Preparation Specification No. 6, *Commercial Blast Cleaning*. (For metal surfaces only)
 - d. SP 11, Surface Preparation Specification No. 11, *Power Tool Cleaning to Bare Metal*.
- E. Finishes Analysis: Analysis of all existing exterior and interior finishes performed by Conservator. For each substrate Conservator shall identify element, type of finish, and number of coats. Sampling shall be done in a manner to minimize the destruction of existing building material as much as possible and/or be in the most visually obscured location. Analysis shall include photomicrographs of sections through coatings.
1. Opaque Coatings: Identify colors of four earliest finish layers using standard color system.
 2. Transparent Finishes: Identify whether wood was stained, whether wood was sealed, and type of finish.
- F. Single-Source Responsibility: Provide all coats of painting systems, including primers, undercoats, and finish coats as a coating system produced by the same manufacturer to ensure compatibility and optimum performance.
- G. Knowledge of Site and Project Conditions: Before submitting bid, Bidders shall make

themselves thoroughly familiar with the Drawings and Specifications, with the scope of this Project, and with all conditions at the Project site relating to requirements of this Section and limitations under which the work will be performed and shall determine or verify dimensions and quantities. Submission of a bid shall be considered conclusive evidence that Contractor is thoroughly familiar with Project requirements and site conditions and limitations.

1.3 SUBMITTALS

- A. General: Submit the following in compliance with the requirements of the Contract Documents. Revise and resubmit each item as required to obtain Architect's approval.
- B. Qualification Data: Qualification data for firm and personnel specified in "Quality Assurance" Article that demonstrates that both firm and personnel have capabilities and experience complying with requirements specified. For firm, foreman, and decorative painter for plaster provide a list of at least three completed projects similar in size and scope to the work required on this Project. For each project list project name, address, architect, conservator, supervising preservation agency, scope of contractor's work, and other relevant information. Submit this information with the bid.
- C. Report on Finishes Analysis: Report containing results of finishes analysis performed by Conservator as required by "Quality Assurance" Article, above.
- D. Product Data: Manufacturer's published technical data for each product to be used in work of this Section including material description, chemical composition (ingredients and proportions), physical properties, recommendations for application and use, test reports and certificates verifying that product complies with specified requirements, and Material Safety Data Sheets (MSDS).
- E. Samples: Provide samples of each coating type in each color selected by Architect on representative samples of the actual substrate, minimum 12 inches square.

1.4 MOCK-UPS

- A. General: Before beginning general painting work, prepare mock-ups to provide standards for work of this Section. Do not proceed with painting work until Architect has approved mock-ups.
 - 1. Locate mock-ups as directed by Architect.
 - 2. Notify Architect 48 hours prior to start of each mock-up.
 - 3. Use crew that will execute the work and follow requirements of this Section.
 - 4. Repeat mock-ups as necessary to obtain Architect's approval.
 - 5. Protect approved mock-ups to ensure that they are without damage, deterioration, or alteration at time of Substantial Completion.
 - 6. Approved mock-ups in undamaged condition at time of Substantial Completion may be incorporated into the Work.
 - 7. Approved mock-ups will represent minimum standards for painting. Subsequent painting work that does not meet standards of approved mock-ups will be rejected.
- B. Prepare the Following Mock-Ups
 - 1. Painting Structural Steel: One member.
 - 2. Painting Exterior Woodwork: One location, 8 sq. ft., minimum.

3. Painting Sheet Metal Roofing: One location, 16 sq. ft.
4. Painting Gutters: 6 linear feet.
5. Painting and Finishing Interior Woodwork: One location, minimum 9 sq. ft.
6. Painting Interior Gypsum Board: 25 sq. ft.
7. Painting and Finishing Other Elements as Indicated on Drawings: One element or one section as selected by Architect.
8. Staining of Interior Wood Applications: One location for each wood type, minimum 3 sq. ft.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store materials in manufacturers' original sealed containers or packaging, clearly labeled with manufacturer's name, address and product identification, including grade, type, color, date of manufacturer, contents by volume for pigment and vehicle, thinning instructions, and application instructions. Immediately reseal containers after partial use.
- B. Store all materials in spaces designated by Owner. Such spaces shall comply with pertinent federal, state, and local laws, codes, and regulations.
 1. Maintain temperatures in storage spaces within range recommended by manufacturer of material being stored in each case but at a temperature of not less than 45 deg F.
- C. Deliver, store, and handle all products and materials to prevent damage, deterioration, or degradation and intrusion of foreign material.
- D. Discard and remove from site deteriorated materials, contaminated materials, and products that have exceeded their expiration dates. Replace with fresh materials.

1.6 PROJECT CONDITIONS

- A. Safety: Take all necessary measures to protect all persons, whether or not they are involved with work of this Section, from harm caused by work of this Section.
 1. Protect all persons not associated with the work from exposure to fumes and vapors.
 2. Ensure adequate ventilation at all times during work of this Section.
- B. Protection of Building: Protect building elements and finishes from damage and from deterioration caused by work of this Section. Repair all damage to materials and all damage to finishes to Architect's satisfaction at no additional cost to Owner.
 1. Take all necessary precautions to prevent fire and spread of fire.
 2. Store oily rags in closed metal containers. Remove oily rags and waste from site daily.
- C. Protection of Surroundings: Protect surrounding elements from damage and deterioration resulting from work of this Section.
- D. Coordination: Coordinate work of this Section with other work to ensure proper completion of all Work.
 1. Schedule painting and coating work so that uncured paint and coatings will not be harmed or marred by airborne dust or debris from other

construction work.

1.7 ENVIRONMENTAL REQUIREMENTS

- A. Follow specified requirements and manufacturer's recommendations concerning temperature requirements for products specified herein. In case of conflict, the more stringent requirements shall govern.
- B. Apply water-based paints only when temperature of surfaces to be painted and surrounding air temperatures are between 50 deg F and 90 deg F.
- C. Apply solvent-thinned paints only when temperature of surfaces to be painted and surrounding air temperatures are between 45 deg F and 95 deg F.
- D. Do not apply paint in snow, rain, fog, or mist; or when relative humidity exceeds 85 percent; or at temperatures less than 5 deg F above dew point; or to damp or wet surfaces.

1.8 LEAD-CONTAINING PAINT (LCP)

- A. General: Perform all work that disturbs lead-containing paint (LCP), handle all material that involves lead-containing paint, and transport and dispose of all lead-containing paint and residue in compliance with all applicable federal, state, and local laws and regulations for identification, removal, labeling, handling, containerization, transportation, and disposal of lead- containing material including, but not limited to, those referenced herein.
- B. U.S. Department of Labor OSHA Regulations: Including but not limited to: Title 29, Code of Federal Regulations (CFR) Section 1926.62: "Lead Exposure in Construction" and Title 29, CFR Section 1910.1200: "Hazard Communication Standard."
- C. U.S. Environmental Protection Agency (USEPA) Regulations: Including but not limited to: Title 40 CFR Part 262: "Standards Applicable to Generators of Hazardous Waste" and Part 263: "Standards Applicable to Transporters of Hazardous Waste."
- D. U.S. Department of Transportation (USDOT) Regulations: Including but not limited to: 49 CFR Parts 172, 173, 174, 175, 177, 178, 179, and 180.

PART 2 - PRODUCTS

2.1 PAINT MATERIALS

- A. Material Compatibility: Provide primers, finish coat materials, and related materials that are compatible with one another and substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
- B. Material Quality: Provide manufacturer's best-quality trade sale paint material of various coating types specified. All paints shall be new, free from defects, and of recent manufacture.
- C. Ready-Mixed Formulations: Paints shall be ready-mixed of approved formulations matching approved colors. Containers shall bear labels giving exact formula of mixture, which shall be guaranteed by manufacturer and subject to analysis by a laboratory

selected by Architect. Paint material containers not displaying manufacturer's product identification will not be acceptable unless approved by Architect.

- D. Manufacturer's Instructions: Comply with material manufacturer's instructions for use of products (including surface preparation, mixing, applying, drying, etc.). In case of conflict with requirements of this Section, the more stringent requirements shall govern.
- E. Thinners: Use only thinners approved by paint manufacturer and use only within recommended limits and when approved in advance by Architect.
- F. Colors: Colors shall be as selected by the Architect based on finishes analysis and will not be limited to manufacturer's standard colors.
- G. Pigments: Pure, non-fading, mildew-proof, sun-proof, finely ground in approved medium and of applicable types to suit substrates and service indicated unless otherwise approved by Architect.
- H. Tinting Prime Coats: Prime coats and undercoats shall each have a slight variation of color to distinguish them from preceding and succeeding coats.

2.2 MISCELLANEOUS MATERIALS

- A. Bleach Solution: 0.5 percent solution of sodium hypochlorite in water. Provide solution of 1 part Clorox bleach, or approved equal, to 9 parts water.
- B. Non-ionic Detergent: Surfonic JL-80X Surfactant, available from Conservation Support Systems, P.O. Box 91746, Santa Barbara, CA 93190 (800-482-6299).
- C. Solvent: Mineral Spirits, available from Mohawk Finishing Products, Division of RPM Wood Finishes Group, Inc., P.O. Box 22000, Hickory, NC 28603 (800-545-0047).
- D. Cleaning Solution for Transparent Finished Wood: 0.1 percent solution of Surfonic JL-80X surfactant in mineral spirits.
- E. Cleaning Solution for Miscellaneous Elements: Simple Green, manufactured by Sunshine Makers, in water.

2.3 SCHEDULE OF FINISHES

- A. Manufacturers
 - 1. Metal: Provide coating systems by Benjamin Moore & Co., 101 Paragon Drive, Montvale, NJ 07645 (800-344-0400), or approved equal.
 - 2. Wood: Provide coating systems by Benjamin Moore & Co., 101 Paragon Drive, Montvale, NJ 07645 (800-344-0400), or approved equal.
- B. Exterior Ferrous Metal and Structural Steel. Two coats.
 - 1. First Coat: Moorcraft Super Spec Urethane Alkyd Gloss Enamel Z22. Provide 1.5 to 2.5 mil dry film thickness.
 - 2. Second Coat: Moorcraft Super Spec Urethane Alkyd Gloss Enamel Z22. Provide 1.5 to 2.5 mil dry film thickness.

- C. Exterior Galvanized Ferrous Metal, Copper, and Tin/Zinc Coated Stainless Steel. Two coats.
 - 1. First Coat: IronClad Latex Low Lustre Metal and Wood Enamel No. 363. Provide 1.5 to 2.5 mil dry film thickness.
 - 2. Second Coat: IronClad Alkyd Low Lustre Metal and Wood Enamel. Provide 1.5 to 2.5 mil dry film thickness.
- D. Exterior Wood. Primer and two finish coats.
 - 1. Primer: Moore's Fresh Start Moorwhite Penetrating Alkyd Primer No.100. Provide 2.1- mil dry film thickness.
 - 2. Second Coat: Moore's Impervex High-Gloss Metal and Wood Enamel No. 309. Provide 1.2-mil dry film thickness.
 - 3. Third Coat: Moore's Impervex High-Gloss Metal and Wood Enamel No. 309. Provide 1.2-mil dry film thickness.
- E. Interior Wood. Transparent finish as determined by finishes analysis for each surface. Finish may include as many as five coats, which may include, but are not limited to, stain, sealer, and varnish or lacquer.
- F. Interior Gypsum Board. Primer and two finish coats.
 - 1. Primer: Benjamin Moore & Co., interior primer for gypsum board surfaces.
 - 2. First Finish Coat: Moore's interior paint for gypsum board surfaces matching color and gloss of Architect's sample determined by paint analysis.
 - 3. Second Finish Coat: Moore's interior paint for gypsum board surfaces matching color and gloss of Architect's sample determined by paint analysis.
- G. Wood Flooring: Finish to be compatible with and to match cleaned existing finish. Provide coats as directed by Architect.

PART 3 - EXECUTION

3.1 SURFACE PREPARATION, GENERAL

- A. General: Prepare all surfaces free of previous coatings, corrosion, oil, grease, and all other contaminants that might adversely affect adhesion, performance, or durability of paint and as required for optimum application.
- B. Manufacturer's Recommendations: Comply with manufacturer's recommendations, requirements specified herein, and best trade practice for surface preparation. In case of conflict, the strictest, most restrictive requirement shall govern.

3.2 PREPARATION OF FERROUS METAL AND GALVANIZED FERROUS METAL

- A. General: Remove all paint, corrosion, oil, grease, and other contaminants.
- B. Paint and Corrosion Removal: Remove paint to comply with requirements of Section 090190 – Paint and Coating Removal. Remove corrosion to comply with requirements of SSPC SP-6 for metal prepared in shop and with requirements of SSPC SP-11 for material prepared on site.
- C. Solvent Cleaning: Wipe metal surfaces using approved solvent on clean white cloths to

remove all traces of oils, grease, and other contaminants. Dry surfaces thoroughly using approved method that does not contaminate cleaned surface.

- D. Recleaning: Reprepare all surfaces that have not been painted within two (2) hours of surface preparation and all surfaces on which flash rusting has occurred (whether or not the surface was prepared within the previous two (2) hours).

3.3 PREPARATION OF COPPER AND TIN/ZINC COATED STAINLESS STEEL

- A. General: Remove all oil, grease, and other contaminants.
- B. Solvent Cleaning: Wipe metal surfaces using approved solvent on clean white cloths to remove all traces of oils, grease, and other contaminants. Dry surfaces thoroughly using approved method that does not contaminate cleaned surface.
- C. Recleaning: Reprepare all surfaces that are contaminated before paint is applied.

3.4 SURFACE PREPARATION OF EXTERIOR WOOD

- A. Removal of Loose and Flaking Paint: Remove loose and flaking paint using appropriate tools with rounded corners that will not damage wood substrate.
- B. Sanding: Sand surfaces lightly to dull existing finish and to feather edges of remaining sound paint. Use care to avoid damaging wood from which paint is missing by "dishing" or other damage.
- C. Rinsing: Thoroughly wipe wood using clean cloths with approved solvent to ensure that it is free of all contaminants that might adversely affect adhesion, performance, or durability of paint coating.

3.5 SURFACE PREPARATION OF INTERIOR WOOD

- A. Removal of Loose and Flaking Paint: Remove loose and flaking paint using appropriate tools with rounded corners that will not damage wood substrate.
- B. Sanding: Sand surfaces lightly to dull existing finish and to feather edges of remaining sound paint. Use care to avoid damaging wood from which paint is missing by "dishing" or other damage.
- C. Rinsing: Thoroughly wipe wood using clean cloths with approved solvent to ensure that it is free of all contaminants that might adversely affect adhesion, performance, or durability of finish.

3.6 SURFACE PREPARATION OF OTHER INTERIOR WOOD

- A. Wood from which Paint Has Been Removed: Following removal of paint sand wood lightly. Remove all sanding dust and dirt with tack cloths. Allow wood to dry thoroughly before painting.
- B. Cleaning Existing Transparent Finish on Wood: Clean clear wood finish using specified detergent solution and clean, white cloths. Wipe finish with cloths moistened with cleaning solution. Wipe with dry white cloths. Repeat cleaning until cloths come away white, without evidence of dirt. Rinse with clean mineral spirits on white cloths.

3.7 MATERIALS PREPARATION

- A. Carefully mix and prepare paint materials according to manufacturer's directions.
 - 1. Maintain containers used in mixing and applying paint in a clean condition, free of foreign materials and residue.
 - 2. Stir material before application to produce a mixture of uniform density; stir as required during application. Do not stir surface film into material. Remove film and, if necessary to remove particles of film, strain material before using.
 - 3. Use only thinners approved by paint manufacturer and only within recommended limits.
- B. Tinting: Tint undercoats to nearly match color of finish coat but with sufficient differences in shades of undercoats to distinguish separate coats. Tint each undercoat slightly lighter than the succeeding coat.

3.8 PAINT AND COATING APPLICATION

- A. General: Apply paints and coatings according to manufacturer's directions.
 - 1. Do not paint over dirt, rust, scale, grease, moisture, or other conditions detrimental to formation of a durable paint film.
 - 2. Provide finish coats that are compatible with primers used.
 - 3. Apply first coat to surfaces that have been prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.
 - 4. Number of coats and film thickness required are same regardless of application method.
 - 5. Allow sufficient time between successive coats to permit proper drying as recommended by coating manufacturer. Do not recoat until paint has dried to where it feels firm, does not deform or feel sticky under moderate thumb pressure, and where application of another coat of paint does not cause undercoat to lift or lose adhesion.
 - 6. Sand between coats where sanding is required to produce a smooth even surface according to manufacturer's directions.
 - 7. Apply additional coats if undercoats, stains, or other conditions show through final coat of paint until paint film is of uniform finish, color, and appearance. Ensure that edges, corners, crevices, welds, exposed fasteners, and other special surface conditions receive a dry film thickness equivalent to that of flat surfaces.
- B. Application: Apply paints by brush, using brushes best suited for material applied, roller, spray, or other applicators.
- C. Minimum Coating Thickness: Apply materials no thinner than manufacturer's recommended spreading rate. Provide total dry film thickness of entire system as recommended by manufacturer.
- D. Prime Coats: Apply a prime coat of material to prepared substrate following manufacturer's directions. Recoat primed and sealed surfaces where evidence of suction spots or unsealed areas in first coat appears, to ensure a finish coat with no burn-through or other defects due to insufficient sealing.
- E. Pigmented (Opaque) Finishes: Completely cover to provide a smooth, opaque surface of uniform finish, color, appearance, and coverage. Cloudiness, spotting,

holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections will not be acceptable.

- G. Clear (Translucent) Finishes: Completely cover to provide a smooth surface of uniform finish, color, appearance, and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, or other surface imperfections will not be acceptable.
- G. Completed Work: Match approved samples for color, texture, and coverage. Remove and repaint work not complying with specified requirements.

3.9 FIELD QUALITY CONTROL

- A. General: Owner reserves the right to invoke the following test procedure at any time and as often as Owner deems necessary during period when paint is being applied:
- B. Owner will engage services of an independent testing agency to sample paint material being used. Samples of material delivered to Project will be taken, identified, sealed, and certified in presence of Contractor.
- C. Testing agency will perform appropriate tests for quantitative analysis of material and analysis of its in-service properties as required by Owner.
- D. If test results show material being used does not comply with specified requirements, Contractor may be directed to stop painting, remove noncomplying paint, pay for testing, repaint surfaces coated with rejected paint, and remove rejected paint from previously painted surfaces if, upon repainting with specified paint, the two coatings are incompatible.
- E. Owner will also engage independent testing agency to measure coating dry film thicknesses. Provide additional coats in all locations in which dry film thickness does not comply with coating manufacturer's recommendations.

3.10 CLEANING

- A. Daily Cleanup: At end of each work day, remove empty cans, rags, rubbish, and other discarded paint materials from site.
- B. Final Cleanup: After completing painting, clean paint-spattered surfaces. Remove spattered paint by washing and scraping. Do not scratch or damage adjacent finished surfaces.

3.11 PROTECTION

- A. Protect work of other trades, whether being painted or not, against damage by painting. Correct damage by cleaning, repairing or replacing, and repainting, as acceptable to Architect.
- B. At completion of construction activities of other trades, touch up and restore damaged painted surfaces and defaced painted surfaces.

END OF SECTION

SECTION 10 14 00 – SIGNAGE

PART 1 - GENERAL

1.1 SUMMARY

- A. Tactile signage with raised text and Grade II Braille in accordance with the (ADAAG) Americans with Disabilities Act Accessibility Guidelines.
- B. Tactile Signage
 - 1. Photopolymer

1.2 REFERENCES

- A. Department of Justice, 2010 ADA Standards for Accessible Design.
 - 1. 2010 Standards for State and local governments, Title II regulations at 28 CFR 35.151 and the 2004 ADAAG at 36 CFR part 1191, appendices B and D.
 - 2. 2010 Standards for public accommodations and commercial facilities, Title III regulations at 28 CFR part 36, subpart D and the 2004 ADAAG at 36 CFR part 1191, appendices B and D.
- B. ICC/ANSI A117.1-2009: Accessible and Usable Buildings and Facilities.

1.3 SUBMITTALS

- A. Product Data: Provide manufacturer's descriptive product literature for sign types specified, including components and accessories.
- B. Shop Drawings: Provide manufacturer's detail of construction relative to materials, dimensions of individual components, profiles and finishes:
 - 1. Show individual sign types, graphics, typestyles, colors, sign dimensions and profiles. Show mounting methods, locations, accessories and installation guidelines.
 - 2. Provide message list for each sign required, including large-scale details of wording and lettering layout where signs contain more than one word or more than one number.
- C. Samples: Provide a single unit sample of each sign type to verify colors, dimensions, profiles, finishes, method of installation and quality.

1.4 QUALITY ASSURANCE

- A. Use a single manufacturing source to produce tactile signage that is finished and ready for installation.
- B. Manufacturer Qualification: Use a tactile sign manufacturer with at least ten years experience in the fabrication of architectural and ADA signs.
- C. Installer Qualifications: Use a sign installation contractor that is specialized and experienced in work similar to the sign installation requirements for this project.

PART 2 - PRODUCTS

2.1 MANUFACTURER

- A. Manufacturer:
Kroy Sign Systems
7575 E. Redfield Rd., Ste 113
Scottsdale, Arizona, 85260
Telephone (800) 950-5769
Fax (480) 483-0235
Web www.kroysignsystems.com
Email: signs@kroysignsystems.com
- B. Basis of Design Product: Kroy Sign Systems Photopolymer based tactile signage.

2.2 DESCRIPTION

- A. Produce tactile signage to meet the following regulatory requirements:
1. 2010 Standards for Title II and III Facilities, 2004 ADAAG.
 2. ICC/ANSI A117.1-2009.
 3. State building code provisions as adopted by regulatory authorities having jurisdiction.

2.3 MATERIALS

- A. General: Produce tactile signage that complies with requirements indicated for material, thickness, colors, design, shapes, sizes and details of construction.
1. Produce tactile signs to comply with applicable provisions of the ADAAG and ICC/ANSI A117.1 - 2009 standards including 0.031 inch raised pictograms, text and Grade II Braille characters.
 2. Produce panel signs to remain flat under installed conditions and within a tolerance of plus or minus 0.015 inches when measured diagonally.
- B. Sign Type: Produce tactile signage using one or more of the following materials and fabrication processes.
1. Photopolymer tactile signs fabricated from manufacturer's list of applicable photopolymer sign materials.
 - a. Fabricate tactile sign panel using a nylon interior grade photopolymer with a non-glare clear (UV) Ultraviolet resistant (PETG) Polyethylene Terephthalate Glycol sign base. Use material that has an overall base thicknesses of 0.118 inches. Surface Paint tactile sign panel with an acrylic polyurethane finish and a UV resistant clear topcoat. Text, pictograms and symbol are raised with surface applied color. Signs to be gray background with white letters and symbols.
 2. Precision laser cut, CNC router cut, saw cut or shear tactile sign panels to achieve dimensional shapes and sizes required or select from manufacturer's list of standard sizes. Tactile signs have Square corners.
 3. Specify text as Positioned as Specified with corresponding Grade II Braille. Produce tactile signs to conform to ADA Accessibility Guidelines and ICC/ANSI A117.1 – 2009, section 703.3 and 703.5, unless otherwise specified.
 4. Specify pictograms and symbols as Positioned as Specified. Produce tactile signs to conform to ADA Accessibility Guidelines and ICC/ANSI A117.1 – 2009, section 703.3 and 703.5, unless otherwise specified.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine wall surfaces, substrate areas and conditions with the Installer present, for compliance with the requirements for installation guidelines, tolerances and other conditions affecting the performance of work.
- B. Verify that items including anchor inserts and electrical power provided under other sections of work are sized and located to accommodate sign installation.
- C. Examine supporting members to ensure that surfaces are at elevations indicated or required to comply with the authorities having jurisdiction and are free from dirt and other deleterious matter.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Locate signs and accessories where indicated, using mounting methods of types described and in compliance with manufacturer's written instructions.
 - 1. Install signs level, plumb and at heights indicated, with sign surfaces free from distortion and other defects in appearance.
 - 2. Install signs in accordance with ADAAG and ICC/ANSI A117.1 – 2009, section 703.4, unless otherwise specified.
- B. Wall Mounted Tactile Signs: Attach Tactile Signage to wall surfaces using the methods indicated.
 - 1. Foam-Tape: Use double-sided foam tape to mount signs to smooth, non-porous surfaces.

3.3 CLEANING AND PROTECTION

- A. After installation, clean soiled sign surfaces according to manufacturers' written instructions. Protect signs from damage until acceptance by Owner.

END OF SECTION

SECTION 102113 - TOILET COMPARTMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Solid Color Reinforced Composite (SCRC) Substrate: (Bobrick SierraSeries®)
 - 1. Toilet Partitions:
 - a. Configuration: Floor-Anchored, Overhead-Braced.
 - 2. Urinal Privacy Screens:
 - a. Configuration: Wall-Hung.

1.2 RELATED REQUIREMENTS

- A. Section 05 50 00 - Metal Fabrications: coordination with overhead supports; steel beams above finished ceiling to secure Ceiling-Hung and floor-to-ceiling stiles.
- B. Section 06 10 00 - Rough Carpentry: coordination with blocking in walls to secure panels, wall posts and stiles.
- C. Section 09 21 00 – Gypsum Board: coordination with blocking
- D. Section 09 30 00 – Tiling: coordination with layout and installation
- E. Section 10 28 00 - Washroom Accessories: for accessories.

1.3 SUBMITTALS

- A. Product Data: Submit manufacturer's data sheets for each product specified.
- B. Shop Drawings: Submit manufacturer's shop drawings for each product specified, including the following:
 - 1. Plans, elevations, details of construction and attachment to adjacent construction.
 - 2. Show anchorage locations and accessory items.
 - 3. Verify dimensions with field measurements prior to final production of toilet compartments.
- C. USA Certificate of Origin: Manufacturer must supply with first submittal, an example of their Certificate of Origin declaring toilet compartments are wholly manufactured and assembled specifically in the United States, including city and state locations. A notarized Certificate of Origin must be provided with closeout documents.

1.4 QUALITY ASSURANCE

- A. Manufacturer: Provide products manufactured by a company with a minimum of 10 years successful experience manufacturing similar products.
- B. Single Source Requirements: To the greatest extent possible provide products from a single manufacturer.
- C. Accessibility Requirements: Comply with requirements applicable in the jurisdiction of the project, including but not limited to ADA and ICC/ANSI A117.1 requirements as applicable.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store and handle materials and products in strict compliance with manufacturer's instructions and recommendations. Protect from damage.

1.6 WARRANTY

- A. Manufacturer's Warranty (SierraSeries): Manufacturer's standard 25 year limited warranty for panels, doors, and stiles against breakage, corrosion, and defects in factory workmanship. Manufacturer's standard 1 year guarantee against defects in material and workmanship for stainless steel door hardware and mounting brackets.

PART 2 PRODUCTS

2.1 MANUFACTURER

- A. Basis-of-Design Products: Based on the quality and performance requirements of the project, specifications are based solely on the products of Bobrick Washroom Equipment, Inc. www.bobrick.com. Location of manufacturing shall be the United States.
- B. Substitutions: The Architect will consider products of comparable manufacturers as a substitution, pending the contractor's submission of adequate documentation of the substitution in accordance with procedures in Division 01 of the Project Manual. Documentation shall include a list of five similar projects of equivalent size where products have been installed for a minimum of two years, and manufacturer's certification that products are fabricated in the United States.

2.2 SOLID COLOR REINFORCED COMPOSITE (SCRC) SUBSTRATE (SierraSeries)

- A. Solid Color Reinforced Composite (SCRC) Partitions: Bobrick SierraSeries.
 - 1. Color: As selected by Architect from manufacturer's standard SierraSeries range.
 - 2. Color: As indicated on Drawings.
 - 3. Color: SC01 Golden Khaki.
 - 4. Color: SC02 Desert Beige.
 - 5. Color: SC03 Terra Cotta.
 - 6. Color: SC04 Forest Green.
- B. Toilet Partitions:
 - 1. Configuration: Overhead-Braced partitions; with satin finish, extruded anodized aluminum headrails, 0.065 inch thick with anti-grip profile.
 - a. Basis-of-Design: Bobrick 1092G.67 SierraSeries Toilet Partitions, vandal resistant, gap-free.
 - 1) Design: Gap-free interlocking design.
 - 2) Hardware: Vandal resistant full-height stainless steel hardware.
- C. Urinal Privacy Screens:
 - 1. Basis-of-Design: Bobrick 1095 SierraSeries Wall-Hung Urinal Privacy Screens.
 - a. Brackets: 11 gauge, double thickness.
 - 2. Hardware: To match partition hardware.
 - 3. Fire Resistance:
 - a. Flame Spread Index (ASTM E 84): 45 for panels and stiles.

- b. Smoke Developed Index (ASTM E 84): 120 for panels, 95 for stiles.
 - c. National Fire Protection Association/International Building Code Interior Wall and Ceiling Finish: Class B.
 - d. Uniform Building Code: Class II.
- D. Materials: Solid color reinforced composite (SCRC) material for stiles, panels, doors, and screens with Bobrick GraffitiOff® coating, thermoset and integrally fused into homogenous piece; high density polyethylene (HDPE), high density polypropylene not acceptable.
 - 1. Composition: Dyes, organic fibrous material, and polycarbonate/phenolic resins.
 - 2. Surface Treatment: Non-ghosting, graffiti resistant surface integrally bonded to core through a series of manufacturing steps requiring thermal and mechanical pressure.
 - 3. Edges: Same color as the surface.
 - 4. Acceptable SCRC Products: Or manufacturer approved equal.
 - a. Ultimate Corian System by Shower Shapes.
 - b. WilsonArt Gibraltar Material.
 - c. WilsonArt EarthStone Material.
- E. Performance Requirements:
 - 1. Graffiti Resistance (ASTM D 6578): Passed cleanability test; 5 staining agents.
 - 2. Scratch Resistance (ASTM D 2197): Maximum load value exceeds 10 kilograms.
 - 3. Impact Resistance (ASTM D 2794): Maximum impact force exceeds 30 inch-pounds.
 - 4. Smoke Developed Index (ASTM E 84): Less than 450.
 - 5. Flame Spread Index (ASTM E 84): Less than 75.
- F. Finished Thickness:
 - 1. Stiles and Doors: 3/4 inch
 - a. Finished thickness of doors and stiles to ensure flush front.
 - 2. Panels and Screens: 1/2 inch.
- G. Stiles: Floor-Anchored stiles furnished with expansion shields and threaded rods.
 - 1. Leveling Devices: 7 gauge, 3/16 inches thick, corrosion-resistant, chromate-treated, double zinc-plated steel angle leveling bar bolted to stile; furnished with 3/8 inch diameter threaded rods, hex nuts, lock washers, flat washers, spacer sleeves, expansion anchors, and shoe retainers.
 - 2. Stile Shoes: One-piece, 22 gauge, 18-8, Type 304 stainless steel, 4 inch height; tops with 90 degree return to stile. One-piece shoe capable of adapting to 3/4 inch or 1 inch stile thickness and capable of being fastened (by clip) to stiles starting at wall line.
- H. Wall Posts: Pre-drilled for door hardware, 18-8, Type 304, 16 gauge stainless steel with satin finish; 1 inch x 1-1/2 inches x 58 inches high.
- I. Anchors: Expansion shields and threaded rods at floor connections as applicable. Threaded rods secured to supports above ceiling as applicable. Supports above ceiling furnished and installed as Work of Section 05 50 00.
- J. Hardware:

1. Compliance: Operable with one hand, without tight grasping, pinching, or twisting of the wrist, and force to operate does not exceed five pounds.
2. Emergency Access: Hinges, latch allow door to be lifted over keeper from outside compartment on inswing doors.
3. Materials: 18-8, Type 304, heavy-gauge stainless steel with satin finish. Chrome-plated "Zamak", aluminum, or extruded plastic hardware not acceptable.
4. Fastening: Hardware secured to door and stile by through-bolted, theft-resistant, pin-in-head Torx stainless steel machine screws into factory-installed, threaded brass inserts. Fasteners secured directly into core not acceptable.
 - a. Threaded Brass Inserts: Factory-installed; withstand direct pull force exceeding 1500 lb per insert.
5. Clothes Hooks: Projecting no more than 1-1/8 inch from face of door.
6. Hardware Type: Standard, commercial hardware.
 - a. Latching: Track of door latch prevents inswing doors from swinging out beyond stile; on outswing doors, door keeper prevents door from swinging in beyond stile; 14 gauge sliding door latch, 11 gauge keeper. Twist-style door latch operation not acceptable.
 - b. Hinges: Balanced, with field-adjustable cam to permit door to be fully closed or partially open when compartment is unoccupied.
 - c. Locking: Door locked from inside by sliding door latch into keeper.
 - d. Mounting Brackets: Mounted inside compartment; exposed brackets on exterior of compartment not acceptable with the exception of outswing doors.

PART 3 EXECUTION

3.1 PREPARATION

- A. Prepare substrates including but not limited to blocking and supports in walls and ceilings at points of attachment using methods recommended by the manufacturer for achieving the best result for the substrates under the project conditions.
 1. Inspect areas scheduled to receive compartments for correct dimensions, plumbness of walls, and soundness of surfaces that would affect installation of mounting brackets.
 2. Verify spacing of plumbing fixtures to assure compatibility with installation of compartments.
- B. If preparation is the responsibility of another installer, notify Architect in writing of deviations from manufacturer's recommended installation tolerances and conditions.
- C. Do not proceed with installation until substrates have been properly prepared with blocking and supports in walls and ceilings at points of attachment and deviations from manufacturer's recommended tolerances are corrected. Commencement of installation constitutes acceptance of conditions.

3.2 INSTALLATION

- A. Install products in strict compliance with manufacturer's written instructions and recommendations, including the following:
 1. Verify blocking and supports in walls and ceilings have been installed properly at points of attachment.
 2. Verify location does not interfere with door swings or use of fixtures.
 3. Use fasteners and anchors suitable for substrate and project conditions

4. Install units rigid, straight, plumb, and level.
5. Conceal evidence of drilling, cutting, and fitting to room finish.
6. Test for proper operation.

3.3 ADJUSTING, CLEANING AND PROTECTION

- A. Adjust hardware for proper operation after installation. Set hinge cam on in-swinging doors to hold doors open when unlatched. Set hinge cam on out-swinging doors to hold unlatched doors in closed position.
- B. Touch-up, repair or replace damaged products.
- C. Clean exposed surfaces of compartments, hardware, and fittings.

END OF SECTION

SECTION 10 28 00 - WASHROOM ACCESSORIES

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Washroom accessories as scheduled in this Section and as indicated on the Drawings.

1.2 RELATED REQUIREMENTS

- A. Section 06 10 00 - Rough Carpentry: coordination with blocking.
- B. Section 09 21 00 - Gypsum Board: coordination with blocking.
- C. Section 09 30 00 – Tiling: coordination with layout and installation.
- D. Section 10 21 13 - Toilet Compartments: coordination with accessories.

1.3 SUBMITTALS

- A. Product Data: Submit manufacturer's data sheets for each product specified, including the following:
 - 1. Installation instructions and recommendations.
 - 2. Storage and handling requirements and recommendations.
 - 3. Cleaning and maintenance instructions.
 - 4. Replacement parts information.
- B. Schedule: Submit a toilet accessory schedule, indicating the type and quantity to be installed in each washroom. Use room numbers as indicated on the Drawings.
- C. Country of Origin: Manufacturer must supply, with first submittal, Country of Origin information for each type of washroom accessory for this project.

1.4 QUALITY ASSURANCE

- A. Manufacturer: Provide products manufactured by a company with a minimum of 10 years successful experience manufacturing similar products.
- B. Single Source Requirements: To the greatest extent possible provide products from a single manufacturer.
- C. Accessibility Requirements: Comply with requirements applicable in the jurisdiction of the project, including but not limited to ADA and ICC/ANSI A117.1 requirements as applicable.
- D. Hazardous Materials: Comply with EU Directive "Restrictions of Hazardous Substances (RoHS) requirements."

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store and handle materials and products in strict compliance with manufacturer's instructions and recommendations. Protect from damage.

1.6 WARRANTY

- A. Manufacturer's Warranty for Washroom Accessories: Manufacturer's standard 1 year warranty for materials and workmanship.

PART 2 - PRODUCTS

2.1 MANUFACTURER

- A. Basis of Design Products: Based on the quality and performance requirements of the project, specifications are based solely on the products of Bobrick Washroom Equipment, Inc.. www.bobrick.com. Location of manufacturing shall be the United States.
- B. Substitutions: The Architect will consider products of comparable manufacturers as a substitution, pending the contractor's submission of adequate documentation of the substitution in accordance with procedures in Division 1 of the Project Manual. Documentation shall include a list of five similar projects of equivalent size where products have been installed for a minimum of two years, and manufacturer's certification that products are fabricated in the United States.

2.2 TOILET ACCESSORY SCHEDULE

- A. Single-User Washroom, Standard Duty:
 - 1. TA-1: B-5806 Series Concealed Mounting Grab Bar – 1-1/4 inch diameter. (B-5806x42, B-5806x36, B-5806x18)
 - 2. TA-2: B-165 Series Channel-Frame Mirror.
TA-3: B-2888 ClassicSeries Surface-Mounted Multi-Roll Toilet Tissue Dispenser.
TA-4: B-262 ClassicSeries Surface-Mounted Paper Towel Dispenser with 262-130 TowelMate Accessory.
TA-5: B-279 ClassicSeries Surface-Mounted Waste Receptacle.
 - 3. TA-6: B-2111 ClassicSeries Wall-Mounted Soap Dispenser.
 - 4. TA-7: B76717 Robe Hook.
 - 5. TA-8: KB110-SSWM Koala Kare Products Horizontal Surface-Mounted Baby Changing Station.
 - 6. TA-9: Trubro Lav-Guard White Trap and Supply Insulation.
- B. Multiple-User Washroom, Standard Duty:
 - 1. TA-1: B-5806 Series Concealed Mounting Grab Bar – 1-1/4 inch diameter. (B-5806x42, B-5806x36, B-5806x18)
 - 2. TA-2: (2) B-165 Series Channel-Frame Mirror.
 - 3. TA-3: (2) B-2888 ClassicSeries Surface-Mounted Multi-Roll Toilet Tissue Dispenser.
TA-4: B-262 ClassicSeries Surface-Mounted Paper Towel Dispenser with 262-130 TowelMate Accessory.
 - 4. TA-5: B-279 ClassicSeries Surface-Mounted Waste Receptacle.
 - 5. TA-6: (2) B-2111 ClassicSeries Wall-Mounted Soap Dispenser.
 - 6. TA-7: KB110-SSWM Koala Kare Products Horizontal Surface-Mounted Baby Changing Station.
 - 7. TA-8: Trubro Lav-Guard White Trap and Supply Insulation.
- C. Kitchen 105 and Janitor 206:
 - 1. TA-1: B223 x 24 Mop & Broom Holder

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install products in strict compliance with manufacturer's written instructions and recommendations, including the following:
 - 1. Verify blocking has been installed properly.
 - 2. Verify location does not interfere with door swings or use of fixtures.
 - 3. Comply with manufacturer's recommendations for backing and proper support.
 - 4. Use fasteners and anchors suitable for substrate and project conditions
 - 5. Install units rigid, straight, plumb, and level, in accordance with manufacturer's installation instructions and approved shop drawings.
 - 6. Conceal evidence of drilling, cutting, and fitting to room finish.
 - 7. Test for proper operation.

3.2 CLEANING AND PROTECTION

- A. Clean exposed surfaces of compartments, hardware, and fittings using methods acceptable to the manufacturer.
- B. Touch-up, repair or replace damaged products until Substantial Completion.

END OF SECTION

SECTION 10 44 00 - FIRE PROTECTION SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Fire extinguishers.
- B. Related Requirements:
 - 1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 REFERENCES

- A. Reference Standards:
 - 1. International Code Council (ICC):
 - a. International Building Code (IBC) - Current Edition.
 - 2. National Fire Protection Association (NFPA):
 - a. NFPA 10-2010, Standard for Portable Fire Extinguishers: For criteria covering installations for Class A, B, C, D, and K hazards as well as the selection, inspection, maintenance, recharging, and testing of portable fire extinguishing equipment.

1.3 ACTION SUBMITTALS

- A. Submit in accordance with Division 01.
 - 1. Product Data:
 - a. Extinguishers: Materials description for fire extinguishers; include ratings and classifications.
 - b. Installation instructions for each product specified.
 - 2. Shop Drawings:
 - a. Small-scale plans showing locations of fire extinguishers.
 - b. Schedules showing each type of extinguisher to ensure proper fit and function.
 - c. Indicate installation procedures and accessories required for a complete installation.
 - 1) Size: 6 inches square.

1.4 INFORMATIONAL SUBMITTALS

- A. Warranty: Sample of special warranty.

1.5 QUALITY ASSURANCE

- A. Comply with standards referenced in Article 1.02 - REFERENCES.
- B. Provide fire extinguishers, produced by a single manufacturer.
- C. Provide fire extinguishers of type approved by UL, State Fire Marshal's Office, and local regulatory agencies, if any.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle fire protection specialties and related materials using means and methods that will prevent damage, deterioration, or loss.
 - 1. Deliver components in manufacturer's original packaging, properly labeled for identification.

1.7 SPECIAL WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace fire protection specialties that fail in materials or workmanship within specified warranty period.
 - 1. Fire Extinguishers:
 - a. Failures include, but are not limited to, the following:
 - 1) Failure of hydrostatic test according to NFPA 10.
 - 2) Faulty operation of valves or release levers.
 - b. Warranty Period: Six years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 FIRE PROTECTION SPECIALTIES MANUFACTURERS

- A. Acceptable Manufacturers:
JL Industries, Inc., a division of Activar Construction Products Group
4450 West 78th St. Circle
Bloomington, MN 55435-5416
(800) 554-6077
(952) 835-6850
(952) 835-2218 (FAX)
SALES@ACTIVARCPG.COM
www.activarcpg.com
- B. Substitutions: Manufacturers seeking approval of their products are required to comply with the Owner's Instructions to Bidders, generally contained in the Project Manual.

2.2 FIRE EXTINGUISHERS

- A. Multi-Purpose Chemical Type: Extinguisher unit containing a fluidized and siliconized mono ammonium phosphate powder; nonconductive and nontoxic.
 - 1. Construction: Heavy duty steel cylinder with metal valve and siphon tube, O-ring seal, replaceable valve stem seal, visual pressure gage, pull pin and upright squeeze grip.
 - 2. Finish: Factory powder-coated; Red.
 - 3. Effectiveness (Rating): Class A, B, and C fires.
 - 4. Model Identification and UL Rating: Cosmic 10E; 4A-80BC.
- B. Accessories:
 - 1. Mounting Brackets:
 - a. Optional Brackets: Provide manufacturer's steel bracket with powder coat paint finish in manufacturer's standard color, and additional straps designed to secure fire extinguisher to wall or structure and prevent

accidental dislodgement, of sizes required for types and capacities of fire extinguishers indicated.

2.3 SOURCE QUALITY CONTROL

- A. Ship extinguishers to the Project site fully charged, EXCEPT those which contain water as an extinguishing agent, if any.
- B. Obtain Fire Extinguishers and Fire Extinguisher Brackets from same manufacturer to ensure compatibility.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine walls and partitions for suitable framing and blocking where surface mounted extinguishers will be installed.
 - 1. Notify the Contractor in writing of conditions detrimental to proper and timely completion of the installation.
 - 2. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install extinguishers in locations and at mounting heights indicated, or if not indicated, at heights to comply with applicable regulations of governing authorities.
 - 1. Securely fasten mounting brackets and fire extinguishers to structure, square and plumb, to comply with manufacturer=s instructions.

3.3 FIELD QUALITY CONTROL

- A. Ensure that each extinguisher is fully charged, and that inspection of each extinguisher has been performed, as evidenced by the National Association of Fire Equipment Distributors certification tag, just prior to turnover.

END OF SECTION

SECTION 11 00 00 - ROLLING SAFETY LADDERS

PART 1 – GENERAL

1.1 SECTION INCLUDES

- A. Rolling Safety Ladders.

1.2 DESIGN / PERFORMANCE REQUIREMENTS

- A. Rolling Safety ladders shall comply with current OSHA and ANSI standards.

1.3 SUBMITTALS

- A. Submit under provisions of Specifications.
- B. Product Data: Manufacturer's data sheets on each product to be used, including:
 - 1. Preparation instructions and recommendations.
 - 2. Storage and handling requirements and recommendations.
 - 3. Installation methods.
- C. Shop Drawings: Include detailed drawings showing complete dimensions, all materials, mounting attachments, and fabrication details.
- D. Selection Samples: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors and finishes.
- E. Manufacturer's Certificates: Certify products meet or exceed specified requirements.

1.4 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in the engineering and manufacturing of metal ladders, with not less than 50 years of experience.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store products indoors in manufacturer's unopened packaging until ready for installation.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturer: Putnam Rolling Ladder Co., Inc., which is located at: 32 Howard St.
New York, NY 10013
Tel: 212-226-5147
Fax: 212-941-1836
Email: request info (putnam1905@aol.com)
Web: www.putnamrollingladder.com

2.2 Requests for substitutions will be considered in accordance with provisions of Division 01 of the Specifications.

- A. Putnam M-2000 Series Model #154014 15 Step Steel Rolling Safety Ladder: 350 lbs capacity.

1. Height: 12'- 6" to top platform.
2. Top Step (Platform) Depth: 21 inches
3. Width: 24 inch wide steps.

PART 3 – EXECUTION

3.1 INSTALLATION

- A. Install in accordance with manufacturer's instructions.

3.2 PROTECTION

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

END OF SECTION

SECTION 11 40 00 – FOODSERVICE EQUIPMENT

PART 1 – GENERAL

1.1 SECTION INCLUDES

- A. Horizontal Air Curtain Refrigerated Merchandiser.
- B. Food Prep Table (Solid Door Sandwich/Salad Unit)
- C. Slanted-Shelf Merchandiser/Dispenser Racks
- D. Wire Shelving
- E. Stainless Steel Tables and Sinks
- F. Dishwasher

1.2 DESIGN / PERFORMANCE REQUIREMENTS

- A. Horizontal Air Curtain Refrigerated Merchandiser shall be NSF approved and comply with current standards.

1.3 SUBMITTALS

- A. Submit under provisions of Specifications.
- B. Product Data: Manufacturer's data sheets on each product to be used, including:
 - 1. Preparation instructions and recommendations.
 - 2. Storage and handling requirements and recommendations.
 - 3. Installation methods.
- C. Shop Drawings: Include manufacturer's detailed drawings showing complete dimensions, all materials, mounting attachments, and fabrication details.
- D. Manufacturer's Certificates: Certify products meet or exceed specified requirements.

1.4 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in the engineering and manufacturing of food service equipment, with not less than 25 years of experience.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store products indoors in manufacturer's unopened packaging until ready for installation.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturer for Refrigerated Merchandiser and Food Prep Table:
True Food Service Equipment, Inc., which is located at:
2001 East Terra Lane
O'Fallon, Missouri 63366
Tel: 636-240-2400

Fax: 636-272-2408
Web: www.truemfg.com

- B. Acceptable Manufacturer for Slanted-Shelf Merchandiser and Wire Shelving:
InterMetro Industries Corp., which is located at:
North Washington Street
Wilkes-Barre, PA 18705
Tel: 570-825-2741
Web: www.metro.com
- C. Acceptable Manufacturer for Ventless Door Type Dishwasher:
Hobart, which is located at:
701 S. Ridge Ave.
Troy, OH 45374
Tel: 937-332-3000
Fax: 937-332-2852
Web: www.hobartcorp.com
- D. Acceptable Manufacturer for Stainless Steel Tables and Sinks:
Advance Tabco, which is located at:
Edgewood, NY 11717
Tel: 631-242-6900
Web: www.advancetabco.com
- E. Requests for substitutions will be considered in accordance with provisions of Division 01 of the Specifications.

2.2 PRODUCTS

- A. True Food Service Equipment, Inc.
 - 1. Horizontal Air Curtain Refrigerated Merchandiser.
 - a. THAC Series: Model THAC-60
 - b. Shelves: 3
 - c. Cabinet Dimensions:
 - 1) Length: 60 1/8"
 - 2) Depth: 30 1/8"
 - 3) Height: 43 3/8"
 - d. Cord Length: 6.5'
 - e. Finish: Stainless Steel
 - 2. Food Prep Table (Solid Door Sandwich/Salad Unit)
 - a. Model TSSU-60-16
 - b. Doors: 2
 - c. Shelves: 4
 - d. Pans: 16
 - e. Cabinet Dimensions:
 - 1) Length: 60 3/8"
 - 2) Depth: 30 1/8"
 - 3) Height: 36 3/4"
 - f. Cord Length: 7'
 - g. Finish: Stainless Steel front, top, and ends. Matching aluminum finish back. Interior – white aluminum liner.
- B. InterMetro Industries Corp.
 - 1. Slanted-Shelf Merchandiser/Dispenser Racks

- a. Super Erecta Shelf: Model DC56EC
 - 1) Shelves: Five Slanted
 - 2) Dimensions:
 - a) Length: 48"
 - b) Width: 18"
 - c) Height: 70"
 - b. Accessories:
 - 1) Retainer:
 - a) Catalog Number/Model: DCR17C
 - b) Size: 4" x 17"
 - 2) Clear Label Holders:
 - a) Catalog Number/Model: 990CL
 - b) Label Size: 3" x 1 1/4"
2. Wire Shelving
- a. Super Erecta Shelf: Chrome Model 2442NC
 - 1) Dimensions:
 - a) Width: 24"
 - b) Length: 42"
 - 2) Shelves: Five (5) per unit
 - b. Super Erecta Shelf: Chrome Model 2448NC
 - 1) Dimensions:
 - a) Width: 24"
 - b) Length: 48"
 - 2) Shelves: Five (5) per unit
 - c. Super Erecta Shelf: Chrome Model 2460NC
 - 1) Dimensions:
 - a) Width: 24"
 - b) Length: 60"
 - 2) Shelves: Five (5) per unit
 - d. SiteSelect Posts (Stationary Posts): Chrome Model 74P
 - 1) Height: 74 1/2"
 - 2) Posts: Four (4) per unit

C. Hobart

- 1. Ventless Door Type Dishwasher
 - a. Hobart AM15VL-2
 - b. Energy Recovery
 - c. Hot water sanitize
 - d. Internal condensing system
 - e. 40 racks/hr
 - f. Corner
 - g. Solid-state controls with digital status
 - h. Booster heater
 - i. Electric tank heat
 - j. Auto-fill
 - k. Stainless steel tank
 - l. 208-240/60/3
 - m. ENERGY STAR®

D. Advance Tabco

- 1. Stainless Steel Tables and Sinks
 - a. Reference drawings for sizes, number, and placement of tables and sinks.

PART 3 – EXECUTION

3.2 INSTALLATION

- A. Assemble and install in accordance with manufacturer's instructions.

3.3 PROTECTION

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

END OF SECTION

SECTION 11 52 13 - LARGE VENUE PROJECTION SCREENS

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes: This Section specifies electrically operated front projection screens and accessories.

1.2 RELATED SECTIONS

- A. Section 26 05 00 – Basic Methods and Requirements (Electrical): Power supply, conduit and wiring.

1.3 DEFINITIONS

- A. Gain: Indication of screen's luminance or brightness, measured perpendicular to screen center and relative to magnesium carbonate block, which serves as standard for 1.0 gain. Higher numbers indicate greater brightness.
- B. Viewing Angle: Horizontal angle from perpendicular center of screen at which gain or brightness decreases by 50%.
- C. Format: Proportion of projection screen viewing area expressed as a ratio of width/height.
 - 1. NTSC or Video Format: 1.33:1.
 - 2. HDTV Format: 1.78:1.
 - 3. 16:10 Wide: 1.60:1.
 - 4. Cinemascope: 2.35:1.
 - 5. Letterbox: 1:85:1.
 - 6. Square: 1:1.

1.4 REFERENCES

- A. International Code Council (ICC):
 - 1. International Building Code.
- B. Society of Motion Picture and Television Engineers (SMPTE):
 - 1. SMPTE RP 94-2000, Gain Determination of Front Projection Screens.
- C. Underwriters Laboratories Inc. (UL).
- D. Underwriters' Laboratories of Canada (ULC).

1.5 ACTION SUBMITTALS

- A. General: Submit listed action submittals in accordance with Contract Conditions and Division 01.
- B. Product Data: Submit product data, including manufacturer's technical product data sheet, for specified products.
 - 1. Material Safety Data Sheets (MSDS).
- C. Shop Drawings: Indicate dimensions, fabrication and installation details.

1. Include electric wiring diagrams.
- D. Samples: Submit 2 samples of screen finish material having dimensions of 6 inches × 6 inches.
- 1.6 INFORMATION SUBMITTALS
- A. Quality Assurance:
1. Test Reports: Certified test reports showing compliance with specified performance characteristics and physical properties.
 2. Certificates: Product certificates signed by manufacturer certifying that materials comply with specified performance characteristics, criteria and physical requirements.
 3. Manufacturer's installation instructions.
- 1.7 CLOSEOUT SUBMITTALS
- A. Operation and Maintenance Data: Submit for products in accordance with Division 01. Include:
1. Manufacturer's instructions detailing maintenance requirements.
 2. Parts catalog that includes complete list of repair and replacement parts, with cuts and identifying numbers.
- 1.8 QUALITY ASSURANCE
- A. Qualifications:
1. Worker experienced in performing work of this section who has specialized in work similar to that required of this project.
- B. Regulatory Requirements:
1. Comply with International Building Code (IBC) and any additional State and Local Codes.
- C. Preinstallation Meetings: Conduct preinstallation meeting to verify project requirements and manufacturer's instructions. Comply with Section [01 31 19 - Project Meetings].
- 1.9 DELIVERY, STORAGE & HANDLING
- A. Storage and Protection:
1. Store electric projection screens in a dry, ventilated area, protected from exposure to harmful weather conditions, at a temperature less than 80 degrees F (27 degrees C).
- B. Handling: Handle electrically operated projection screen materials with care in order to prevent damage.
- C. Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.
- D. Waste Management and Disposal:
1. Remove packaging materials from site and dispose of at appropriate recycling

facilities.

1.10 PROJECT AMBIENT CONDITIONS

- A. Project Location: Perform electrically operated projection screen work when temperatures are greater than 40 degrees F (4 degrees C).

1.11 SEQUENCING

- A. Sequence With Other Work: Comply with projection screen manufacturer's written recommendations for sequencing construction operations.

1.12 WARRANTY

- A. Manufacturer's Warranty: Submit, for Owner's acceptance, manufacturer's standard warranty document executed by authorized company official. Manufacturer's warranty is in addition to, and does not limit, other rights Owner may have under Contract Documents.
- B. Warranty: Commencing on date of acceptance by Owner.

1.13 MAINTENANCE MATERIALS

- A. Use standard product line parts produced by manufacturer of electrically operated projection screens.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Ensure manufacturer has minimum 5 years experience manufacturing components similar to or exceeding project requirements.
- B. Manufacturer: Da-Lite Screen Company, Inc.
 - 1. Contact:
P.O. Box 137
3100 N. Detroit St.
Warsaw, IN 46581-0137
Telephone: (800) 622-3737, (574) 267-8101
Fax: (877) 325-4832, (574) 267-7804
E-mail: info@da-lite.com; website: www.da-lite.com

2.2 PROPRIETARY PRODUCTS/PROJECTION SCREEN SYSTEMS

- A. Type 1: Non-Tensioned System.
 - 1. Screen Operation: Electrically operated, UL and ULC listed, retractable, heavy duty, with rigid metal roller.
 - a. Motor: Single motor, UL and ULC certified, 3-wire, permanently lubricated reversal-type, attached to header and including automatic thermal overload protection, integral gears, capacitor and electric brake to prevent coasting.
 - 1) Voltage, Frequency: [115 V, 60 Hz].
 - 2) Amperage: 2.2 amps.
 - 3) Limit Switches: Preset and adjustable to automatically stop viewing surface in UP or DOWN position.
 - 4) Housing: In metal-lined end compartment.

2. Screen Mounting: Ceiling.
 - a. Include mounting hardware.
3. Screen Case: Designed to receive mounting hardware and sized to suit projection screen.
 - a. Material: Wood with double top member for rigidity.
 - b. Finish:
 - 1) Prime painted Black.
4. Screen Size:
 - a. Viewing Area: H 105 inches × W 140 inches.
5. Acceptable Material: Da-Lite Screen Company, Inc. Senior Electrol Projection Screen.
 - a. Screen Viewing Surface:
 - 1) Front projection, flame retardant, mildew resistant, vinyl coated fiberglass, black backed, with standard black borders, easily cleaned with mild soap and water solution.
 - 2) Seams: Seamless when screen heights are less than 16 feet (4.9 m).
 - 3) Include pocket containing metal rod at screen bottom edge.
Gain: To SMPTE RP 94-2000, 1.0.
 - 4) Viewing angle: 60.
 - 5) Format: NTSC 4:3.
 - b. Acceptable Viewing Surface: Da-Lite Screen Company, Inc.:
 - 1) Matte White.
6. Optional Accessories:
 - a. Screen Drop: Extra drop of 6 feet in black fabric.
 - b. Single Motor Low Voltage Control (LVC): External.
 - c. Wireless Remote Control for LVC: 3-button handheld remote control for UP, DOWN and STOP functions, with single motor, low voltage control unit.
 - 1) Type: Radio Frequency Remote with Frequency Range Extender.
 - d. Key Locking Cover Plate: Hinged cover plate with brushed stainless steel finish provides keyed access to 120 V LVC wall switch.
 - e. Video Projector Interface Control: External, DC controls and low voltage 3-button switch with cover plate for wall switch operation.
 - f. Key Operated Switch for 120 V: Flush mounted wall control switch with white cover plate, key activated for security.
 - g. External SCB-100 Serial Control Board with NET-100 Ethernet-Serial Adapter.

2.3 PRODUCT SUBSTITUTIONS

- A. Substitutions: In accordance with the Product Substitution Procedures

PART 3 EXECUTION

2.4 INSTALLERS

- A. Provide experienced and qualified technicians to install electrically operated projection screens.

2.5 MANUFACTURER'S INSTRUCTIONS

- A. Compliance: Comply with manufacturer's written data, including product technical bulletins, product catalog installation instructions, product carton installation instructions and Da-Lite Screen Company, Inc., technical data sheets.

2.6 EXAMINATION

A. Site Verification of Conditions

1. Verify that conditions of substrates previously installed under other sections or contracts are acceptable with electrically operated projection screen installation.
2. Ensure electrical power supply is installed to meet electric projection screen requirements in accordance with the electrical specifications.
 - a. Verify type and location of power supply.
3. Inform Architect unacceptable conditions immediately upon discovery.
4. Proceed with installation only after unacceptable conditions have been corrected.

2.7 COORDINATION

- ### A. Coordinate electric projection screen placement with placement of other ceiling and wall mounted components.

2.8 INSTALLATION

- ### A. Install electric projection screens in accordance with reviewed shop drawings at locations and heights indicated.
- ### B. Install screen housing and make electrical connections in conjunction with installation of ceiling system.
1. Verify locations with Architect prior to installation.
- ### C. Install viewing surface and drive assembly in housing only after interior construction is substantially complete.
- ### D. Securely install screens plumb and level to supporting substrate.

2.9 FIELD QUALITY CONTROL

- ### A. Manufacturer's Field Services: Have manufacturer's technical representative schedule site visits to review work as follows:
1. Upon completion of work, after cleaning is carried out.
- ### B. Testing and Inspection: Operate each screen 3 times to ensure viewing surfaces extend and retract through full range of motion.
1. Verify controls, limit switches, automatic doors and other components function as designed and meet project requirements.
 2. Ensure viewing surface raising operation fully engages and lifts screen closure door into closed position.
 3. Adjust motors, controls and components to allow for smooth, unobstructed screen operation.

2.10 FINAL CLEANING

- ### A. Perform cleanup in accordance with specifications.
- ### B. Upon completion, remove surplus materials, rubbish, tools and equipment.

2.11 PROTECTION

- ### A. Protect electrically operated projection screens from damage during construction in

accordance with specifications.

- B. Repair damage to adjacent materials caused by electrically operated projection screen work.

2.12 MAINTENANCE

- A. Perform work during regular trade working hours satisfactory to Owner.

END OF SECTION

SECTION 11 61 43 – STAGE CURTAINS & EQUIPMENT

PART 1 - GENERAL

1.1 WORK OF THIS SECTION:

- A. The Contractor shall provide all necessary labor, materials, equipment, transportation, service and product engineering required for a complete installation of the equipment outlined in the specifications and drawings.
- B. The stage drapery and rigging equipment shall consist of the following:
 - 1. Stage drapery
 - 2. Rope locks and manual handlines
 - 3. Rods, tracks and rigging

1.2 RELATED WORK NOT INCLUDED

- A. Section 06 10 00 - Rough Carpentry

1.3 SUBMITTALS

- A. Submit shop drawings, product data, and samples as required. Shop drawings submittals shall consist of six copies for review. The shop drawings shall show all systems, all components of each system, and all interfaces to other trades. Component drawings shall show dimensions, capacities and construction details.

1.4 OPERATION AND MAINTENANCE INFORMATION

- A. Provide two sets of operating and maintenance manuals which contain the following data:
 - 1. Operating instructions for all of the equipment provided.
 - 2. Maintenance information for all of the equipment provided, including a list of all periodic maintenance functions, a list of all equipment with parts identification.
 - 3. "As Built" drawings, showing the equipment as built and installed.

1.5 STANDARDS

- A. The following codes, standards and specifications shall apply to the work of this section:
 - 1. American Institute of Steel Construction, "Manual of Steel Construction" January 1988, including the "Specification for the Design, Fabrication, and Erection of Structural Steel for Buildings," November 1978
 - 2. American Welding Society, "Code for Welding in Building Construction," AWS D1.1-1988
 - 3. National Fire Protection Association, "National Electrical Code 1987" (NEC Uniform Building Code (UBC) 1988
 - 4. United States Institute for Theatre Technology (USITT), "Recommended Guidelines for Stage Rigging and Stage Machinery – Specifications and Practices," January 1986
- B. Trade standards, including the latest revisions of all applicable standards and codes published by the following organizations:
 - 1. American National Standards Institute (ANSI)
 - 2. American Society for Testing Materials (ASTM)
 - 3. American Iron and Steel Institute (AISI)

4. American Society of Mechanical Engineers (ASME)
5. Society of Motion Picture and Television Engineers (SMPTE)

1.6 WARRANTY

- A. A warranty covering all labor, materials and workmanship for a period of one year after the date of final payment shall be provided. Any warranty work required shall be completed promptly and in conjunction with the production schedule if the utility of the system is affected to the point of severely affecting performances.
- B. Certification from the original fabric mill supplier shall be provided to verify that all stage drapery fabrics comply with applicable governing codes and guidelines regarding flame resistance.

PART 2 - PRODUCTS

2.1 STAGE DRAPERY

- A. General
 1. New stage curtains and supporting hardware and mechanical equipment. All curtains shall be sewn from inherently flame retardant ("IFR") synthetic face fabric and lined with inherently flame retardant synthetic ("IFR") lining fabric.

- B. Drapery Schedule
The drapery shall consist of the following separate pieces:

| Quantity | Drapery Item |
|-------------|---------------------|
| 2 halves | Main Curtain |
| 1 piece | Main Valance |
| 1 pieces | Mid Valance |
| 2X 2 halves | Side Legs |
| 2 halves | Mid Stage Traveller |
| 4 pieces | Rear Traveller |

- C. Fabrics - The stage drapery shall be sewn from the following fabrics:
 1. Front Setting:
 - a. Face Fabric: IFR Synthetic Fabric, 25 ounces per yard permanently and inherently flame retardant synthetic, opaque polyester velour; Baron Stage Curtain & Equipment Co., Inc./Karma Corporation "Prestige" or similar as approved by architect.
 - b. Lining: IFR Synthetic Line Fabric: 8 ounce permanently and inherently flame retardant synthetic fabric, sewn to same fullness as face fabric, or similar as approved by architect.
 2. Intermediate and Back Setting:
 - a. Face Fabric: IFR Synthetic Fabric, 12 ounce permanently and inherently flame retardant synthetic, or similar as approved by architect.
 - b. Lining: Same as front setting.
 3. Miscellaneous:
 - a. Color as selected by architect from manufacturer's standard colors.
 - b. Provide inserts, cabling, bolts, backing, reinforcements, fasteners, etc. manufacturer's standard units as required. All accessory fabrics to also be inherently flame retardant material in similar manner as face fabric.
 4. All fabrics shall comply with the following minimum guidelines:

- a. NFPA 701
- b. California Code Title 19
- c. New York City Calendar #294-40

D. Construction

1. All fabric material shall be new and unused. Full and continuous lengths shall be used for the full height of each curtain face, with no piecing or cross-seams allowed. All drapery of the same color shall be constructed of fabric from the same dye lot.
2. The velour nap shall be sewn in the "up" direction. All curtains shall be sewn with minimum 60% added fullness.
3. All curtains shall be lined with black fabric, sewn to the same added fullness as the face fabric.
4. Bi-parting Traveler curtains shall be constructed in two matching halves, sized to allow minimum 36" overlap at the centerline. Side Leg curtains shall be constructed in pairs of two matching halves.
5. Field dimensions shall be the contractor's responsibility to obtain, to duplicate existing curtain sizes. Guarantee that proper sight lines are taken into consideration.
6. Lining fabric shall duplicate face fabric type, such that synthetic IFR liner shall complement synthetic IFR face fabric.

E. Top Heading

1. The top edge of each drape shall be sewn flat to 3½" wide heavy duty nylon webbing, constructed with box pleats sewn 12" on centers. No. 2 brass grommets shall be set through the face fabric, lining, and webbing. Each grommet shall be centered in each pleat, with minimum 1" fabric remaining above top edge of grommet.
2. Track-mounted Traveler curtains shall be provided with a plated S-hook at each grommet. Border and leg curtains shall be provided with a 36" length of tie line inserted at each grommet.

F. Side Hems

1. B-parting Traveller curtains shall include minimum turnback of one half width of face fabric at the onstage leading edge. Offstage vertical edges of full-height traveling curtains shall be minimum 6" of face fabric.
2. Masking Legs shall include 24" onstage face fabric side hem, and 6" offstage face fabric side hem.
3. All Lining pieces shall include 2" side hems at both vertical edges.
4. All Lining pieces shall be attached to the face fabric with 6" x 1" fabric strips, along both vertical side hem edges at 24" intervals.

G. Bottom Hems

1. All curtains shall include a 6" bottom face fabric hem, with an internal canvas chain sleeve sewn into the bottom hem. The internal sleeve shall be attached 2" above the bottom edge of the curtain, with a continuous plated chain weight tacked at each end to prevent bunching.
2. All Lining pieces shall include 2" bottom hem.
3. All Lining pieces shall be attached to the face fabric with 6" x 1" fabric strips, along the bottom hem at every strip interval.

2.2 COUNTERWEIGHT RIGGING EQUIPMENT

A. Rope Lock

1. Rope locks shall be a one piece, first grade, grey iron casting, with a once piece cast eccentric hand lever and malleable hardened iron cams. The handle shall be a minimum of 9" long, and shall be covered with colored plastic. The rope lock shall mount to the locking rail with four (4) 3/8" bolts. An oval steel ring to lock the hand lever to the hand line shall be provided. A 3/8" adjusting thumb screw with locking nut shall be provided to permit adjustment for hand lines in the range of 5/8" to 7/8".
- B. Manual Handlines
1. 3/4" diameter handlines shall consist of 3-strand composite rope, with cover yarn of polyester filament wrapped around a polyolefin core. The rope shall employ a 3-strand composite construction, combining a polypropylene filament wrapped around a fibrillated polyolefin.
 2. The rope shall hold knots well, be easily spliced and be dense enough to allow it to be clamped in a rope lock without damage. The rope shall not be subject to rotting, mildew, or moisture damage nor shall its length be affected by changes in ambient humidity. Tape ends prior to cutting.
 3. Attach to Arbor top using bowline knot, and bottom of arbor with two half hitches. Tails shall be secured to the standing line using gaffer's fabric tape.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. All stage equipment shall be installed in accordance with the highest standards of the industry. All equipment shall be securely anchored and installed plumb, straight and true. All components shall function properly, safety, quietly and without binding or rubbing.

3.2 FIELD QUALITY CONTROL

- A. An experienced installation supervisor, regularly employed by the Contractor, shall be present during the entire installation and shall actively direct and supervise the work.
- B. The Contractor shall consult with trades doing related or adjoining work in order to ensure an installation of first class quality.

3.3 DEMONSTRATION AND INSTRUCTION

- A. Upon completing installation and adjustment for suitable operation of all work specified in this section, the Contractor shall notify the Architect in writing. The Architect will then schedule an inspection. At the time of this inspection, the Contractor shall furnish sufficient tools and workmen to operate all equipment and to perform adjustments and tests as may be required by the Architect. Should any equipment fail to meet the specifications, such equipment shall be repaired or replaced with suitable equipment and an additional inspection will be scheduled. Final approval will be withheld until all systems been thoroughly and completely tested, and found to be in first class operating condition and in compliance with the specifications and drawings.
- B. The Contractor will be responsible for storage of stage curtains, tools and equipment during the period of the installation.
- C. The Contractor shall provide instruction in safe and proper operation of the equipment to the owner's designated representative.

- D. The Contractor shall be responsible for clean-up of debris and garbage which results from installation of stage rigging and drapery equipment.

END OF SECTION

SECTION 12 24 13 –ROLLER WINDOW SHADES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. See Window Schedule on drawings.

1.2 SUMMARY

- A. Section Includes:
 - 1. Motor-operated roller shades with single rollers.
- B. Related Requirements:
 - 1. Section 06 10 53 - Rough Carpentry: for wood blocking and grounds for mounting roller shades and accessories.
 - 2. Section 07 92 00 - Joint Sealants: for sealing the perimeters of installation accessories for light-blocking shades with a sealant.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include styles, material descriptions, construction details, dimensions of individual components and profiles, features, finishes, and operating instructions for roller shades.
- B. Shop Drawings: Show fabrication and installation details for roller shades, including fabric panel materials, their orientation to rollers, and their seam and batten locations.
 - 1. Motor-Operated Shades: Include details of installation and diagrams for power, signal, and control wiring.
- C. Samples: For each exposed product and for each color and texture specified, 10 inches long.
- D. Samples for Initial Selection: For each type and color of fabric panel material.
 - 1. Include Samples of accessories involving color selection.
- E. Samples for Verification: For each type of roller shade.
 - 1. Fabric Panel Material: Not less than 10 inches square. Mark inside face of material if applicable.
 - 2. Roller Shade: Full-size operating unit, not less than 16 inches wide by 36 inches long for each type of roller shade indicated.
 - 3. Installation Accessories: Full-size unit, not less than 10 inches long.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer

- B. Product Certificates: For each type of fabric panel material, signed by product manufacturer.
 - C. Product Test Reports: For each type of fabric panel material, for tests performed by a qualified testing agency.
- 1.5 CLOSEOUT SUBMITTALS
- A. Maintenance Data: For roller shades to include in maintenance manuals.
- 1.6 MAINTENANCE MATERIAL SUBMITTALS
- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Roller Shades: Full-size units equal to 5 percent of quantity installed for each size, color, and fabric panel material indicated, but no fewer than two units.
- 1.7 QUALITY ASSURANCE
- A. Manufacturer Qualifications:
 - 1. A firm with at least 20 years of demonstrated experience in United States-based manufacture of the products required in this Section.
 - 2. A firm with the capability to use both knife cutting and ultrasonic cutting in the manufacture of the products required in this Section.
 - B. Installer Qualifications: Fabricator of products.
 - C. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution. Build mock-up in actual window location to test fit installation and operation.
 - 1. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 - 2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.
- 1.8 DELIVERY, STORAGE, AND HANDLING
- A. Deliver roller shades in factory packages, marked with manufacturer, product name, and location of installation using same designations indicated on Drawings.
- 1.9 FIELD CONDITIONS
- A. Environmental Limitations: Do not install roller shades until construction and finish work in spaces, including painting, is complete and dry and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
 - B. Field Measurements: Where roller shades are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Allow clearances for operating hardware of operable glazed units through entire operating range. Notify Architect of installation conditions that

vary from Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

PART 2 - PRODUCTS

2.1 MANUFACTURER

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Insolroll, Inc.; Insolroll Window Shading Systems Audio-Visual Shades.
- B. Source Limitations: Obtain roller shades from single source from single manufacturer.
- C. Requests for substitutions will be considered in accordance with provisions of Division 01.

2.2 MOTOR-OPERATED, SINGLE-ROLLER SHADES

- A. Motorized Operating System: Provide factory-assembled, shade-operator system of size and capacity and with features, characteristics, and accessories suitable for conditions indicated, complete with electric motor and factory-prewired motor controls, power disconnect switch, enclosures protecting controls and operating parts, and accessories required for reliable operation without malfunction. Include wiring from motor controls to motors. Coordinate operator wiring requirements and electrical characteristics with building electrical system.
 - 1. Electrical Components: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 - a. Electric Motor: Manufacturer's standard tubular, enclosed in roller.
Electrical Characteristics: Single phase, 110V, 60 Hz.
 - 2. Remote Control: Electric controls with NEMA ICS 6, Type 1 enclosure for recessed or flush type mounting. Provide the following for remote-control activation of shades:
 - a. Wireless Control: System consisting of a concealed wireless 433 MHz radio receiver built into motor with no external components. Provide wireless wall switches and handheld remote transmitters for individual shades or groups of shades, to open and close shades simultaneously, and to stop shade movement.
 - b. Microprocessor Control: Electronic programmable means for setting, changing, and adjusting control features; isolated from voltage spikes and surges.
 - c. Color: As selected by Architect from manufacturer's full range
 - 3. Limit Switches: Adjustable switches interlocked with motor controls and set to stop shades automatically at fully raised and fully lowered positions.
 - 4. Operating Features:
 - a. Group switching with integrated switch control; single faceplate for multiple switch cutouts.
 - b. Capable of interface with audiovisual control system.
- B. Rollers: Corrosion-resistant steel or extruded-aluminum tubes of diameters and wall thicknesses required to accommodate operating mechanisms and weights and widths of fabric panels indicated without deflection. Provide with permanently lubricated drive-end assemblies and idle-end assemblies designed to facilitate removal of fabric panels for service.
 - 1. Roller Drive-End Location: As required.
 - 2. Direction of Fabric Panel Roll: Reverse, from front of roller.

3. Fabric Panel-to-Roller Attachment: Manufacturer's standard method.
 - a. Provide fabric panels not less than 12 inches longer than desired shade height to assure solid attachment to roller tube and ability to adjust panels in field without removing mounting brackets.
- C. Mounting Hardware: Brackets or endcaps, corrosion resistant and compatible with roller assembly, operating mechanism, installation accessories, and mounting location and conditions indicated.
- D. Fabric Panels:
Coordinate option retained in "Fabric Panel Material" Subparagraph below with requirements specified in "Fabric Panel Materials" Article.
 1. Fabric Panel Material: Light-blocking fabric
 2. Fabric Panel Bottom (Hem) Bar: Enclosed in hem pocket of fabric panel material, thermally sealed, not sewn.
 - a. Bottom (Sill) Channel: With light seals and designed to eliminate light gaps at bottoms of shades when shades are closed.
- E. Installation Accessories:
 1. Recessed Shade Pocket: Rectangular, extruded-aluminum enclosure designed for recessed installation; with front, top, and back formed as one piece, end plates, and removable bottom closure panel.
 - a. Height: Manufacturer's standard height required to enclose roller and fabric panel when shade is fully open, but not less than 5 inches.
 - b. Closure-Panel Width: As required.
 2. Side Channels: Designed to eliminate light gaps at sides of shades as shades are drawn down.
 3. Bottom (Sill) Channel: With light seals and designed to eliminate light gaps at bottoms of shades when shades are closed.
 4. Installation Accessories Color and Finish: As selected from manufacturer's full range.

2.3 FABRIC PANEL MATERIALS

- A. Fabric Panel Material Flame-Resistance Rating: Comply with NFPA 701. Testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
- B. Light-Blocking Fabric: Opaque fabric, stain and fade resistant.
 1. Basis-of-Design Product: Insolroll 14-ounce Fiberglass Blackout Fabric.
 2. Composition: Four-ply laminate with one ply fiberglass, 14 ounces per square yard.
 3. Fire Classification: NFPA 701 small scale.

2.4 ROLLER-SHADE FABRICATION

- A. Product Safety Standard: Fabricate roller shades to comply with WCMA A 100.1, including requirements for flexible, chain-loop devices; lead content of components; and warning labels.
- B. Unit Sizes: Fabricate units in sizes to fill window and other openings as follows, measured at 74 deg F.

1. Between (Inside) Jamb Installation: Width equal to jamb-to-jamb dimension of opening in which shade is installed less 1/4 inch per side or 1/2-inch total, plus or minus 1/8 inch. Length equal to head-to-sill or -floor dimension of opening in which shade is installed less 1/4 inch, plus or minus 1/8 inch.
- C. Fabric Panel Fabrication: Fabricate fabric panels without battens or seams to extent possible except as follows:
 1. Vertical Shades: Where width-to-length ratio of fabric panel is equal to or greater than 1:4, provide battens and seams at uniform spacings along fabric panel length to ensure fabric panel tracking and alignment through its full range of movement without distortion of the material.
 2. Railroaded Materials: Railroad material where material roll width is less than the required width of fabric panel and where indicated. Provide seams as required by railroaded material to produce fabric panels with full roll-width panel(s) plus, if required, one partial roll-width panel located at top of fabric panel.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, operational clearances, accurate locations of connections to building electrical system, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 ROLLER-SHADE INSTALLATION

- A. Install roller shades level, plumb, and aligned with adjacent units according to manufacturer's written instructions.
- B. Coordinate requirements for distance between roller shades and glass with glass type and placement of heating/cooling air supplies to avoid heat buildup and possible damage to glass.
 1. Opaque Fabric Panels: Located so fabric panel is not closer than 2 inches to interior face of glass. Allow clearances for window operation hardware.
- C. Electrical Connections: Connect motor-operated roller shades to building electrical system.

3.3 ADJUSTING

- A. Adjust and balance roller shades to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.

3.4 CLEANING AND PROTECTION

- A. Clean roller-shade surfaces after installation, according to manufacturer's written instructions.
- B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and installer that ensure that roller shades are without damage or deterioration at time of Substantial Completion.

- C. Replace damaged roller shades that cannot be repaired, in a manner approved by Architect, before time of Substantial Completion.

3.5 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain motor-operated roller shades.

END OF SECTION

SECTION 14 42 51 – WHEELCHAIR PLATFORM LIFT

PART 1 – GENERAL

1.1 RELATED SECTIONS

- A. Section 06 10 00 - Rough Carpentry: Blocking in framed construction for lift attachment.
- B. Division 26 - Electrical: Electrical power service and wiring connections.

1.2 REFERENCES

- A. ASME A17.1 - Safety Code for Elevators and Escalators.
- B. ASME A17.5 - Elevator and Escalator Electrical Equipment.
- C. ASME A18.1 - Safety Standard for Platform Lifts and Stairway Chairlifts.
- D. ICC/ANSI A117.1 - Accessible and Usable Buildings and Facilities.
- E. NFPA 70 - National Electric Code.

1.3 SUBMITTALS

- A. Submit under provisions of the Specifications.
- B. Product Data: Manufacturer's data sheets on each product to be used, including:
 - 1. Submit manufacturer's installation instructions, including preparation, storage and handling requirements.
 - 2. Include complete description of performance and operating characteristics.
 - 3. Show maximum and average power demands.
- C. Shop Drawings:
 - 1. Show typical details of assembly, erection and anchorage.
 - 2. Include wiring diagrams for power, control, and signal systems.
 - 3. Show complete layout and location of equipment, including required clearances and coordination with shaftway.
- D. Selection Samples: For each finished product specified, provide two complete sets of color chips representing manufacturer's full range of available colors and patterns.

1.4 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Firm with minimum 10 years experience in manufacturing of vertical platform lifts, with evidence of experience with similar installations of type specified.
- B. Installer Qualifications: Licensed to install equipment of this scope, with evidence of experience with specified equipment. Installer shall maintain an adequate stock of replacement parts, have qualified people available to ensure fulfillment of maintenance and callback service without unreasonable loss of time in reaching project site.

1.5 REGULATORY REQUIREMENTS

- A. Provide platform lifts in compliance with:
 - 1. ASME A18.1 - Safety Standard for Platform Lifts and Stairway Chairlifts.
 - 2. ASME A17.1 - Safety Code for Elevators and Escalators.
 - 3. ASME A17.5 - Elevator and Escalator Electrical Equipment.
 - 4. NFPA 70 - National Electric Code.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufacturer's unopened packaging until ready for installation.
- B. Store components off the ground in a dry covered area, protected from adverse weather conditions.

1.7 PROJECT CONDITIONS

- A. Do not use wheelchair lift for hoisting materials or personnel during construction period.

1.8 WARRANTY

- A. Warranty: Provide a two year limited warranty for wheelchair lift materials and workmanship.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturer: Garaventa Lift, which is located at:
7505 134 A St.
Surrey, BC; Canada V3W 7B3
Toll Free Tel: 800-663-6556
Tel: 604-594-0422
Fax: 604-594-9915
Email: [request info \(bramsay@garaventallift.com\)](mailto:request info (bramsay@garaventallift.com))
Web: www.garaventallift.com
- B. Requests for substitutions will be considered in accordance with provisions of the Specifications.

2.2 UNENCLOSED VERTICAL WHEELCHAIR LIFT FOR STAGE

- A. Capacity: 750 lbs rated capacity.
- B. Mast Height:
 - 1. Model GVL-OP-42; 45 inches maximum lifting height.
- C. Platform Size and Nominal Clear Platform Dimensions:
 - 1. Standard: 36 inches by 48-7/8 inches clear platform dimensions.
- D. Platform Configuration:
 - 1. Straight Through: Front and rear openings.

- E. Landing Openings: Gates shall be self closing type.
 - 1. Gate Height: 42-1/8 inches.
 - 2. Gate Width: 41-3/4 inches.
 - 3. Platform Gate: Travels with platform and opens at lower landing.
 - 4. Upper Landing Gate: Detached, freestanding type.

- F. Power Gate Operators:
 - 1. Location:
 - a. Platform Gate: Travels with platform and opens lower landing.
 - b. Upper Landing Gate.

- G. Lift Components:
 - 1. Machine Tower: Custom aluminum extrusion.
 - 2. Base Frame: Structural steel.
 - 3. Platform Side Wall Panels: 16 gauge galvanized steel sheet.
 - 4. Platform Access Ramp: 12 gauge galvanized steel plates; slip resistant surfaces.
 - a. Ramp: Stationary type.
 - 5. Side Guard Panels: 42-1/8 inches high mounted on platform.

- H. Base Mounting at Lower Landing:
 - 1. Floor Mount: Base of lift shall be mounted on the floor surface of the lower landing. For access onto the platform provide a ramp of 16 gauge galvanized steel sheet with a slip resistant surface.

- I. Leadscrew Drive:
 - 1. Drive Type: Self-lubricating acme screw drive.
 - 2. Emergency Operation: Manual handwheel device to raise or lower platform.
 - 3. Battery Powered Emergency Lowering: Battery powered platform lowering device that automatically activates in the event of power failure. Allows passenger to drive platform downward to lower landing. Does not operate lift in up direction.
 - 4. Safety Devices:
 - a. Integral safety nut assembly with safety switch.
 - 5. Travel Speed: 10 fpm.
 - 6. Motor: 2.0 hp (560 W).
 - 7. Power Supply:
 - a. 120 VAC single phase; 60 Hz on a dedicated 20 amp circuit.

- J. Platform Controls: 24 VDC control circuit with the following features.
 - 1. Direction Control: Constant pressure rocker switch.
 - 2. Illuminated and audible emergency stop switch shuts off power to lift and activates audio alarm with battery backup.
 - 3. Keyless operation.
 - 4. Arrival Gong and Digital Floor Display.

- K. Call Station Controls: 24 VDC control circuit with the following features.
 - 1. Direction Control:
 - a. Elevator style with illuminated and tactile buttons.
 - 2. Keyless operation.
 - 3. Call Station Mounting:

- a. Upper:
 - 1) Frame mounted.

- L. Safety Devices and Features:
 - 1. Grounded electrical system with upper, lower, and final limit switches.
 - 2. Tamper resistant interlock to electrically monitor that the gate is in the closed position and the lock is engaged before lift can move from landing.
 - 3. Electrical disconnect shall shut off power to the lift.
 - 4. Under platform safety pan with five waterproof safety switches to detect obstruction under platform.

- M. Finishes
 - 1. Aluminum Extrusions: Champagne anodized finish.
 - 2. Ferrous Components: Electrostatically applied baked powder finish, fine textured.
 - a. Color: Selected from manufacturer's standard colors.

PART 3 – EXECUTION

3.1 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared.
- B. Verify shaft and machine space are of correct size and within tolerances.
- C. Verify required landings and openings are of correct size and within tolerances.
- D. Verify electrical rough-in is at correct location.
- E. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION

- A. Install lifts in accordance with applicable regulatory requirements including ASME A 17.1, ASME A 18.1 and the manufacturer's instructions.
- B. Install system components and connect to building utilities.
- C. Accommodate equipment in space indicated.
- D. Startup equipment in accordance with manufacturer's instructions.
- E. Adjust for smooth operation.

3.4 FIELD QUALITY CONTROL

- A. Perform tests in compliance with ASME A17.1 or A18.1 and as required by authorities

having jurisdiction.

- B. Schedule tests with agencies and Architect, Owner, and Contractor present.

3.5 PROTECTION

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

END OF SECTION

SECTION 22 10 00 - PLUMBING PIPING AND PUMPS

PART 1 - GENERAL

1.1 DESCRIPTION

Domestic water, sewer, oxygen, nitrogen, vacuum, scavenger, and fuel gas systems, including piping, equipment and all necessary accessories as designated in this section.

1.2 RELATED WORK

- A. Section 09 90 00 – Painting and Coating: preparation and finish painting and identification of piping systems
- B. Section 22 30 00 – Plumbing Equipment
- C. Section 22 40 00 – Plumbing Fixtures
- D. Section 23 21 23 – Hydronic Pumps

1.3 SUBMITTALS

- A. Submit in accordance with Division 01.
- B. Manufacturer's Literature and Data:
 - 1. Piping and Outlets to include medical oxygen gas, nitrogen, vacuum and scavenger piping. Medical gas piping shall be ASTM B-819 factory cleaned and capped type k or l copper tubing for medical gas. Medical gas piping shall be labeled per code.
 - 2. Valves.
 - 3. Floor Drains.
 - 4. Roof Drains, if specified.
 - 5. Backflow Preventers.
 - 6. Water Meter, if specified.
 - 7. Strainers.
 - 8. Pressure Gages.
 - 9. Grease Removal Unit, if specified.
 - 10. Hot Water Temperature Maintenance Heat Tracing, if specified.
 - 11. Pressure Reducing Valves.
 - 12. Cleanouts.
 - 13. All items listed in Part 2 - Products.
- C. Detailed shop drawing of clamping device and extensions when required in connection with the waterproofing membrane or the floor drain.

1.4 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. Federal Specifications (Fed. Spec.):

| | |
|-------------|--|
| L-C-530C | Coating, Pipe, Thermoplastic Resin |
| L-T-1512A | Tape, Pressure Sensitive Adhesive, Pipe Wrapping |
| 0-C-114B(2) | Calcium Hypochlorite, Technical |
| 0-S-602E | Sodium Hypochlorite Solution |
| BB-C-120C | Chlorine, Technical, Liquid |

| | |
|-----------|--|
| WW-U-516B | Unions, Brass or Bronze Threaded, Pipe Connections and Solder-Joint Tube Connections |
| WW-V-35C | Valve Ball Brass or Bronze |
| WW-V-1967 | INT AMD 1 Valve, Butterfly (Threaded Ends And Solder Ends) |

- C. American National Standards Institute (ANSI):
American Society of Mechanical Engineers (ASME): (Copyrighted Society)
- | | |
|--------------|--|
| A11.21.1M-91 | Floor Drains ANSI/ASME |
| A13.1-81 | Scheme for Identification of Piping Systems |
| B16.3-92 | Malleable Iron Threaded Fittings ANSI/ASME |
| B16.4-92 | Cast Iron Threaded Fittings Classes 125 and 250 ANSI/ASME |
| B16.9-93 | Factory-Made Wrought Steel Buttwelding Fittings ANSI/ASME |
| B16.11-91 | Forged Steel Fittings, Socket-Welding and Threaded ANSI/ASME |
| B16.12-83 | Cast Iron Threaded Drainage Fittings ANSI/ASME |
| B16.15-85 | Cast Bronze Threaded Fittings ANSI/ASME |
| B16.18-84 | Cast Copper Alloy Solder-Joint Pressure Fittings ANSI/ASME |
| B16.22-89 | Wrought Copper and Copper Alloy Solder Joint Pressure Fittings ANSI/ASME |
| B31.8-94 | Gas Transmission and Distribution Piping Systems ANSI/ASME |
| B40.1-91 | Gauges-Pressure Indicating Dial Type-Elastic Element ANSI/ASME |
- D. American Society for Testing and Materials (ASTM):
- | | |
|---------------------|---|
| A47-90 | Ferritic Malleable Iron Castings Revision 1989 |
| A53-95 | Pipe, Steel, Black And Hot-Dipped, Zinc-coated Welded and Seamless |
| A74-94 | Cast Iron Soil Pipe and Fittings |
| A183-83 | (R1990 Carbon Steel Track Bolts and Nuts |
| A312-94 | Seamless and Welded Austenitic Stainless Steel Pipe |
| A536-84 | (R1993 Ductile Iron Castings |
| A733-93 | Welded and Seamless Carbon Steel and Austenitic Stainless Steel Pipe Nipples |
| B32-95 | Solder Metal |
| B61-93 | Steam or Bronze Castings |
| B62-93 | Composition Bronze or Ounce Metal Castings |
| B75-93 | (Rev A) Seamless Copper Tube |
| B88-95 | Seamless Copper Water Tube |
| B306-95 | Copper Drainage Tube (DWV) |
| B584-93 | Copper Alloy Sand Castings for General Applications Revision A |
| B687-88 | Brass, Copper, and Chromium-Plated Pipe Nipples |
| C564-95 | Rubber Gaskets for Cast Iron Soil Pipe and Fittings |
| D2000-90 | Rubber Products in Automotive Applications |
| D2146-82 | Propylene Plastic Molding and Extrusion Materials |
| D2447-93 | Polyethylene (PE) Plastic Pipe, Schedule 40 and 80, Based on Outside Diameter |
| D2564-94 | Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Pipe and Fittings |
| D2665-94 Revision A | Poly (Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings |
| D4101-91 | Propylene Plastic Injection and Extrusion Materials |
- E. American Water Works Association (AWWA):
- | | |
|---------|--|
| C110-93 | Ductile Iron and Gray Iron Fittings - 75 mm thru 1200 mm (3 inch thru 48 inches) for Water and other liquids |
|---------|--|

- | | | |
|----|---|--|
| | C151-91 | Ductile-Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds, for Water or Other Liquids |
| | C203-91 | Coal-Tar Protective Coatings and Linings for Steel Water Pipelines - Enamel and Tape - Hot Applied |
| | C651-92 | Disinfecting Water Mains |
| | C701-88 | Cold Water Meters-Turbine Type, for Customer Service |
| F. | National Fire Protection Association (NFPA): 54-92 | National Fuel Gas Code |
| G. | American Welding Society (AWS): A5.8-92 | Filler Metals for Brazing |
| H. | National Association of Plumbing - Heating - Cooling Contractors (PHCC): National Standard Plumbing Code – 1996 | |
| I. | Cast Iron Soil Pipe Institute (CISPI): 301-90 | Hubless Cast Iron Soil and Fittings |
| J. | International Association of Plumbing and Mechanical Officials (IAPMO): Uniform Plumbing Code - 1991 IS6-93 | Installation Standard |
| K. | International Plumbing Code (IPC) – 1997 | |
| L. | Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. (MSS): SP-67-95 SP-70-90 SP-72-92 SP-80-87 | Butterfly Valve of the Single flange Type (Lug Wafer) Cast Iron Gate Valves, Flanged and Threaded Ends. General Purpose Ball Valves Gate Valve-Bronze |
| M. | American Society of Sanitary Engineers (ASSE): 1001-70 1013-93 1015-93 1018-86 1020-81 | Pipe Applied Atmospheric Type Vacuum Breakers Reduced Pressure Principle Backflow Preventers Double Check Backflow Prevention Assembly Performance for trap seal primer valve-water supply fed Vacuum Breakers, Anti-Siphon, Pressure Type |
| N. | Factory Mutual (FM): 1680-89 | Coupling Used in Hubless Cast Iron Systems for Drains, Waste and Vent Systems. |

PART 2 - PRODUCTS

2.1 SANITARY, WASTE, STORM WATER DRAIN AND VENT PIPING

- A. Cast Iron Soil Pipe and Fittings: Used for pipe buried in or in contact with earth and for extension of pipe to a distance of approximately 1500 mm (5 feet) outside of building walls and interior waste and vent piping above grade. Pipe shall be bell and spigot, modified hub, or plain end (no-hub) as required by selected jointing method.
1. Material, (Pipe and Fittings): ASTM A74, C1SP1-301, Service Class.
 2. Joints: Provide any one of the following types to suit pipe furnished.
 - a. Lead and oakum and caulked by hand.
 - b. Double seal, compression-type molded neoprene gasket. Gaskets shall suit class of pipe being jointed.

- c. Mechanical: Meet the requirements and criteria for pressure, leak, deflection and shear tests as outlined in Factory Mutual No. 1680 for Class 1 couplings.
 - 1) Stainless steel clamp type coupling of elastomeric sealing sleeve, ASTM C564 and a Series 300 stainless steel shield and clamp assembly. Sealing sleeve with center-stop to prevent contact between pipes/fittings being joined shall be marked ASTM C564.
 - 2) Cast Iron coupling with neoprene gasket and stainless steel bolts and nuts.
 - d. Mechanical Grooved Couplings: Shall consist of ductile iron (ASTM A536, Grade 65-45-12), or malleable iron (ASTM A47, Grade 32510) housings, a pressure responsive elastomeric gasket (ASTM D2000), and steel track head bolts. Shall be for use on pipe and fittings grooved to the manufacturer's specifications. Couplings and fittings to be of the same manufacturer.
 - e. Adapters: Where service weight pipe is connected to extra heavy pipe and extra heavy fittings of chair carriers, provide adapters or similar system to make tight, leakproof joints.
- B. Steel Pipe and Fittings: May be used for vent piping and storm water piping above grade.
- 1. Pipe Galvanized: ASTM A53, standard weight.
 - 2. Fittings:
 - a. Soil, Waste and Drain Piping: Cast iron, ANSI B16.12, threaded, galvanized.
 - b. Sanitary and Exhaust Vent Piping: Malleable iron, ANSI B16.3, or cast iron, ANSI B16.4. All piping shall be of the same kind. Couplings of vent piping may be standard couplings furnished with pipe.
 - c. Unions: Tucker connection or equivalent type throughout.
 - d. Mechanical Grooved Couplings: Shall consist of ductile iron (ASTM A536, Grade 65-45-12), or malleable iron (ASTM A47, Grade 32510) housings, a pressure responsive elastomeric gasket (ASTM D2000), and steel track head bolts. Shall be for use on pipe and fittings grooved to the manufacturer's specifications. Couplings and fittings to be of the same manufacturer.
- C. Copper Tube, (DWV): May be used for piping above ground, except for urinal drains.
- 1. Tube: ASTM B306.
 - 2. Fittings:
 - a. Solder type.
 - b. Grooved fittings, 50 to 150 mm (2 to 6 inch) wrought copper conforming to ASTM B75 C12200, 125 to 150 mm (5 to 6 inch) bronze casting conforming to ASTM B584, CDA 844(81-3-7-9). Mechanical grooved couplings, ductile iron, ASTM A536 (Grade 65-45-12), or malleable iron, ASTM A47 (Grade 32510) housings, with EPDM gasket, steel track head bolts, ASTM A183, coated with copper colored alkyd enamel.
 - 3. Joints: ASTM B32, 50/50, special alloy, lead free. Solder using non-corrosive flux.
- D. Polyvinyl Chloride (PVC): Schedule 40. Shall not be used where waste temperature may exceed 60°C (140°F), such as mechanical equipment rooms, kitchen, and sterilizer areas. **PVC shall not be used inside building and above ceiling, if the ceiling area is used as a HVAC return air plenum.**
- 1. Pipe: ASTM D2665.
 - 2. Fittings:

- a. Solvent Welded Socket Type: Use solvent cement, ASTM D2564.
- b. Threaded Type: Molded threads only. Use tape or lubricant specifically intended for use with PVC plastic pipe.

2.2 CHEMICAL RESISTANT WASTE AND VENT PIPING (IF SPECIFIED)

- A. General: The material includes connecting fittings in stacks or mains.
- B. Cast Iron: Acid resistant, close grained, cast iron pipe containing not less than 14.25 percent silicon.
 - 1. Mechanical Joint: Stainless steel coupling, Series 300. Install couplings over one-piece, sleeve type gaskets. Gaskets shall be either of the following:
 - a. Sintered polytetrafluoroethyl surrounded with neoprene.
 - b. Inner layer of fluorocarbon resin, middle layer of fluorocarbon resin impregnated glass cloth, and outer wrap of neoprene.
 - 2. Bell and Spigot Joint.
- C. Glass: Pre-stressed heat and chemical resistant borosilicate glass pipe and fittings.
- D. Polypropylene Plastic: ASTM D4101, Schedule 40, flame retardant. Pipe shall meet tolerances in accordance with ASTM D2447-74. Join pipe and fittings by heat fusion or mechanical joint in accordance with ASTM D2657. Must conform to National Sanitation Foundation requirements for corrosive waste service. Short turn elbows and sanitary tees are prohibited. Use standard DWV pattern for fittings. Mechanical joint fittings 38 thru 50 mm (1 1/2 thru 2 inches) shall be used for above grade vent piping and under counters within cabinet space.
- E. Stainless Steel: Type AISI 316L, high-grade austenitic stainless steel, chemically descaled for enhanced corrosion resistance and matt silver finish. Furnish pipe and fittings with EPDM gasketed hub and spigot push-fit connection. Use conversion couplings where connections are made to other piping materials. Gasket exceptions:
 - 1. Highly Corrosive Acids and Solvents or Elevated Temperatures: FPM gasket.
 - 2. Petroleum Products Present: NBR gasket.

2.3 SILVER RECOVERY PIPING (IF SPECIFIED)

- A. Polyvinyl Chloride (PVC): ASTM D2665, solvent welded joints.

2.4 WATER SERVICE CONNECTIONS TO BUILDINGS

- A. From inside face of exterior wall to a distance of approximately 1500 mm (5 feet) outside of building and underground inside building, material selected shall be the same for the size specified.
- B. Seventy five millimeters (3 inch) Diameter and Over: Ductile iron, AWWA C151, 850 kPa (125 pounds) water steam pressure (WSP), exterior bituminous coating, cement lined. Provide flanged and anchored connection to interior piping.
- C. Under 75 mm (3 inch) Diameter: Copper tubing, ASTM B88, type K, seamless, annealed. Fittings as specified under Article, INTERIOR DOMESTIC WATER PIPING. Use brazing alloys, AWS A5.8, Classification BCuP.
- D. Flexible Expansion Joint: Ductile iron with ball joints rated for 1725 kPa (250 psi) working pressure conforming to ANSI/AWWA A21.53/C153, capable of deflecting a minimum of

30 degrees and expanding simultaneously to the amount shown on the drawings. Flexible expansion joint shall have the expansion capability designed as an integral part of the ductile iron ball castings. Pressure containing parts shall be lined with a minimum of 15 mils of fusion bonded epoxy conforming to the applicable requirements of ANSI/AWWA C213 and shall be factory holiday tested with a 1500 volt spark test. Flexible expansion joint shall have flanged connections conforming to ANSI/AWWA A21.11/C110. Bolts and nuts shall be 316 stainless steel and gaskets shall be neoprene.

2.5 INTERIOR DOMESTIC WATER PIPING

- A. Pipe: Copper tube, ASTM B88, type K or L, drawn. For pipe 150 mm (6 inches) and larger, stainless, steel ASTM A312, schedule 10 may be used.
- B. Fittings for Copper Tube:
 - 1. Wrought copper or bronze castings conforming to ANSI B16.18 and B16.22. Unions shall be bronze, Fed. Spec. WW-U-516. Solder or braze joints.
 - 2. Grooved fittings, 50 to 150 mm (2 to 6 inch) wrought copper ASTM B75 C12200, 125 to 150 mm (5 to 6 inch) bronze casting ASTM B584, CDA 844. Mechanical grooved couplings, ductile iron, ASTM A536 (Grade 65-45-12), or malleable iron, ASTM A47 (Grade 32510) housing, with EPDM gasket, steel track head bolts, ASTM A183, coated with copper colored alkyd enamel.
 - 3. Mechanically formed tee connection: Form mechanically extracted collars in a continuous operation by drilling pilot hole and drawing out tube surface to form collar, having a height of not less than three times the thickness of tube wall. Adjustable collaring device shall insure proper tolerance and complete uniformity of the joint. Notch and dimple joining branch tube in a single process to provide free flow where the branch tube penetrates the fitting. Braze joints.
- C. Fittings for Stainless Steel:
 - 1. Stainless steel butt-welded fittings, Type 316, Schedule 10, conforming to ANSI B16.9.
 - 2. Grooved fittings, stainless steel, Type 316, Schedule 10, conforming to ASTM A403. Segmentally fabricated fittings are not allowed. Mechanical grooved couplings, ductile iron, ASTM A536 (Grade 65-45-12), or Malleable iron, ASTM A47 (Grade 32510) housing, with EPDM gasket, steel track head bolts, ASTM A183, coated with copper colored alkyd enamel.
- D. Adapters: Provide adapters for joining screwed pipe to copper tubing.
- E. Solder: ASTM B32 Composition Sb5 HA or HB. Provide non-corrosive flux.
- F. Brazing alloy: AWS A5.8, Classification BCuP.
- G. Reagent Grade Water Piping and Dialysis Water Piping (if specified):
 - 1. Polypropylene, ASTM D4101, Schedule 80 pressure pipe with dimensions in conformance with ASTM D2447, but without additions of modifiers, plasticizers, colorants, stabilizers or lubricants. This virgin un-plasticized pipe and fittings shall transport 10 megohm water with no loss of purity. Provide socket fusion joints.
 - 2. Polyethylene, food and medical grade, capable of transporting 10 megohm water with no loss of purity. Processed by continuous compression molding without the addition of fillers, polymer modifiers or processing aids. Uniform color with no

cracks, flaws, blisters or other imperfections in appearance. Provide heat fusion butt welded joints. In accordance with manufacturer's recommendations, provide continuous channel support under all horizontal piping.

2.6 FUEL GAS SERVICE CONNECTIONS TO BUILDING

- A. From inside face of exterior wall to a distance of approximately 1500 mm (5 feet) outside of building, use coated piping.
- B. Pipe: Black steel, ASTM A53, Schedule 40. Shop-applied pipe coating shall be one of the following types:
 - 1. Coal Tar Enamel Coating: Exterior of pipe and fittings shall be cleaned, primed with Type B primer and coated with hot-applied coal tar enamel with bonded layer of felt wrap in accordance with AWWA C203. Asbestos felt shall not be used; felt material shall be fibrous glass mat as specified in Appendix Section A2.1 of AWWA C203.
 - 2. Adhesive-thermoplastic Resin Coating: Fed. Spec. L-C-530, Type I.
 - 3. Thermosetting Epoxy Coating: Fed. Spec. L-C-530, Type II.
 - 4. Field-applied plastic tape material used on pipe joints and for repairing damaged areas of shop-applied coatings, Fed. Spec. L-T-1512, Type I, 10 mils nominal thickness for pipe joints, and Type II, 20 mils nominal thickness for coating repairs.
- C. Fittings:
 - 1. Butt weld fittings, wrought steel, ANSI B16.9.
 - 2. Socket weld and threaded fittings forged steel, ANSI B16.11.
 - 3. Grooved End: Ductile iron (ASTM A536, Grade 65-45-12), malleable iron (ASTM A47, Grade 32510), or steel (ASTM A53, Type F or Type E or S, Grade B).
- D. Joints: Welded, ANSI B31.8.

2.7 FUEL GAS PIPING

- A. Pipe: Black steel, ASTM A53, Schedule 40.
- B. Nipples: Steel, ASTM A733, schedule 40.
- C. Fittings:
 - 1. Steel Welded: Schedule 40
 - a. Up to 100 mm (4 inch), ANSI B16.11, Socket welded.
 - b. Over 100 mm (4 inch), ANSI B16.9, Butt welded.
 - 2. Malleable Iron, Threaded: ANSI B16.3.
 - 3. Grooved End: Ductile iron (ASTM A536, Grade 65-45-12), malleable iron (ASTM A47, Grade 32510), or steel (ASTM A53, Type F or Type E or S, Grade B).
- D. Joints: Provide welded or threaded joints.

2.8 EXPOSED WATER, WASTE, FUEL AND MEDICAL GAS PIPING, AS SPECIFIED.

- A. Finished Room: Use full iron pipe size chrome plated brass piping for exposed water, waste, fuel gas, medical and laboratory gas piping connecting fixtures, casework, cabinets, equipment and reagent racks when not concealed by apron including those furnished by the Owner or specified in other sections.

1. Pipe: Fed. Spec. WW-P-351, standard weight.
 2. Fittings: ANSI B16.15 cast bronze threaded fittings, (125 and 250).
 3. Nipples: ASTM B 687, Chromium-plated.
 4. Unions: Fed. Spec. WW-U-516, Brass or Bronze. Unions 65 mm (2-1/2 inches) and larger shall be flange type with approved gaskets.
 5. Valves: Fed. Spec. WW-V-35, Brass or bronze.
- B. Unfinished Rooms, Mechanical Rooms and Kitchens: Chrome-plated brass piping is not required. Paint piping systems as specified in Section 09900, PAINTING.
- 2.9 PUMPED WASTE, DRAIN AND SEWAGE PIPING:
- A. Pipe: Copper tube, ASTM B88, Type K or L, drawn. For pipe 100 mm (4 inches) and larger, galvanized steel ASTM A53, seamless, standard weight may be used.
 - B. Fittings for Copper Tube:
 1. Wrought copper or bronze castings conforming to ANSI B16.18 and B16.22. Unions shall be bronze, Fed Spec. WW-U-516. Solder or braze joints.
 2. Grooved fittings, 65 mm to 100 mm (2-1/2 to 4 inch) wrought copper ASTM A75 C12200, 125 to 150 mm (5 to 6 inch) bronze castings ASTM B584, CDA 844. Mechanical grooved couplings, ductile iron, ASTM A536 (Grade 65-45-12), malleable iron, ASTM A47 (Grade 32510) housing, with EPDM gasket, steel track head bolts, ASTM A183, coated with colored alkyd enamel.
 - C. Adapters: Provide adapters for joining screwed pipe to copper tubing.
 - D. Solder: ASTM B32 Composition Sb5. Provide non-corrosive flux.
- 2.11 TRAP PRIMER WATER PIPING:
- A. Pipe: Copper tube, ASTM B88, type K, hard drawn.
 - B. Fittings: Bronze castings conforming to ANSI B16.18 Solder joints.
 - C. Solder: ASTM B32 composition Sb5. Provide non-corrosive flux.
- 2.12 VALVES
- A. Asbestos packing is prohibited.
 - B. Shut-off:
 1. Cold, Hot and Recirculating Hot Water:
 - a. Fifty millimeter (2 inches) and smaller:
 - 1) Ball, Fed. Spec. WW-V-35, Type II, Class 125, Style 1, three piece or double union end construction, full ported, full flow, with solder end connections, 2750 kPa (400 psi) WOG, MSS-SP-67.
 - b. Larger than 50 mm (2 inches): Butterfly, iron body, aluminum bronze disc, 416 stainless steel stem, EPDM seat, wafer design, lever operator to six 150 mm (6 inch)size, gear operated and crank for 200 mm (8 inches) and above, 1375 kPa (200 pound) WOG, Fed. Spec WW-V-1967.
 - c. One hundred millimeters (4 inches) and larger:

- 1) Gate, MSS-SP-70, wedge disc, class 125, cast iron body with bronze trim, flanged.
 - 2) Grooved end butterfly valves with ductile iron body and disc core ASTM A536. Disc rubber coated with compatible material for intended service, maximum working pressure 2050 kPa (300 pounds psi) grooved ends for connection with mechanical grooved couplings.
2. Reagent Grade Water: Shall be ball type of same material as used for pipe.
 3. Fuel Gas:
 - a. Twenty-five mm (one inch) and smaller: UL Listed, semi-steel body, eccentric plug valve, with bronze plug, screwed, 1200 kPa (175 pound) WOG with resilient plug seal recommended for fuel gas service.
 - b. Larger than 25 mm (one inch):
 - 1) UL Listed, semi-steel body eccentric plug valve, electroless nickel plated plug, bronze bearings, with resilient plug seal recommended for fuel gas service, flanged or screwed, 1200 kPa (175 pound) WOG.
 - 2) Grooved end butterfly valves with ductile iron body and disc core, ASTM A536. Disc rubber coated with compatible material for intended service, maximum working pressure 2050 kPa (300 psi), grooved ends for connection with mechanical grooved couplings.
- C. Balancing:
1. Hot Water Recirculating, 50 mm (2 inches) and smaller: Combination type, calibrated, bronze with bronze disc, equipped with readout valves with integral check valve, indexing position pointer and calibrated name plate, internal EPT O-ring seals and factory molded insulating enclosures.
 2. Larger than 50 mm (2 inches): Combination balancing and shut-off, non-lubricated eccentric plug type with cast iron or semi-steel body, electroless nickel plated cast iron plug, with resilient facing suitable for continuous water service up to 80 °C (180 °F), bronze bearings, 1200 kPa (175 pound) WOG rating and an adjustable open position memory stop and lever.
- D. Check:
1. Less than 100 mm (3 inches) and smaller: Bronze body and trim, swing type, MSS-SP-80, 850 kPa (125 pound) WSP.
 2. Larger than 100 mm (4 inches and larger):
 - a. Iron body, bronze trim, swing type, vertical or horizontal installation, flange connections, 1375 kPa (200 pound) WOG.
 - b. Ductile iron (ASTM A536) or malleable iron (ASTM A47) body, stainless steel or aluminum bronze trim, dual disc, spring loaded, non-slamming design with grooved ends for connection with mechanical grooved couplings. Consult manufacturer for appropriate elastomeric seal for intended service. Maximum working pressure 3450 kPa (500 pounds psi), depending on size.
- E. Globe:
1. Eighty millimeters (3 inches) or smaller: Bronze body and bonnet, MSS-SP-80, 850 kPa (125 pound) WSP.
 2. Larger than 80 mm (3 inches): Similar to above, except with cast iron body and bronze trim.

2.13 WATER PRESSURE REDUCING VALVE AND CONNECTIONS

- A. Single-seated, for dead end service for 200 to 850 kPa (30 to 125 pounds) range on low pressure side. Composition diaphragm and stainless steel springs, bronze body with threaded connections for sizes 15 to 55 mm (1/2 to 2 inch), cast iron or semi-steel body with brass or bronze trimmings and flanged connections for sizes 15 to 50 mm (2-1/2 to 4 inch).
- B. Operation: Diaphragm and spring to act directly on valve stem. Delivered pressure shall vary not more than one kPa for each 10 kPa (one pound for each 10 pounds) variation on inlet pressure.
- C. Setting: Entering water pressure, discharge pressure, capacity, size, and related measurements shall be as shown on the drawings.
- D. Connections Valves and Strainers: Install shut off valve on each side of reducing valve and full sized bypass with shut off valve. Install strainer on inlet side of, and same size as pressure reducing valve. Install pressure gage on low pressure side of line.

2.14 AIR PRESSURE REDUCING VALVE AND CONNECTIONS, IF SPECIFIED

- A. Under seventy-five millimeters (3 inches) , bronze body and trim, 75 mm (3 inches) and over, cast-iron body with bronze trim. Single seated, for dead end service for 200 to 1025 kPa (30 to 150 pounds) range on low pressure side. Composition diaphragm and bronze spring to act directly on valve stem. Delivered pressure shall not vary more than one kPa for each 10 kPa (one pound for each 10 pounds) variation in inlet pressure.

2.15 BACKWATER VALVE, IF SPECIFIED

- A. Flap type, hinged or pivoted, with revolving disc. Cast iron body with cleanout of sufficient size to permit removal of interior parts. Hinge, pivot, disc and seat shall be nonferrous metal. Normal position of disc shall be slightly open. Extend the cleanout to the finished floor and fit with threaded countersunk plug. Provide clamping device wherever the cleanout extends through the membrane waterproofing.

2.16 CLEANOUTS

- A. Same size as the pipe, up to 100 mm (4 inches); not less than 100 mm (4 inches) for larger pipe. Cleanouts for chemical waste drain pipe shall be of same material as the pipe. Cleanouts shall be easily accessible. Provide a minimum clearance of 600 mm (24 inches) for the rodding.
- B. In Floors: Floor cleanouts shall have cast iron body and frame with square adjustable scoriated secured nickel bronze top. Unit shall be vertically adjustable for a minimum of 50 mm (2 inches). When a waterproof membrane is used in the floor system, provide clamping collars on the cleanouts. Cleanouts shall consist of "Y" fittings and 3 mm (1/8 inch) bends with brass or bronze screw plugs. Cleanouts in the resilient tile floors, quarry tile and ceramic tile floors shall be provided with square top covers recessed for tile insertion. In the carpeted areas, provide carpet cleanout markers. Provide two way cleanouts where indicated on drawings.
- C. Provide cleanouts at or near the base of the vertical stacks with the cleanout plug located approximately 600 mm (24 inches) above the floor. If there are no fixtures installed on the lowest floor, the cleanout shall be installed at the base of the stack. Extend the cleanouts to the wall access cover. Cleanout shall consist of sanitary tees. Furnish nickel-bronze square frame and stainless steel cover with minimum opening of 150 by 150 mm (6 by 6

inches) at each wall cleanout. Where the piping is concealed, a fixture trap or a fixture with integral trap, readily removable without disturbing concealed roughing work, shall be accepted as a cleanout equivalent providing the opening to be used as a cleanout opening is the size required by the NPHCC National Standard Plumbing Code.

- D. In horizontal runs above grade, cleanouts shall consist of cast brass tapered screw plug in fitting or caulked/no hub cast iron ferrule. Plain end (no-hub) piping in interstitial space or above ceiling may use plain end (no-hub) blind plug and clamp.

2.17 FLOOR DRAINS

- A. ANSI A112.21.1. Provide a caulking flange for connection to cast iron pipe, screwed or no hub outlets for connection to steel pipe, and side outlet when shown. Provide membrane clamp and extensions if required, where installed in connection with waterproof membrane. Puncturing membrane other than for drain opening will not be permitted. Double drainage pattern floor drains shall have integral seepage pan for embedding into floor construction, and weep holes to provide adequate drainage from pan to drain pipe. For drains not installed in connection with a waterproof membrane, provide a 2.2 kg (16-ounce) soft copper membrane, 600 mm (24 inches) square. Provide trap primer fitting as specified.

2.18 ROOF DRAINS AND CONNECTIONS, AS SPECIFIED

- A. Roof Drains: Cast iron with clamping device for making watertight connection. Free openings through strainer shall be twice area of drain outlet. For roof drains not installed in connection with a waterproof membrane, provide a soft copper membrane 300 mm (12 inches) in diameter greater than outside diameter of drain collar. Provide an integral gravel stop for drains installed on roofs having built-up roofing covered with gravel or slag. Provide integral no-hub, soil pipe gasket or threaded outlet connection.
 - 1. Flat Roofs: Beehive or dome shaped strainer with integral flange not less than 300 mm (12 inches) in diameter. For insulated roofs, provide a roof drain with an adjustable drainage collar, which can be raised or lowered to meet required insulation heights, sump receiver and deck clamp. Bottom section shall serve as roof drain during construction before insulation is installed.
 - 2. Canopy Roofs: Beehive or dome shaped strainer with the integral flange not larger than 200 mm (8 inches) in diameter. For insulated roof provide a roof drain with an adjustable drainage collar, which can be raised or lowered to meet the required insulation heights, sump receiver and deck clamp. Bottom section shall serve as roof drain during construction before insulation is installed.
 - 3. Promenade Decks: Same as for canopy roofs, except decks shall have flat, round, loose, non-slip, bronze grate set in square, non-slip, bronze frame.
 - 4. Portico Roofs and Gutters: Horizontal angle type drain with flat bottom and horizontal outlet at the same elevation as the pipe to which it is connected. Strainer shall be removable angle grate type.
 - 5. Protective Roof Membrane Insulation Assembly: Perforated stainless steel extension filter, non-puncturing clamp ring, large sump with extra wide roof flange and deck clamp.
 - a. Non-pedestrian Roofs: Large polypropylene or aluminum locking dome.
 - b. Pedestrian Roof: Bronze promenade top 350 mm (14 inches) square, set in square secured frame support collar.
- B. Expansion Joints: Heavy cast iron with cast brass or copper expansion sleeve having smooth bearing surface working freely against a packing ring held in place and under pressure of a bolted gland ring, forming a water and air tight flexible joint. Asbestos packing is prohibited.

- C. Interior Downspouts: Provide an expansion joint, specified above, at top of run on straight, vertical runs of downspout piping 12 m (40 feet) long or more.
- D. Downspout Nozzle: The nozzle fitting shall be of brass, unfinished, with internal pipe thread for connection to downspout.

2.19 TRAPS

- A. Provide on all sanitary branch waste connections from fixtures or equipment not provided with traps. Exposed brass shall be polished brass chromium plated with nipple and set screw escutcheons. Concealed traps may be rough cast brass or same material as pipe connected to. Slip joints not permitted on sewer side of trap. Traps shall correspond to fittings on cast iron soil pipe or steel pipe respectively, and size shall be as required by connected service or fixture. Traps shall be insulated per A.D.A. requirements for handicap fixtures specified.

2.20 TRAP PRIMERS

- A. Trap Primer (TP-1): Electronic type if specified.
 - 1. Controller: Programmable, solid state, 6 zone, minimum adjustable run time of 1 minute for each zone, 12 hour program battery backup, 120VAC to 24VAC internal transformer, fuse protected circuitry, UL listed, 120VAC input-24VAC output, constructed of enameled steel or plastic, equal to Toro Model Vision.
 - 2. Solenoid Valve: Brass body, Buna "N" seats, normally closed, 125 psi rated, 24VAC, equal to ASCO model 8210.
 - 3. Control Wiring: Control wiring to be copper in accordance with NEC 1990, Article 725 and not less than 18 gauge. All wiring shall be in conduit and in accordance with division 16 of the specifications.
- B. Trap Primer (TP-2): Hydraulic.
 - 1. Fifteen millimeter (1/2 inch) Inlet/ fifteen millimeter (1/2 inch) Outlet fully automatic, all brass trap primer valve, activated by a drop in building water pressure, no adjustment required. Model for one (1) to four (4) traps with distribution unit, may be located anywhere in an active cold water line, as indicated on the drawings or as required by code. ASSE Standard 1018. Omit distribution unit when serving a single trap.

2.21 HAIR INTERCEPTOR AS SPECIFIED

- A. Provide on sinks and lavatories, as specified and shown on the drawings, in lieu of P-traps. Shall be chromium plated cast brass with top slip joint inlet, 40 mm (1-1/2 inch) slip outlet and screwed, gasketed, watertight cover in bottom. Provide interceptor with removable, perforated, cylindrical screen of corrosion resisting metal or brass.

2.22 BACKFLOW PREVENTERS

- A. Provide a backflow prevention device at any point in the plumbing system where the potable water supply comes in contact with a potential source of contamination. Device shall be certified by the American Society of Sanitary Engineers. Listed below is a partial list of connection to the potable water system which shall be protected against backflow or back siphonage.
- B. Reduced Pressure Backflow Preventer: ASSE 1013.

1. Deionizers.
 2. Sterilizers.
 3. Stills.
 4. Dialysis, Deionized or Reverse Osmosis Water Systems.
 5. Water make-up to heating systems, cooling tower, chilled water system, and generators.
 6. Water service entrance from loop system.
- C. Pressure Type: ASSE 1020
1. Water make-up to heating systems, cooling tower, chilled water system, and generators.
 2. Dental equipment.
 3. Print washer.
- D. Atmospheric Vacuum Breaker: ASSE 1001
1. Hose bibs and sinks w/threaded outlets.
 2. Disposers.
 3. Showers (telephone type).
 4. Hydrotherapy units.
 5. Autopsy - on each hot and cold water outlet at each table or sink.
 6. All kitchen equipment, if not protected by air gap.
 7. Ventilating hoods w/ washdown system.
 8. Film processor.
 9. Detergent system.
 10. Dental equipment.
 11. Fume hoods.
 12. Glassware washers.
- E. Double Check Detector Backflow Prevention Assembly: Fire service. ASSE 1015.

2.23 WATER METER IF SPECIFIED

- A. Turbine type, Class II, AWWA C701. Peak domestic flow shall be 100 gpm. Register shall indicate in liters or U.S. gallons.

2.24 WATERPROOFING

- A. Provide at points where pipes pass through membrane waterproofed floors or walls in contact with earth.
- B. Floors: Provide cast iron stack sleeve with flashing device and a underdeck clamp. After stack is passed through sleeve, provide a waterproofed caulked joint at top hub.
- C. Walls: See detail shown on drawings.

2.25 STRAINERS

- A. Provide on high pressure side of pressure reducing valves, on suction side of pumps, on inlet side of indicating and control instruments and equipment subject to sediment damage and where shown on drawings. Strainer element shall be removable without disconnection of piping.
- B. Gas Lines: "Y" type with removable mesh lined brass strainer sleeve.

- C. Water: Basket or "Y" type with easily removable cover and brass strainer basket.
- D. Body: Smaller than 80 mm (3 inches), brass or bronze; 80 mm (3 inches) and larger, cast iron or semi-steel.

2.26 PRESSURE GAUGES FOR WATER AND SEWAGE USAGE

- A. ANSI B40.1 all metal case 114 mm (4-1/2 inches) diameter, bottom connected. throughout, graduated as required for service, and identity labeled. Range shall be 1375 kPa (0 to psi) gauge.

2.27 DIELECTRIC FITTINGS

- A. Provide dielectric couplings or unions between ferrous and non-ferrous pipe.

2.28 GAS EQUIPMENT CONNECTORS

- A. Flexible connectors with teflon core, interlocked galvanized steel protective casing, AGA certified design. Must be allowed and comply with local codes.

2.29 WATER HAMMER ARRESTER:

- A. Closed copper tube chamber with permanently sealed 410 kPa (60 psig) air charge above a triple o-ring piston. Three high heat Buna-N O-rings pressure packed and lubricated with FDA approved Dow Corning No. 11 silicone compound. All units shall be designed in accordance with ASSE 1010 for sealed wall installations without an access panel. Size and install in accordance with Plumbing and Drainage Institute requirements. Unit shall be as manufactured by Precision Plumbing Products Inc., Watts or Sioux Chief. Provide water hammer arrestors at all solenoid valves, at all groups of two or more flush valves, at all quick opening or closing valves, and at all medical washing equipment.

2.30 MEDICAL GAS OXYGEN, NITROGEN, VACUUM AND SCAVENGER PIPING

- A. Pipe: Copper tube, ASTM B819, type K or L, factory cleaned and capped copper tubing. Pipe shall bear one of the following labels: OXY, MED, or OXY/MED. **Do not use ACR type tubing.**
- B. Use brazing filler metals AWS classification BcuP-5 (self-fluxing), omit flux when joining medical gas copper piping.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: Comply with the PHCC National Standard Plumbing Code, the International Plumbing Code, local codes and the following:
 1. Install branch piping for water, waste and fuel gas, from the respective piping systems and connect to all fixtures, valves, cocks, outlets, casework, cabinets and equipment, including those furnished by the Owner or specified in other sections.
 2. Install piping for reagent racks, if specified. Neatly group, rack and locate piping as required by the equipment.
 3. Pipe shall be round and straight. Cutting shall be done with proper tools. Pipe, except for plastic and glass, shall be reamed to full size after cutting.

4. All pipe runs shall be laid out to avoid interference with other work.
5. Install valves with stem in horizontal position whenever possible. All valves shall be easily accessible. Install valve in each water connection to fixture.
6. Install union and shut-off valve on pressure piping at connections to equipment.
7. All gravity waste drain lines inside the building with vertical drops over 6 m (20 feet) shall be provided with joint restraint on the vertical drop and horizontal offset or branch below the vertical drop. Joint restraint shall be accomplished by threaded, soldered, lead and oakum or grooved joints or a combination of pipe clamps and tie-rods as detailed in NFPA 24. Vertical joint restraint shall be provided from the fitting at the bottom of the vertical drop through every joint up to the riser clamp at the floor penetration of the floor above. Horizontal joint restraint shall be provided from the same fitting at the bottom of the vertical drop through every joint on the horizontal offset or branch for a minimum of 18 m (60 feet) or to anchoring point from the building structure. Joint restraint below ground shall be accomplished by thrust blocks detailed in NFPA 24.
8. All piping shall be supported per the National Standard Plumbing Code, Chapter No. 8 and International Plumbing Code. If the vertical distance exceeds 6 m (20 feet) for cast iron pipe additional support shall be provided in the center of that span. Provide all necessary auxiliary steel to provide that support.
9. Install cast escutcheon with set screw at each wall, floor and ceiling penetration in exposed finished locations and within cabinets and millwork.
10. Penetrations:
 - a. Fire Stopping: Where pipes pass through fire partitions, fire walls, smoke partitions, or floors, install a fire stop that provides an effective barrier against the spread of fire, smoke and gases as specified in Section 07 27 00, AIR BARRIERS. Completely fill and seal clearances between raceways and openings with the fire stopping materials.
 - b. Waterproofing: At floor penetrations, completely seal clearances around the pipe and make watertight with sealant as specified in Section 07 92 00, JOINT SEALANTS.

B. Piping shall conform to the following:

1. Waste, Storm Water Drain and Vent Drain to main stacks:

| Pipe Size | Minimum Pitch |
|------------------------------|-----------------------------|
| 80 mm (3 inches) and smaller | 1 : 50 (1/4" to the foot). |
| 80 mm (4 inches) and larger | 1 : 100 (1/8" to the foot). |

2. Exhaust Vent: Extend separately through roof. Sanitary vents shall not connect to exhaust vents.
3. Chemical Resistant Waste and Vent and Silver Recovery, if specified:
 - a. Where waste lines from fixtures are shown on plans to be chemical resistant, vents shall also be chemical resistant.
 - b. PVC Pipe: Storage and installation shall comply with ASTM D2665.
 - c. Glass Piping: Installation shall be as recommended by manufacturer. Pitch shall be 1 : 50 (1/4 inch per foot), minimum.
 - d. Silver recovery pitch shall be 1 : 200 (0.5 percent), minimum.
 - e. Mechanical Joint Polypropylene Pipe: This joint requires pregrooved pipe or cutting of a groove in each pipe section using a rotation cutting tool. Pitch shall be 6 mm (1/4 inch per foot) minimum. Do not install below grade. Do not install within 23 m (75 feet) of hot water appliances (autoclaves, dishwashers, sterilizers and similar equipment).
 - f. Silicon cast iron pipe with bell and spigot joints and heat fusion polypropylene pipe may be used below grade under building.
 - g. Do not install stainless steel mechanical joints below grade.
 - h. Stainless Steel Piping: Join and support piping system per manufacturer's recommendations.

4. Domestic Water:
 - a. Where possible, grade all lines to facilitate drainage. Provide drain valves at bottom of risers. All unnecessary traps in circulating lines shall be avoided.
 - b. Connect branch lines at bottom of main serving fixtures below and pitch down so that main may be drained through fixture. Connect branch lines to top of main serving only fixtures located on floor above.
5. Fuel Gas:
 - a. Entire fuel gas piping installation shall be in accordance with requirements of NFPA 54 and local gas company requirements.
 - b. Install fuel gas piping with plugged drip pockets at low points.
6. Medical Gas Oxygen, Nitrogen, Vacuum and Scavenger
 - a. Entire medical gas oxygen, nitrogen, vacuum and scavenger installation shall be in accordance with requirements of NFPA 99 and medical gas pipe manufacturer's requirements.
 - b. Omit flux when joining medical gas copper piping. Use AWS classification BcuP-5 brazing filler which is self-fluxing.
 - c. During all medical gas brazing operations, purge the system with a low flow of nitrogen to drive air out of the piping. Copper tubing must be kept clean at all times during installation.

3.2 TESTS

- A. General: Test system either in its entirety or in sections per local code.
- B. Soil, Waste, Storm Water Drain, Vent, and Silver Recovery Systems: Conduct before trenches are backfilled or fixtures are connected. Conduct water test or air test, as directed by local code officials or, as a minimum, the following.
 1. Water Test: If entire system is tested, tightly close all openings in pipes except highest opening, and fill system with water to point of overflow. If system is tested in sections, tightly plug each opening except highest opening of section under test, fill each section with water and test with at least a 3 m (10 foot) head of water. In testing successive sections, test at least upper 3 m (10 feet) of next preceding section so that each joint or pipe except upper most 3 m (10 feet) of system has been submitted to a test of at least a 3 m (10 foot) head of water. Keep water in system, or in portion under test, for at least 15 minutes before inspection starts. System shall then be tight at all joints.
 2. Air Test: Maintain air pressure of 35 kPa (5 psi) gage for at least 15 minutes without leakage. Use force pump and mercury column gage.
 3. Final Tests: Either one of the following tests may be used.
 - a. Smoke Test: After fixtures are permanently connected and traps are filled with water, fill entire drainage and vent systems with smoke under pressure of 1.3 kPa (one inch of water) with a smoke machine. Chemical smoke is prohibited.
 - b. Peppermint Test: Introduce (two ounces) of peppermint into each line or stack.
- C. Potable Water System: Test after installation of piping and domestic water heaters, but before piping is concealed, before covering is applied, and before plumbing fixtures are connected. Fill systems with water and maintain hydrostatic pressure of 690 kPa (100 psi) gage for two hours. No decrease in pressure is allowed. Provide a pressure gage with a shutoff and bleeder valve at the highest point of the piping being tested.

- D. Reagent Grade Water Systems, if specified: Fill system with water and maintain hydrostatic pressure of 690 kPa (100 psi) gage during inspection and prove tight.
- E. Fuel Gas System: NFPA 54 and local gas company requirements.
- F. Medical Gas Oxygen System: NFPA 99 and manufacturer's requirements.
- G. All Other Piping Tests: Test new installed piping under 1 1/2 times actual operating conditions and prove tight.

3.3 STERILIZATION

- A. After tests have been successfully completed, thoroughly flush and sterilize the interior domestic water distribution system in accordance with AWWA C651 and local code requirements.
- B. Use either liquid chlorine or hypochlorite for sterilization or per local code requirements.

END OF SECTION

SECTION 22 30 00 - PLUMBING EQUIPMENT

PART 1 - GENERAL

1.1 DESCRIPTION

- A. A domestic water heater system complete, ready for operation including water heaters, thermometers, circulator pumps, and all necessary accessories, controls, connections and equipment.

1.2 RELATED WORK

- A. Preparation and finish painting: Section 09 90 00, PAINTING AND COATING.
- B. Piping, Fittings, Valves and Gages: Section 22 10 00, PLUMBING PIPING AND PUMPS.
- C. Section 22 40 00, PLUMBING FIXTURES.
- D. Section 23 21 23, HYDRONIC PUMPS.

1.3 SUBMITTALS

- A. Submit in one package in accordance with Division 01.
- B. Manufacturer's Literature and Data:
 - 1. Heaters.
 - 2. Valves.
 - 3. Thermometers.
 - 4. Gages.
 - 5. Vacuum Breakers and Vacuum Relief Valves.

1.4 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
 - B. American National Standard Institute (ANSI):
 - Z21.10.1 Gas Water Heaters
 - C. American Society of Mechanical Engineers (ASME):
 - Section IV-95 Heating Boilers
 - Section VIII-95 Pressure Vessels, Division 1
 - D. Underwriters Laboratories Inc. (UL):
 - UL-174 Standard for Electrical Storage Water Heater

PART 2 - PRODUCTS

2.1 ELECTRICAL WATER HEATER, AS SPECIFIED

- A. UL-174, glass lined, single or double heating element as specified, suitable for operating on voltage, phase and cycle, shown in the schedule on the Plumbing and Electrical Drawings.

2.2 LP GAS WATER HEATER

- A. Constructed and rated in accordance with American Gas Association Code for testing and rating LP gas-fired water heaters. ANSI Z21.1.10.1
- B. Material: Steel, heavily zinc-coated inside and outside, tested to hydrostatic pressure of 1025 kPa (150 psi).
- C. General Features: Equip each heater with brass and copper fittings and snap action or gradual action thermostat. Fit gas supply pipe with a control gas cock between gas cock and burner and provide a suitable safety pilot light, with valved pipe from connection to the outside of thermostatic valve. Provide a combination pressure and temperature relief valve and a thermometer. Provide medium pressure regulator with rating per gas line pressures.
- D. Flue: Provide each heater with number 0.85 mm thick (22 gage) galvanized iron flue of same size as heater outlet, extending from heater to chimney if specified. **For direct vented hot water heaters, follow manufacturer's installation instructions and recommendations and local code requirements. Provide all required concentric termination fittings with corrosion resistant screened inlet and outlet.**
- E. Temperature Setting: Set thermostat for maximum water temperature of 55 °C (130 °F).

2.3 THERMOMETERS

- A. Gas and Electric Water Heaters: Straight stem, iron case, red reflecting mercury thermometer approximately 175 mm (7 inches) high, 4 to 115 °C (40 to 240 °F). Install in hot water pipe close to outlet of tank.

2.4 RELIEF VALVE FOR GAS AND ELECTRIC WATER HEATERS

- A. Brass or bronze, fully automatic, self-closing combination pressure and temperature relief valve. Pressure relief valve shall be spring-operated with testing lever, set at 690 kPa (100 pounds) pressure. Temperature relief valves shall contain a noncorrosive metal thermostat with bulb. Valve shall be tested and approved as to its BTU capacity by ASME or an independent laboratory satisfactory to the Contracting Officer. Pipe discharge to floor drain as shown.

PART 3 - EXECUTION

3.1 LEAKAGE TEST

- A. Before connections are made, test heaters with hydrostatic pressure of 1375 kPa (200 psi) or per manufacturer's requirements and prove tight. Contractor shall comply with all local and state code testing requirements.

3.2 PERFORMANCE TEST

- A. Prove system is balanced and a minimum of 49 °C (120 °F) and a maximum of 54 °C (130 °F) is available at the most remote outlet from heaters.

END OF SECTION

SECTION 22 40 00 - PLUMBING FIXTURES

PART 1 – GENERAL

1.1 DESCRIPTION

- A. Plumbing fixtures, associated trim and fittings necessary to make a complete installation from wall or floor connections to rough piping, and certain accessories.

1.2 RELATED WORK

- A. Sealing between fixtures and other finish surfaces: Section 07 92 00, JOINT SEALANTS
- B. Flush panel access doors: Division 08
- C. Through bolts: Division 10.
- D. Section 22 10 00, PLUMBING PIPING AND PUMPS.
- E. Section 22 30 00, PLUMBING EQUIPMENT.

1.3 SUBMITTALS

- A. Submit in accordance with Division 01.
- B. Submit plumbing fixture information in an assembled brochure, showing cuts and full detailed description of each fixture.

1.4 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American National Standard Institute (ANSI):
The American Society of Mechanical Engineers (ASME):
A112.6.1M-90 Supports for Off-the-Floor Plumbing Fixtures for Public Use
A112.19.1M-89 Enameled Cast Iron Plumbing fixtures
A112.19.2M-90 Vitreous China Plumbing Fixtures
A112.19.3M-90 Stainless Steel Plumbing fixtures (Designed for Residential Use)
- C. American Society for Testing and Materials (ASTM):
A276-A94 Stainless and Heat-Resisting Steel Bars and Shapes
- D. National Association of Architectural Metal Manufacturers (NAAMM):
Metal Finishes Manual (1988)
- E. American Society of Sanitary Engineers (ASSE):
1016-88 Individual Thermostatic, Pressure Balancing and Combination Control
Valves for Bathing Facilities

PART 2 – PRODUCTS

2.1 STAINLESS STEEL

- A. Corrosion-resistant Steel (CRS):

1. Plate, Sheet and Strip: CRS flat products shall conform to chemical composition requirements of any 300 series steel specified in ASTM A276.
2. Finish: Exposed surfaces shall have standard polish (ground and polished) equal to NAAMM finish Number 4.

B. Die-cast zinc alloy products are prohibited.

2.2 STOPS

- A. Provide lock-shield loose key or screw driver pattern angle stops, straight stops or stops integral with faucet, with each compression type faucet whether specifically called for or not, including sinks in wood and metal casework. Locate stops centrally above or below fixture in accessible location.
- B. Furnish keys for lock shield stops to Architect/ Engineer and Client.
- C. Supply from stops not integral with faucet shall be chrome plated copper flexible tubing or flexible stainless steel with inner core of non-toxic polymer.
- D. Supply pipe from wall to valve stop shall be rigid threaded IPS copper alloy pipe

2.3 ESCUTCHEONS

- A. Heavy type, chrome plated, with set screws. Provide for piping serving plumbing fixtures and at each wall, ceiling and floor penetrations in exposed finished locations and within cabinets and millwork.

2.4 LAMINAR FLOW CONTROL DEVICE, IF SPECIFIED

- A. Smooth, bright stainless steel or satin finish, chrome plated metal laminar flow device shall provide non-aeration, clear, coherent laminar flow that will not splash in basin. Device shall also have a flow control restrictor and have vandal resistant housing.
- B. Flow Control Restrictor, if specified:
 1. Capable of restricting flow from 95 to 110 mL/s (1.5 to 1.7 gpm) for lavatories; 125 to 140 mL/s (2.0 to 2.2 gpm) for sinks P-505 through P-520, P-524 and P-528; and 170 to 190 mL/s (2.75 to 3.0 gpm) for dietary food preparation and rinse sinks.
 2. Compensates for pressure fluctuation maintaining flow rate specified above within 10 percent between 170 and 550 kPa (25 and 80 psi).
 3. Operates by expansion and contraction, eliminates mineral/sediment build-up with self clearing action, and is capable of easy manual cleaning.
- C. Device manufactured by OMNI Products, Inc. or equal.

2.5 CARRIERS, IF REQUIRED OR SPECIFIED

- A. ASME/ANSI A112.6.1M, with adjustable gasketed face plate chair carriers for wall hung closets with auxiliary anchor foot assembly, hanger rod support feet, and rear anchor tie down .
- B. ASME/ANSI A112.6.1M, lavatory, chair carrier for thin wall construction. All lavatory chair carriers shall be capable of supporting the lavatory with a 250 pound vertical load applied at the front of the fixture.

- C. Where water closets, lavatories or sinks are installed back-to-back and carriers are specified, provide one carrier to serve both fixtures in lieu of individual carriers.

2.6 WATER CLOSETS

- A. Water Closet (Floor Mounted, ANSI 112) - office and industrial, elongated bowl, siphon jet 6 L (1.6 gallons) per flush, floor/rear outlet. Top of rim shall be per A.D.A. and code above finished floor, as specified.
 - 1. Seat: Institutional/Industrial, extra heavy duty, chemical resistant, solid plastic, open front less cover for elongated bowls, integrally molded bumpers, concealed check hinge with stainless steel post. Seat shall be posture contoured body design. Color shall be white.
 - 2. Fittings and Accessories: Floor flange fittings-cast iron; Gasket-wax; bolts with chromium plated cap nuts and washers.
 - 3. Flush valve: Lever handle with location on access side for A.D.A. with water saver design 6 L (1.6 gallons) per flush, chrome angle stop.

2.7 URINALS

- A. Urinal (Wall Hung, ANSI A112.19.2M) bowl with integral flush distribution. Wall hung with integral trap, siphon jet flushing action 4 L (1.0 gallons) per flush with 50mm (2-inch) back outlet and 20 mm (3/4-inch) top inlet spud.
 - 1. Support urinal with chair carrier and install with rim 600 mm (24 inches) above finished floor.
 - 2. Flushing Device: Chrome flush handle, water saver design, 20 mm (3/4-inch) capped screwdriver angle stop valve. Install per A.D.A. and code.

2.8 LAVATORIES

- A. Dimensions for lavatories as specified on drawings, Length by width (distance from wall) and depth.
- B. Brass components in contact with water shall contain no more than 3 percent lead content by dry weight.
- C. Lavatory (Single Lever Handle Control ASME/ANSI A112.19.2M) straight back, approximately 500 by 450 mm (20 by 18 inches) and a 102 mm (4-inch) maximum apron, first quality per schedule. Punching for faucet on 102mm (4-inch) centers. Set rim per A.D.A. above finished floor.
 - 1. Faucet: Solid cast brass construction, vandal resistant, heavy duty single lever handle, center set. Provide insulation per A.D.A. requirements for water lines and traps.

2.9 SINKS AND SERVICE SINKS

- A. Dimensions for sinks and laundry tubs are specified on drawings, length by width (distance from wall) and depth.
- B. Service Sink (Corner, Floor Mounted) stain resistant terrazzo, 24 by 24 by 12 inches. Terrazzo, composed of marble chips and white Portland cement, shall develop compressive strength of 20 684 kPa (3000 psi) seven days after casting. Provide extruded aluminum cap on front side.

1. Faucet: Cast or wrought copper alloy, combination faucet with replaceable monel seat, removable replacement unit containing all parts subject to wear, integral stops, mounted on wall above sink. Spout shall have a pail hook, 20 mm (3/4-inch) hose coupling threads, vacuum breaker, and top or bottom brace to wall. Four-arm handles on faucets shall be cast, formed, or drop forged copper alloy. Escutcheons shall be either forged copper alloy or CRS. Exposed metal parts, including exposed part under valve handle when in open position, shall have a smooth bright finish. Provide 914 mm (three-foot) hose with wall hook. Centerline of rough-in is 1220 mm (48 inches) above finished floor.
2. Drain: Eighty millimeter (3-inch) cast brass drain with nickel bronze strainer.
3. Trap: P-trap, drain through floor.

2.10 HYDRANT, HOSE BIBB AND MISCELLANEOUS DEVICES

- A. Wall Hydrant: Cast bronze non-freeze hydrant with detachable T-handle. Brass operating rod within casing of bronze pipe of sufficient length to extend through wall and place valve inside building. Brass valve with coupling and union elbow having metal-to-metal seat. Valve rod and seat washer removable through face of hydrant; 20 mm (3/4-inch) hose thread on spout; 20 mm (3/4-inch) pipe thread on inlet. Finish may be rough; exposed surfaces shall be chrome plated. Set not less than 460 mm (1-1/2 feet) or more than 920 mm (3-feet) above grade. On porches and platforms, set approximately 760 mm (2-1/2 feet) above finished floor. Provide integral vacuum breaker which automatically drains when shut off.
- B. Hose Bibb (Combination Faucet, Wall Mounted to concealed supply pipes): Cast or wrought copper alloy, combination faucet with replaceable monel seat, removable replacement unit containing all parts subject to wear, mounted on wall 914 mm (36 inches) above floor to concealed supply pipes. Provide faucet without top or bottom brace and with 20 mm (3/4-inch) hose coupling threads on spout, integral stops and vacuum breaker. Design valves with valve disc arranged to eliminate rotation on seat. Four-arm handles on faucets shall be cast, formed or drop forged copper alloy. Escutcheons shall be either forged copper alloy or CRS. Exposed metal parts, including exposed part under valve handle when in open position, shall have a bright finish.

2.11 OTHER SPECIFIED FIXTURES:

- A. Provide other plumbing fixtures as specified on drawings and install per manufacturer's installation instructions. Contractor shall submit alternate manufacturer's for approval prior to procurement and installation.

PART 3 – EXECUTION

3.1 INSTALLATION

- A. Fixture Setting: Opening between fixture and floor and wall finish shall be sealed as specified under Section, JOINT SEALANTS.
- B. Supports and Fastening: Secure all fixtures, equipment and trimmings to partitions, walls and related finish surfaces. Exposed heads of bolts and nuts in finished rooms shall be hexagonal, polished chrome plated brass with rounded tops.
- C. Through Bolts: For free standing marble and metal stud partitions refer to Section METAL TOILET COMPARTMENTS.
- D. Toggle Bolts: For hollow masonry units, finished or unfinished.

- E. Expansion Bolts: For brick or concrete or other solid masonry. Shall be 6 mm (1/4-inch) diameter bolts, and to extend at least 75 mm (3-inches) into masonry and be fitted with loose tubing or sleeves extending into masonry. Wood plugs, fiber plugs, lead or other soft metal shields are prohibited.
- F. Power Set Fasteners: May be used for concrete walls, shall be 6 mm (1/4-inch) threaded studs, and shall extend at least 35 mm (1-1/4 inches) into wall.
- G. Tightly cover and protect fixtures and equipment against dirt, water and chemical or mechanical injury.
- H. Where water closet waste pipe has to be offset due to beam interference, provide correct and additional piping necessary to eliminate relocation of water closet.

3.2 CLEANING

- A. At completion of all work, fixtures, exposed materials and equipment shall be thoroughly cleaned.

END OF SECTION

SECTION 23 05 00 - COMMON WORK RESULTS FOR HVAC

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Applies to all sections of Division 23.
- B. Definitions:
 - 1. Exposed: Piping, ductwork, and equipment exposed to view in finished rooms.
 - 2. Option or optional: Contractor's choice of an alternate material or method.

1.2 RELATED WORK

- A. Section 03 30 00 – Cast-in-Place Concrete: Concrete and Grout
- B. Section 05 50 00 - Metal Fabrications
- C. Section 07 27 00 - Air Barriers
- D. Section 07 62 00 – Flashing and Sheet Metal: Flashing for Wall and Roof Penetrations
- E. Section 07 92 00 - Joint Sealants
- F. Section 09 90 00 – Painting and Coating
- G. Section 23 30 00 – HVAC Air Distribution
- H. Section 23 05 48 – Vibration Controls for HVAC
- I. Section 23 07 00 – HVAC Insulation
- J. Section 23 05 93 – Testing, Adjusting, Balancing for HVAC.
- K. Section 23 21 23 – Hydronic Pumps
- L. Section 23 34 00 – HVAC Fans
- M. Section 23 40 00 – HVAC Air Cleaning Devices
- N. Division 26 - Electrical

1.3 QUALITY ASSURANCE

- A. Flow Rate Tolerance for HVAC Equipment: Section 23 05 93, TESTING, ADJUSTING, AND BALANCING FOR HVAC.
- B. Equipment Vibration Tolerance:
 - 1. The allowable vibration tolerance is specified in Section 23 05 48, VIBRATION CONTROLS FOR HVAC PIPING & EQUIPMENT CONTROL. Equipment specifications require factory balancing of equipment to this tolerance.
 - 2. After air balance work is completed and permanent drive sheaves are in place, perform field mechanical balancing and adjustments required to meet the specified vibration tolerance as specified.

- C. Products Criteria:
1. Standard Products: Material and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of the products for at least 3 years. See other specification sections for any exceptions.
 2. Equipment Service: Products shall be supported by a service organization which maintains a complete inventory of repair parts and is located reasonably close to the site.
 3. Multiple Units: When two or more units of materials or equipment of the same type or class are required, these units shall be products of one manufacturer.
 4. Assembled Units: Manufacturers of equipment assemblies, which use components made by others, assume complete responsibility for the final assembled product.
 5. Nameplates: Nameplate bearing manufacturer's name or identifiable trademark shall be securely affixed in a conspicuous place on equipment, or name or trademark cast integrally with equipment, stamped or otherwise permanently marked on each item of equipment.
 6. Asbestos products or equipment or materials containing asbestos shall not be used.
- D. Welding: Before any welding is performed, contractor shall submit a certificate certifying that welders comply with the following requirements:
1. Qualify welding processes and operators for piping according to ASME "Boiler and Pressure Vessel Code", section IX, "Welding and Brazing Qualifications".
 2. Comply with provisions of ASME B31 series "Code for Pressure Piping".
 3. Certify that each welder has passed American Welding Society (AWS) qualification tests for the welding processes involved, and that certification is current.
- E. Manufacturer's Recommendations: Where installation procedures or any part thereof are required to be in accordance with the recommendations of the manufacturer of the material being installed, printed copies of these recommendations shall be furnished to the Architect/Engineer prior to installation. Installation of the item will not be allowed to proceed until the recommendations are received. Failure to furnish these recommendations can be cause for rejection of the material.
- F. Guaranty: Section 01 00 00, GENERAL REQUIREMENTS.
- G. Extended Guarantee Period Services: Section 23 09 00, INSTRUMENTATION & CONTROL FOR HVAC.
1. Qualifications: All service technicians assigned to perform work under this contract shall be qualified and factory trained by the Original Equipment Manufacturer (O.E.M.). Each technician shall have at least three years experience of working on comparable systems and shall be a full time employee of the contractor. The contractor shall furnish, for the OWNER review and approval, resumes of all service technicians scheduled to service the equipment and systems. The resume shall include details of experience, training, and educational qualifications and performance evaluations.
 2. Replacement Parts: The contractor shall be equipped with all replacement parts of all equipment and systems to be serviced and the manufacturer's standard service and repair procedures. All replacement parts shall be brand new and of current design. The replacement parts shall be O.E.M. items. Obsolete or refurbished parts are unacceptable. "Approved Equal" parts must have prior

- approval of the Architect/Engineer or Owner. Contractor shall furnish evidence of guaranteed supply of parts for the life of the system.
3. Service Supplies: The services shall include, without any additional cost to the Owner, all replacement parts, special tools and equipment, and consumable materials, that is, lubrication oil, grease, and cleaning materials, as required. The requirement of UL listing, where applicable, shall not be voided by any replacement parts, components, software, or modifications provided by the contractor.
 4. Scheduled and Emergency Call Service: The service shall include a scheduled monthly visit to perform systematic examination of equipment and/or systems and a 7 day, 24 hours call back service for emergency service. The emergency service is defined as a situation created by a breakdown or malfunction of any equipment or system warranting urgent attention. A qualified service representative shall respond to the Owner request for emergency service within two hours and assess the problem either by telephone or remote diagnostic capability. If the emergency situation cannot be rectified by the Owner personnel, on site emergency service shall be provided by sending a qualified service representative within 24 hours. For the rural locations of the Owner facilities, situated over 200 miles from the contractor's established service depot, the maximum response time of 48 hours shall be acceptable. The emergency service shall be limited to adjustments and repairs specifically required to protect the safety of the equipment for which the emergency service was required to be performed.
 5. Licensing: The contractor shall be licensed to perform the contracted services. The contractor shall furnish details of all applicable local and state licensing requirements to Owner as a part of the qualification requirements. The licenses shall be current, valid through the term of the contract and in the name of the contractor.
 6. Documentation Requirements: The contractor shall maintain a separate log for each item of equipment and each system covered under the extended guarantee period service contract with the Owner's building maintenance service. The log shall list dates and times of all scheduled and emergency calls. Each emergency call shall be described with details of the nature and causes of emergency, steps taken to rectify the situations, and specific recommendations to avoid such conditions in the future.
 7. Reports: The contractor shall provide a quarterly report for the first year and twice a year for the remainder of the guarantee period for all equipment and systems serviced under the extended guarantee period contract. The report shall clearly and concisely describe the services rendered, parts replaced, and repairs performed. The report shall prescribe anticipated future needs of the equipment and systems for preventive and predictive maintenance.
 8. Quality Program: The contractor shall provide a description of the quality management and control program. The description shall include a tangible proof the existence of such program, names of at least three customers who have participated in the program, and specific information showing the applicability of program to the project.
 9. Training: During each scheduled service visit, the contractor shall actively involve the Owner maintenance personnel in performing scheduled service and associated activities. The practical training during the scheduled service visits shall include parting oral and written instructions, for each specific task of the servicing contract, to the Owner's maintenance personnel who shall operate the hardware and software in accordance with the intent of the design and under direct supervision of the service contractor's qualified service technician. At the end of the first year of the service contract, the contractor shall obtain a certificate from the Owner's maintenance department confirming completion of training to the authorized Owner's representative(s).

- 10. Classroom Training: Provide list and costs of classroom training courses offered by contractor or O.E.M.
- H. Plumbing Systems: NAPHCC National Standard Plumbing Code, International Plumbing Code and local codes.
- I. Supports for sprinkler piping shall be in conformance with NFPA 13.
- J. Supports for standpipe shall be in conformance with NFPA 14.

1.4 SUBMITTALS

- A. Submit in accordance with Division 01.
- B. Manufacturer's Literature and Data: Submit under the pertinent section rather than under this section.
 - 1. Submit belt drive with the driven equipment. Submit selection data for specific drives when requested by the Architect/Engineer.
 - 2. Submit electric motor data and variable speed drive data with the driven equipment.
 - 3. Equipment and materials identification.
 - 4. Fire-stopping materials.
 - 5. Hangers, inserts, supports and bracing. Provide load calculations for variable spring and constant support hangers, if specified.
 - 6. Wall, floor, and ceiling plates.
- C. Coordination Drawings: In accordance with Section 01 00 00, GENERAL REQUIREMENTS, Article, SUBCONTRACTS AND WORK COORDINATION. Provide detailed layout drawings of all piping and duct systems. In addition provide details of the following.
 - 1. Mechanical equipment rooms.
 - 2. Interstitial space.
 - 3. Hangers, inserts, supports, and bracing.
 - 4. Pipe sleeves.
 - 5. Duct or equipment penetrations of floors, walls, ceilings, or roofs.
- D. Maintenance Data and Operating Instructions:
 - 1. Maintenance and operating manuals in accordance with Section 01 00 00, GENERAL REQUIREMENTS, Article, INSTRUCTIONS, for systems and equipment.
 - 2. Provide a listing of recommended replacement parts for keeping in stock supply, including sources of supply, for equipment. Include in the listing belts for equipment: Belt manufacturer, model number, size and style, and distinguished whether of multiple belt sets.
- E. Provide copies of approved HVAC equipment submittals to the Testing, Adjusting and Balancing Subcontractor.

1.5 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

- B. Air Conditioning and Refrigeration Institute (ARI):
430-89 Central Station Air-Handling Units
- C. American National Standard Institute (ANSI):
B31.1-95 Power Piping
- D. Rubber Manufacturers Association (ANSI/RMA):
IP-20-88 Drives Using Classical V-Belts and Sheaves - Cross Sections A, B, C, D,
and E
IP-21-91 Drives Using Double-V (Hexagonal) Belts (AA, BB, XX, DD Cross
Sections)
IP-22-91 Drives Using Narrow Multiple V-Belts (3V, 5V, and 8V Cross Sections)
- E. Air Movement and Control Association (AMCA):
410-91 Recommended Safety Practices for Air Moving Devices
- F. American Society of Mechanical Engineers (ASME):
Boiler and Pressure Vessel Code (BPVC):
SEC IX-95 Qualifications Standard for Welding and Brazing Procedures, Welders,
Brazers, and Welding and Brazing Operators
- G. American Society for Testing and Materials (ASTM):
A36/A36M-94 Carbon Structural Steel
A575-89 Steel Bars, Carbon, Merchant Quality, M-Grades
E84-95 Surface Burning Characteristics of Building Materials
E119-95 Fire Tests of Building Construction and Materials
- H. Manufacturers Standardization Society (MSS) of the Valve and Fittings Industry, Inc:
SP-58-93 Pipe Hangers and Supports-Materials, Design and Manufacture
SP-69-91 Pipe Hangers and Supports-Selection and Application
- I. International Plumbing Code (IPC):
1997 International Plumbing Code
- J. National Fire Protection Association (NFPA):
90A-96 Installation of Air Conditioning and Ventilating Systems
101-97 Life Safety Code

PART 2 - PRODUCTS

2.1 BELT DRIVES

- A. Type: ANSI/RMA standard V-belts with proper motor pulley and driven sheave. Belts shall be constructed of reinforced cord and rubber.
- B. Dimensions, rating and selection standards: ANSI/RMA IP-20 and IP-21.
- C. Minimum Horsepower Rating: Motor horsepower plus recommended ANSI/RMA service factor (not less than 20 percent) in addition to the ANSI/RMA allowances for pitch diameter, center distance, and arc of contact.
- D. Maximum Speed: 25 m/s (5000 feet per minute).
- E. Adjustment Provisions: For alignment and ANSI/RMA standard allowances for installation and take-up.

- F. Drives may utilize a single V-Belt (any cross section) when it is the manufacturer's standard.
- G. Multiple Belts: Matched to ANSI/RMA specified limits by measurement on a belt measuring fixture. Seal matched sets together to prevent mixing or partial loss of sets. Replacement, when necessary, shall be an entire set of new matched belts.
- H. Sheaves and Pulleys:
 - 1. Material: Pressed steel, or close grained cast iron.
 - 2. Bore: Fixed or bushing type for securing to shaft with keys.
 - 3. Balanced: Statically and dynamically.
 - 4. Groove spacing for driving and driven pulleys shall be the same.
 - 5. Minimum Diameter of V-Belt Sheaves (ANSI/RMA recommendations) in millimeters and inches:

| Fractional Horsepower | | Standard | | High Capacity | |
|-----------------------|-----------------|---------------|-----------------|---------------|-----------------|
| Cross Section | Min. od mm (in) | Cross Section | Min. od mm (in) | Cross Section | Min. od mm (in) |
| 2L | 20 (0.8) | A | 83 (3.25) | 3V | 67 (2.65) |
| 3L | 38 (1.5) | B | 146 (5.75) | 4V | 180 (7.10) |
| 4L | 64 (2.5) | C | 239 (9.40) | 5V | 318 (12.50) |
| 5L | 89 (3.5) | D | 345 (13.60) | | |
| | | E | 554 (21.80) | | |

- I. Drive Types, Based on ARI 435:
 - 1. Provide adjustable-pitch or fixed-pitch drive as follows:
 - a. Fan speeds up to 1800 RPM: 7.5 kW (10 horsepower) and smaller.
 - b. Fan speeds over 1800 RPM: 2.2 kW (3 horsepower) and smaller.
 - 2. Provide fixed-pitch drives for drives larger than those listed above.
 - 3. The final fan speeds required to just meet the system CFM and pressure requirements, without throttling, shall be determined by adjustment of a temporary adjustable-pitch motor sheave or by fan law calculation if a fixed-pitch drive is used initially.

2.2 DRIVE GUARDS

- A. For machinery and equipment, provide guards as shown in AMCA 410 for belts, chains, couplings, pulleys, sheaves, shafts, gears and other moving parts regardless of height above the floor. Drive guards may be excluded where motors and drives are inside factory fabricated air handling unit casings.
- B. Materials: Sheet steel, cast iron, expanded metal or wire mesh rigidly secured so as to be removable without disassembling pipe, duct, or electrical connections to equipment.
- C. Access for Speed Measurement: 25 mm (One inch) diameter hole at each shaft center.

2.3 ELECTRIC MOTORS

- A. Section 26 00 00, ELECTRICAL, specifies the applicable requirements for electric motors. Provide special energy efficient motors as scheduled. Unless otherwise specified for a particular application use electric motors with the following requirements.
- B. Single-phase Motors: Capacitor-start type for hard starting applications. Motors for centrifugal fans and pumps may be split phase or permanent split capacitor (PSC).

- C. Poly-phase Motors: NEMA Design B, Squirrel cage, induction type. Each two-speed motor shall have two separate windings. Provide a time- delay (20 seconds minimum) relay for switching from high to low speed.
- D. Rating: Continuous duty at 100 percent capacity in an ambient temperature of 40 degrees centigrade (104 degrees F); minimum horsepower as shown on drawings; maximum horsepower in normal operation not to exceed nameplate rating without service factor.
- E. Insulation Resistance: Not less than one-half meg-ohm between stator conductors and frame, to be determined at the time of final inspection.

2.4 VARIABLE SPEED MOTOR CONTROLLERS

- A. Refer to Division 26, ELECTRICAL for specifications.
- B. The combination of controller and motor shall be provided by the respective air handler, fan or pump manufacturer, and shall be rated for 100 percent output performance. Multiple units of the same class of equipment, i.e. air handlers, fans, pumps, shall be product of a single manufacturer.
- C. Motors shall be energy efficient type and be approved by the motor controller manufacturer. The controller-motor combination shall be guaranteed to provide full motor nameplate horsepower in variable frequency operation. Both driving and driven motor/fan sheaves shall be fixed pitch.
- D. Controller shall not add any current or voltage transients to the input AC power distribution system, DDC controls, sensitive medical equipment, etc., nor shall be affected from other devices on the AC power system.

2.5 EQUIPMENT AND MATERIALS IDENTIFICATION

- A. Use symbols, nomenclature and equipment numbers specified, shown on the drawings and shown in the maintenance manuals. Identification for piping is specified in Section 09 90 00, PAINTING AND COATING.
- B. Interior (Indoor) Equipment: Engraved nameplates, with letters not less than 48 mm (3/16-inch) high of brass with black-filled letters, or rigid black plastic with white letters specified in Section 09 90 00, PAINTING permanently fastened to the equipment. Identify unit components such as coils, filters, fans, etc.
- C. Exterior (Outdoor) Equipment: Brass nameplates, with engraved black filled letters, not less than 48 mm (3/16-inch) high riveted or bolted to the equipment.
- D. Control Items: Label all temperature and humidity sensors, controllers and control dampers. Identify and label each item as they appear on the control diagrams.
- E. Valve Tags and Lists:
 - 1. Plumbing: Provide for all valves (Fixture stops not included).
 - 2. HVAC: Provide for all valves.
 - 3. Valve tags: Engraved black filled numbers and letters not less than 13 mm (1/2-inch) high for number designation, and not less than 6.4 mm (1/4-inch) for service designation on 19 gage 38 mm (1-1/2 inches) round brass disc, attached with brass "S" hook or brass chain.

4. Valve lists: Typed or printed plastic coated card(s), sized 216 mm(8-1/2 inches) by 280 mm (11 inches) showing tag number, valve function and area of control, for each service or system. Punch sheets for a 3-ring notebook.
5. Provide detailed plan for each floor of the building indicating the location and valve number for each valve. Identify location of each valve with a color coded thumb tack in ceiling.

2.6 GALVANIZED REPAIR COMPOUND

- A. Mil. Spec. DOD-P-21035B, paint form.

2.7 PIPE AND EQUIPMENT SUPPORTS AND RESTRAINTS

- A. Vibration Isolators: Refer to Section 23 05 48, VIBRATION CONTROLS FOR HVAC PIPING & EQUIPMENT.
- B. In lieu of the paragraph which follows, suspended equipment support and restraints may be designed and installed in accordance with the National Uniform Seismic Installation Guidelines (NUSIG), most current edition. Submittals based on either the NUSIG guidelines or the following paragraphs of this Section shall be stamped and signed by a professional engineer registered in a state where the project is located. Support of suspended equipment over 227kg (500 pounds) shall be submitted for approval of the Architect/Engineer in all cases. See paragraph 2.8.L for lateral force design requirements.
- C. Supports For Roof Mounted Items:
 1. Equipment: Equipment rails shall be galvanized steel, minimum 1.3 mm (18 gauge), with integral baseplate, continuous welded corner seams, factory installed 50 mm by 100 mm (2 by 4) treated wood nailer, 1.3 mm (18 gauge) galvanized steel counter flashing cap with screws, built-in cant strip, (except for gypsum or tectum deck), minimum height 280 mm (11 inches). For surface insulated roof deck, provide raised cant strip to start at the upper surface of the insulation.
 2. Pipe/duct pedestals: Provide a galvanized unistrut channel welded to U-shaped mounting brackets which are secured to side of rail with galvanized lag bolts.
- D. Refer to Section 05 50 00, METAL FABRICATIONS, for miscellaneous metal support materials and prime coat painting.
- E. For Attachment to Concrete Construction:
 1. Concrete insert: Type 18, MSS SP-58.
 2. Self-drilling expansion shields and machine bolt expansion anchors: permitted in concrete not less than 102 mm (four inches) thick. Applied load shall not exceed one-fourth the proof test load.
 3. Power-driven fasteners: Permitted in existing concrete or masonry not less than 102 mm (four inches) thick when approved by the Architect/Engineer for each job condition. Applied load shall not exceed one-fourth the proof test load.
- F. For Attachment to Steel Construction:
 1. Welded attachment: Type 22.
 2. Beam clamps: Types 20, 21, 28 or 29. Type 23 C-clamp may be used for individual copper tubing up to 23mm (7/8-inch) outside diameter.

- G. For Attachment to Wood Construction: Wood screws or lag bolts.
- H. Hanger Rods: Hot-rolled steel, ASTM A36 or A575 for allowable load. For piping, provide adjustment means for controlling level or slope. Types 13 or 15 turn-buckles shall provide 38 mm (1-1/2 inches) minimum of adjustment and incorporate locknuts. All-thread rods are acceptable.
- I. Multiple (Trapeze) Hangers: Galvanized, cold formed, lipped steel channel horizontal member, not less than 41mm by 41mm (1-5/8 inches by 1-5/8 inches), 2.7 mm (No. 12 gage), designed to accept special spring held, hardened steel nuts. Not permitted for steam supply and condensate piping.
1. Allowable hanger load: Manufacturers rating less 91kg (200 pounds).
 2. Guide individual pipes on the horizontal member of every other trapeze hanger with 6 mm (1/4-inch) U-bolt fabricated from steel rod. Provide Type 40 insulation shield, secured by two 13mm (1/2-inch) galvanized steel bands, or preinsulated calcium silicate shield for insulated piping at each hanger.
- J. Pipe Hangers and Supports: use hangers sized to encircle insulation on insulated piping. Refer to Section 23 07 00, HVAC INSULATION for insulation thickness. To protect insulation, provide Type 39 saddles for roller type supports or preinsulated calcium silicate shields. Provide Type 40 insulation shield or preinsulated calcium silicate shield at all other types of supports and hangers including those for preinsulated piping.
1. General Types:
 - a. Standard clevis hanger: Type 1; provide locknut.
 - b. Riser clamps: Type 8.
 - c. Wall brackets: Types 31, 32 or 33.
 - d. Roller supports: Type 41, 43, 44 and 46.
 - e. Saddle support: Type 36, 37 or 38.
 - f. Turnbuckle: Types 13 or 15. preinsulate
 - g. U-bolt clamp: Type 24.
 - h. Copper Tube:
 - 1) Hangers, clamps and other support material in contact with tubing shall be painted with copper colored epoxy paint, plastic coated or taped with non adhesive isolation tape to prevent electrolysis.
 - 2) For vertical runs use epoxy painted or plastic coated riser clamps.
 - 3) For supporting tube to strut: Provide epoxy painted pipe straps for copper tube or plastic inserted vibration isolation clamps.
 - 4) Insulated Lines: Provide pre-insulated calcium silicate shields sized for copper tube.
 - i. Supports for plastic or glass piping: As recommended by the pipe manufacturer with black rubber tape extending one inch beyond steel support or clamp.
 2. Plumbing Piping (Other Than General Types):
 - a. Horizontal piping: Type 1, 5, 7, 9, and 10.
 - b. Chrome plated piping: Chrome plated supports.
 - c. Hangers and supports in pipe chase: Prefabricated system ABS self-extinguishing material, not subject to electrolytic action, to hold piping, prevent vibration and compensate for all static and operational conditions.
 - d. Blocking, stays and bracing: Angle iron or preformed metal channel shapes, 1.3 mm (18 gage) minimum.

- K. Pre-insulated Calcium Silicate Shields:
1. Provide 360 degree water resistant high density 965 kPa (140 psi) compressive strength calcium silicate shields encased in galvanized metal.
 2. Pre-insulated calcium silicate shields to be installed at the point of support during erection.
 3. Shield thickness shall match the pipe insulation.
 4. The type of shield is selected by the temperature of the pipe, the load it must carry, and the type of support it will be used with.
 - a. Shields for supporting chilled or cold water shall have insulation that extends a minimum of 1 inch past the sheet metal. Provide for an adequate vapor barrier in chilled lines.
 - b. The pre-insulated calcium silicate shield shall support the maximum allowable water filled span as indicated. To support the load, the shields may have one or more of the following features: structural inserts 4138 kPa (600 psi) compressive strength, an extra bottom metal shield, or formed structural steel (ASTM A36) wear plates welded to the bottom sheet metal jacket.
 5. Shields may be used on steel clevis hanger type supports, roller supports or flat surfaces.

2.8 PIPE PENETRATIONS

- A. Install sleeves during construction for other than blocked out floor openings for risers in mechanical bays.
- B. To prevent accidental liquid spills from passing to a lower level, provide the following:
1. For sleeves: Extend sleeve 25 mm (one inch) above finished floor and provide sealant for watertight joint.
 2. For blocked out floor openings: Provide 40 mm (1-1/2 inch) angle set in silicone adhesive around opening.
 3. For drilled penetrations: Provide 40 mm (1-1/2 inch) angle ring or square set in silicone adhesive around penetration.
- D. Penetrations are not allowed through beams or ribs, but may be installed in concrete beam flanges. Any deviation from this requirement must receive prior approval of Architect/Engineer.
- E. Sheet Metal, Plastic, or Moisture-resistant Fiber Sleeves: Provide for pipe passing through floors, interior walls, and partitions, unless brass or steel pipe sleeves are specifically called for below.
- F. Cast Iron or Zinc Coated Pipe Sleeves: Provide for pipe passing through exterior walls below grade. Make space between sleeve and pipe watertight with a modular or link rubber seal. Seal shall be applied at both ends of sleeve.
- G. Galvanized Steel Pipe Sleeves: Provide for pipe passing through concrete beam flanges, except where brass pipe sleeves are called for. Provide sleeve for pipe passing through floor of mechanical rooms, laundry work rooms, and animal rooms above basement. Except in mechanical rooms, connect sleeve with floor plate.
- H. Brass Pipe Sleeves: Provide for pipe passing through quarry tile, terrazzo or ceramic tile floors. Connect sleeve with floor plate.

- I. Sleeves are not required for wall hydrants for fire department connections or in drywall construction.
- J. Sleeve Clearance: Sleeve through floors, walls, partitions, and beam flanges shall be one inch greater in diameter than external diameter of pipe. Sleeve for pipe with insulation shall be large enough to accommodate the insulation. Interior openings shall be caulked tight with fire stopping material and sealant to prevent the spread of fire, smoke, and gases.
- K. Sealant and Adhesives: Shall be as specified in Section 07 92 00, JOINT SEALANTS.

2.9 TOOLS AND LUBRICANTS

- A. Furnish, and turn over to the Owner, special tools not readily available commercially, that are required for disassembly or adjustment of equipment and machinery furnished.
- B. Grease Guns with Attachments for Applicable Fittings: One for each type of grease required for each motor or other equipment.
- C. Tool Containers: Hardwood or metal, permanently identified for intended service and mounted, or located, where directed by the Architect/Engineer.
- D. Lubricants: A minimum of 0.95 L (one quart) of oil, and 0.45 kg (one pound) of grease, of equipment manufacturer's recommended grade and type, in unopened containers and properly identified as to use for each different application.

2.10 WALL, FLOOR AND CEILING PLATES

- A. Material and Type: Chrome plated brass or chrome plated steel, one piece or split type with concealed hinge, with set screw for fastening to pipe, or sleeve. Use plates that fit tight around pipes, cover openings around pipes and cover the entire pipe sleeve projection.
- B. Thickness: Not less than 2.4 mm (3/32-inch) for floor plates. For wall and ceiling plates, not less than 0.64 mm (0.025-inch) for up to 80 mm (3-inch pipe), 0.89 mm (0.035-inch) for larger pipe.
- C. Locations: Use where pipe penetrates floors, walls and ceilings in exposed locations, in finished areas only. Use also where insulation ends on exposed water supply pipe drop from overhead. Provide a watertight joint in spaces where brass or steel pipe sleeves are specified.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Coordinate location of piping, sleeves, inserts, hangers, ductwork and equipment. Locate piping, sleeves, inserts, hangers, ductwork and equipment clear of windows, doors, openings, light outlets, and other services and utilities. Follow manufacturer's published recommendations for installation methods not otherwise specified.
- B. Protection and Cleaning:
 - 1. Equipment and materials shall be carefully handled, properly stored, and adequately protected to prevent damage before and during installation, in accordance with the manufacturer's recommendations and as approved by the

- Architect/Engineer. Damaged or defective items in the opinion of the Architect/Engineer, shall be replaced.
2. Protect all finished parts of equipment, such as shafts and bearings where accessible, from rust prior to operation by means of protective grease coating and wrapping. Close pipe openings with caps or plugs during installation. Tightly cover and protect fixtures and equipment against dirt, water chemical or mechanical injury. At completion of all work thoroughly clean fixtures, exposed materials and equipment.
- C. Concrete and Grout: Use concrete and shrink compensating grout 25 MPa (3000 psi) minimum, specified in Section 03 30 00, CAST-IN-PLACE CONCRETE.
- D. Install gages, thermometers, valves and other devices with due regard for ease in reading or operating and maintaining said devices. Locate and position thermometers and gages to be easily read by operator or staff standing on floor or walkway provided. Servicing shall not require dismantling adjacent equipment or pipe work.
- E. Work in Existing Building:
1. Perform as specified in Article, OPERATIONS AND STORAGE AREAS, Article, ALTERATIONS, and Article, RESTORATION of the Section 01 00 00, GENERAL REQUIREMENTS for relocation of existing equipment, alterations and restoration of existing building(s).
 2. As specified in Section 01 00 00, GENERAL REQUIREMENTS, Article, OPERATIONS AND STORAGE AREAS, make alterations to existing service piping at times that will least interfere with normal operation of the facility.
 3. Cut required openings through existing masonry and reinforced concrete using diamond core drills. Use of pneumatic hammer type drills, impact type electric drills, and hand or manual hammer type drills, will be permitted only with approval of the Architect/Engineer and General Contractor. Locate openings that will least effect structural slabs, columns, ribs or beams. Refer to the Architect/Engineer for determination of proper design for openings through structural sections and opening layouts approval, prior to cutting or drilling into structure. After Architect/Engineer's approval, carefully cut opening through construction no larger than absolutely necessary for the required installation.
- F. Switchgear Drip Protection: Every effort shall be made to eliminate the installation of pipe above electrical and telephone switchgear. If this is not possible, encase pipe in a second pipe with a minimum of joints.
- G. Inaccessible Equipment:
1. Where the Owner determines that the Contractor has installed equipment not conveniently accessible for operation and maintenance, equipment shall be removed and reinstalled or remedial action performed as directed at no additional cost to the Owner.
 2. The term "conveniently accessible" is defined as capable of being reached without the use of ladders, or without climbing or crawling under or over obstacles such as motors, fans, pumps, belt guards, transformers, high voltage lines, piping, and ductwork.

3.2 PIPE AND EQUIPMENT SUPPORTS

- A. Where hanger spacing does not correspond with joist or rib spacing, use structural steel channels secured directly to joist and rib structure that will correspond to the required hanger spacing, and then suspend the equipment and piping from the channels. Drill or burn holes in structural steel only with the prior approval of the Architect/Engineer.

- B. Use of chain, wire or strap hangers; wood for blocking, stays and bracing; or, hangers suspended from piping above will not be permitted. Replace or thoroughly clean rusty products and paint with zinc primer.
- C. Use hanger rods that are straight and vertical. Turnbuckles for vertical adjustments may be omitted where limited space prevents use. Provide a minimum of 15 mm (1/2-inch) clearance between pipe or piping covering and adjacent work.
- D. HVAC Horizontal Pipe Support Spacing: Provide additional supports at valves, strainers, in-line pumps and other heavy components. Provide a support within one foot of each elbow.
- E. HVAC Vertical Pipe Supports:
 - 1. Up to 150 mm (6-inch pipe), 9 m (30 feet) long, bolt riser clamps to the pipe below couplings, or welded to the pipe and rests supports securely on the building structure.
 - 2. Vertical pipe larger than the foregoing, support on base elbows or tees, or substantial pipe legs extending to the building structure.
- F. Plumbing horizontal and vertical pipe supports, refer to the NAPHCC National Standard Plumbing Code or International Plumbing Code, whichever is more stringent.

3.3 MOTOR AND DRIVE ALIGNMENT

- A. Belt Drive: Set driving and driven shafts parallel and align so that the corresponding grooves are in the same plane.
- B. Direct-connect Drive: Securely mount motor in accurate alignment so that shafts are free from both angular and parallel misalignment when both motor and driven machine are operating at normal temperatures.

3.4 LUBRICATION

- A. Field check and lubricate equipment requiring lubrication prior to initial operation.

3.5 STARTUP AND TEMPORARY OPERATION

- A. Start up equipment as described in equipment specifications. Verify that vibration is within specified tolerance prior to extended operation. Temporary use of equipment is specified in Section 01 00 00, GENERAL REQUIREMENTS, Article, TEMPORARY USE OF MECHANICAL AND ELECTRICAL EQUIPMENT.

3.6 OPERATING AND PERFORMANCE TESTS

- A. Prior to the final inspection, perform required tests as specified in Section 01 00 00, GENERAL REQUIREMENTS, Article, TESTS and submit the test reports and records to the Architect/Engineer.
- B. Should evidence of malfunction in any tested system, or piece of equipment or component part thereof, occur during or as a result of tests, make proper corrections, repairs or replacements, and repeat tests at no additional cost to the Owner.
- C. When completion of certain work or system occurs at a time when final control settings and adjustments cannot be properly made to make performance tests, then make

performance tests for heating systems and for cooling systems respectively during first actual seasonal use of respective systems following completion of work.

3.7 INSTRUCTIONS TO OWNER PERSONNEL

- A. Provide in accordance with Article, INSTRUCTIONS, of Section 01 00 00, GENERAL REQUIREMENTS.

END OF SECTION

SECTION 23 05 48 - VIBRATION CONTROLS FOR HVAC PIPING & EQUIPMENT

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Noise criteria, vibration tolerance, and vibration isolation for HVAC and plumbing work.

1.2 RELATED WORK

- A. Concrete for Inertia Bases: Section 03 30 00, CAST-IN-PLACE CONCRETE.
- B. Section 23 05 00, COMMON WORK RESULTS FOR HVAC.
- C. Flexible Duct Connectors, Sound Attenuators and Sound Absorbing Duct Lining: Section 23 30 00, HVAC AIR DISTRIBUTION.
- D. Sound Tests and Vibration Tests: Section 23 05 93, TESTING, ADJUSTING AND BALANCING FOR HVAC.

1.3 QUALITY ASSURANCE

- A. Refer to article, QUALITY ASSURANCE in Section 23 05 00, COMMON WORK RESULTS FOR HVAC.
- B. Noise Criteria:
- Noise levels in all 8 octave bands due to equipment and duct systems shall not exceed NC 35 within the occupied room, except as follows:

| <u>TYPE OF ROOM</u> | <u>NC LEVEL</u> |
|--|-----------------|
| Patient Rooms | 35 |
| Examination Rooms | 35 |
| Audio Suites, Audio Speech Pathology, Phono/Cardiology | 25 |
| Chapels | 35 |
| Conference Rooms | 35 |
| Auditoriums, Theaters | 35 |
| Operating Rooms | 40 |
| Offices, small private | 35 |
| Offices, large open | 40 |
| Lobbies, Waiting Areas | 40 |
| Treatment Rooms | 35 |
| Corridors (Nurse Stations) | 40 |
| Corridors (Public) | 40 |
| Bath Rooms and Toilet Rooms | 40 |
| Laboratories | 45 |
| SPD, Dining Rooms, Food Service/Serving, Therapeutic Pools | 45 |
| Kitchens, Locker Rooms, Warehouses, Shop, Laundries Gymnasiums, Recreation Rooms | 50 |
| X-Ray & General Work Rooms | 40 |

- The manufacturer's equipment sound power ratings shall be used to check compliance with room noise criteria levels.** For equipment which has no sound power ratings, the contractor shall select equipment such that the foregoing noise criteria, local ordinance noise levels, and OSHA requirements are not exceeded. Selection procedure shall be in accordance with ASHRAE 1995

HVAC Applications Handbook, Chapter 43, SOUND AND VIBRATION CONTROL.

3. An allowance, not to exceed 5db, may be added to the measured value to compensate for the variation of the room attenuating effect between room test condition prior to occupancy and design condition after occupancy which may include the addition of sound absorbing material, such as, furniture. This allowance may not be taken after occupancy. The room attenuating effect is defined as the difference between sound power level emitted to room and sound pressure level in room.
 4. In absence of specified measurement requirements, measure equipment noise levels three feet from equipment and at an elevation of maximum noise generation. Contractor has option to provide manufacturer's sound measurement data to show conformance.
- C. Allowable Vibration Tolerances for Rotating, Non-reciprocating Equipment: Not to exceed a self-excited vibration maximum velocity of 5 mm per second (0.20-inch per second) RMS, filter in, when measured with a vibration meter on bearing caps of machine in vertical, horizontal and axial directions or measured at equipment mounting feet if bearings are concealed. Measurements for internally isolated fans and motors may be made at the mounting feet. Contractor has option to provide manufacturer's vibration measurement test data to show conformance.

1.4 SUBMITTALS

- A. Submit in accordance with Division 01.
- B. Manufacturer's Literature and Data:
 1. Vibration isolators:
 - a. Floor mountings.
 - b. Hangers.
 - c. Snubbers.
 - d. Thrust restraints.
 2. Bases.
 3. Acoustical enclosures.
 4. Equipment sound power ratings.
- C. Isolator manufacturer shall furnish with submittal load calculations for selection of isolators, including supplemental bases, based on lowest operating speed of equipment supported.

1.5 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE):
Systems Handbook 1991, Chapter 42, Sound and Vibration Control.
- C. American Society for Testing and Materials (ASTM):
A123-89 Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
A307-94 Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength
D2240-91 Standard Test Method for Rubber Property - Durometer Hardness

- D. Manufacturers Standardization (MSS):
SP-58-93 Pipe Hangers and Supports-Materials, Design and Manufacture
- E. Occupational Safety and Health Administration (OSHA):
1910 Occupational Noise Exposure

PART 2 – PRODUCTS

2.1 GENERAL

- A. Type of isolator, base, and minimum static deflection shall be as required for each specific equipment application as recommended by isolator or equipment manufacturer but subject to minimum requirements indicated in the schedule on the drawings.

2.2 VIBRATION ISOLATORS

- A. Floor Mountings:
 - 1. Double Deflection Neoprene (Type N): Shall include neoprene covered steel support plated (top and bottom), friction pads, and necessary bolt holes.
 - 2. Spring Isolators (Type S): Shall be free-standing, laterally stable and include acoustical friction pads and leveling bolts. Isolators shall have a minimum ratio of spring diameter-to-operating spring height of 1.0 and an additional travel to solid equal to 50 percent of rated deflection.
 - 3. Pads (Type D), Washers (Type W), and Bushings (Type L): Pads shall be felt, cork, neoprene waffle, neoprene and cork sandwich, neoprene and fiberglass, neoprene and steel waffle, or reinforced duck and neoprene. Washers and bushings shall be reinforced duck and neoprene. Size pads for a maximum load of 345 kPa (50 pounds per square inch).
- B. Hangers: Shall be combination neoprene and springs unless otherwise noted and shall allow for expansion of pipe.
 - 1. Combination Neoprene and Spring (Type H): Vibration hanger shall contain a spring and double deflection neoprene element in series. Spring shall have a diameter not less than 0.8 of compressed operating spring height. Spring shall have a minimum additional travel of 50 percent between design height and solid height. Spring shall permit a 15 degree angular misalignment without rubbing on hanger box.
 - 2. Spring Position Hanger (Type HP): Similar to combination neoprene and spring hanger except hanger shall hold piping at a fixed elevation during installation and include a secondary adjustment feature to transfer load to spring while maintaining same position.
 - 3. Neoprene (Type HN): Vibration hanger shall contain a double deflection type neoprene isolation element. Hanger rod shall be separated from contact with hanger bracket by a neoprene grommet.
 - 4. Spring (Type HS): Vibration hanger shall contain a coiled steel spring in series with a neoprene grommet. Spring shall have a diameter not less than 0.8 of compressed operating spring height. Spring shall have a minimum additional travel of 50 percent between design height and solid height. Spring shall permit a 15 degree angular misalignment without rubbing on hanger box.

5. Hanger supports for piping 50 mm (2-inches) and larger shall have a pointer and scale deflection indicator.
- C. Thrust Restraints (Type THR): Restraints shall provide a spring element contained in a steel frame with neoprene pads at each end attachment. Restraints shall have factory preset thrust and be field adjustable to allow a maximum movement of 6 mm (1/4-inch) when the fan starts and stops. Restraint assemblies shall include rods, angle brackets and other hardware for field installation.

2.3 BASES (OTHER THAN MANUFACTURER'S SUPPLIED EQUIPMENT BASES)

- A. Rails (Type R): Design rails with isolator brackets to reduce mounting height of equipment and cradle machines having legs or bases that do not require a complete supplementary base. To assure adequate stiffness, height of members shall be a minimum of 1/12 of longest base dimension but not less than 100 mm (four-inches). Where rails are used with neoprene mounts for small fans or close coupled pumps, extend rails to compensate overhang of housing.
- B. Integral Structural Steel Base (Type B): Design base with isolator brackets to reduce mounting height of equipment which require a complete supplementary rigid base. To assure adequate stiffness, height of members shall be a minimum of 1/12 of longest base dimension, but not less than 100 mm (four-inches).
- C. Inertia Base (Type I): Base shall be a reinforced concrete inertia base. Pour concrete into a welded steel channel frame, incorporating prelocated equipment anchor bolts and pipe sleeves. Level concrete to provide a smooth uniform bearing surface for equipment mounting. Provide grout under uneven supports. Channel depth shall be a minimum of 1/12 of longest dimension of base but not less than 150 mm (six inches). Form shall include 13 mm (1/2-inch) reinforcing bars welded in place on minimum of 203 mm (eight inch) centers running both ways in a layer 40 mm (1-1/2 inches) above bottom. Use height saving brackets in all mounting locations. Weight of inertia base shall be equal to or greater than weight of equipment supported to provide a maximum peak-to-peak displacement of 2 mm (1/16-inch).
- D. Curb Mounted Isolation Base (Type CB): Fabricate from aluminum to fit on top of standard curb with overlap to allow water run-off and have wind and water seals which shall not interfere with spring action. Provide resilient snubbers with 6 mm (1/4-inch) clearance for wind resistance. Top and bottom bearing surfaces shall have sponge type weather seals. Integral spring isolators shall comply with Spring Isolator (Type S) requirements.

2.4 GENERAL ISOLATOR REQUIREMENTS:

- A. Elastomeric isolators shall comply with ASTM D2240 and be oil resistant neoprene with a maximum stiffness of 60 durometer and have a straight-line deflection curve.
- B. Exposure to Weather: Isolators, including springs, exposed to weather shall be hot-dip galvanized after fabrication. Hot-dip zinc coating shall be not less than 609 grams per square meter (two ounces per square foot) by weight complying with ASTM A123. In addition, provide limit stops to resist wind velocity. Comply with the design wind velocity for hurricane areas as per local building codes.
- C. Uniform Loading: Select and locate isolators to produce uniform loading and deflection even when equipment weight is not evenly distributed.
- D. Color code isolator by type and size for easy identification of capacity.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Vibration Isolation:

1. No metal-to-metal contact will be permitted between fixed and rotating parts.
2. Connections to Equipment: Allow for deflections equal to or greater than equipment deflections. Electrical, drain, piping connections, and other items made to rotating or reciprocating equipment (pumps, compressors, etc.) which rests on vibration isolators, shall be isolated from building structure for first three hangers or supports.
3. Common Foundation: Mount each electric motor on same foundation as driven machine. Hold driving motor and driven machine in positive rigid alignment with provision for adjusting motor alignment and belt tension. Bases shall be level throughout length and width. Provide shims to facilitate pipe connections, leveling, and bolting.
4. Provide heat shields where elastomers are subject to temperatures over 38 degrees C (100 degrees F).
5. Extend bases for pipe elbow supports at discharge and suction connections at pumps. Pipe elbow supports shall not short circuit pump vibration to structure.
6. Non-rotating equipment such as heat exchangers and converters shall be mounted on isolation units having the same static deflection as the isolation hangers or support of the pipe connected to the equipment.

- #### B. Inspection and Adjustments:
- Check for vibration and noise transmission through connections, piping, ductwork, foundations, and walls. Adjust, repair, or replace isolators as required to reduce vibration and noise transmissions to specified levels.

END OF SECTION

SELECTION GUIDE FOR VIBRATION ISOLATORS *1

EQUIPMENT LOCATION *2

| EQUIPMENT | ON GRADE | | | 6M (20FT) FLOOR SPAN | | | 9M (30FT) FLOOR SPAN | | | 12M (40FT) FLOOR SPAN | | | 15M (50FT) FLOOR SPAN | | |
|-----------|----------|------|-----|----------------------|------|-----|----------------------|------|-----|-----------------------|------|-----|-----------------------|------|-----|
| | BASE | ISOL | MIN | BASE | ISOL | MIN | BASE | ISOL | MIN | BASE | ISOL | MIN | BASE | ISOL | MIN |

COMPRESSORS AND VACUUM PUMPS

| | | | | | | | | | | | | | | | |
|-------------------------|---|-------|---|---|-------|---|---|-------|---|---|-------|---|---|-------|---|
| UP THRU 1 kW (1-1/2 HP) | - | D,L,W | - | - | D,L,W | - | - | D,L,W | - | - | D,L,W | - | - | D,L,W | - |
|-------------------------|---|-------|---|---|-------|---|---|-------|---|---|-------|---|---|-------|---|

1.5 kW (2 HP) AND OVER:

| | | | | | | | | | | | | | | | |
|-------------------------------|---|---|---|---|---|----|---|---|----|---|---|----|---|---|----|
| 8-13 REV/S (500 - 750 RPM) | - | D | - | - | S | 43 | - | S | 64 | - | S | 64 | - | S | 64 |
| 13.1 REV/S (751 RPM) AND OVER | - | D | - | - | S | 25 | - | S | 43 | - | S | 64 | - | S | 64 |

PUMPS *3 *4

CLOSE COUPLED:

| | | | | | | | | | | | | | | | |
|-------------------------|---|---|---|---|-------|----|---|-------|----|---|-------|----|---|-------|----|
| UP THRU 1 kW (1-1/2 HP) | - | - | - | - | D,L,W | - | - | D,L,W | - | - | D,L,W | - | - | D,L,W | - |
| 1.5 kW (2 HP) AND OVER | - | - | - | I | S | 25 | I | S | 25 | I | S | 43 | I | S | 43 |

BASE MOUNTED:

| | | | | | | | | | | | | | | | |
|------------------------|---|---|---|---|-------|---|---|-------|---|---|-------|---|---|-------|---|
| UP THRU 7.5 kW (10 HP) | - | - | - | - | D,L,W | - | - | D,L,W | - | - | D,L,W | - | - | D,L,W | - |
|------------------------|---|---|---|---|-------|---|---|-------|---|---|-------|---|---|-------|---|

| SELECTION GUIDE FOR VIBRATION ISOLATORS *1 | | | | | | | | | | | | | | | |
|--|----------|------|-----|----------------------|------|-----|----------------------|------|-----|-----------------------|------|-----|-----------------------|------|-----|
| EQUIPMENT LOCATION *2 | | | | | | | | | | | | | | | |
| EQUIPMENT | ON GRADE | | | 6M (20FT) FLOOR SPAN | | | 9M (30FT) FLOOR SPAN | | | 12M (40FT) FLOOR SPAN | | | 15M (50FT) FLOOR SPAN | | |
| | BASE | ISOL | MIN | BASE | ISOL | MIN | BASE | ISOL | MIN | BASE | ISOL | MIN | BASE | ISOL | MIN |
| 11 kW thru 30 kW (15 HP THRU 40 HP) | I | S | 25 | I | S | 25 | I | S | 43 | I | S | 43 | I | S | 43 |
| 37 kW (50HP) AND OVER | I | S | 25 | I | S | 25 | I | S | 43 | I | S | 64 | I | S | 64 |

*NOTES:

1. SEE SPECIFICATIONS FOR ISOLATOR SYMBOL DESIGNATION.
2. FOR SUSPENDED FLOORS LIGHTER THAN 4-INCH CONCRETE, SELECT DEFLECTION REQUIREMENT FROM NEXT HIGHER SPAN.
3. FOR SEPARATE CHILLER BUILDING ON GRADE, PUMP ISOLATORS MAY BE OMITTED.
4. DIRECT BOLT FIRE PUMPS TO CONCRETE BASE. PROVIDE PADS (D) FOR DOMESTIC WATER BOOSTER PUMP PACKAGE.

SELECTION GUIDE FOR VIBRATION ISOLATORS *1

EQUIPMENT LOCATION *2

| EQUIPMENT | ON GRADE | | | 6M (20FT) FLOOR SPAN | | | 9M (30FT) FLOOR SPAN | | | 12M (40FT) FLOOR SPAN | | | 15M (50FT) FLOOR SPAN | | |
|-----------|----------|------|-----|----------------------|------|-----|----------------------|------|-----|-----------------------|------|-----|-----------------------|------|-----|
| | BASE | ISOL | MIN | BASE | ISOL | MIN | BASE | ISOL | MIN | BASE | ISOL | MIN | BASE | ISOL | MIN |

AIR HANDLING UNITS, PACKAGED

SUSPENDED:

| | | | | | | | | | | | | | | | |
|---------------------|--|--|--|---|---|----|---|---|----|---|---|----|---|---|----|
| UP THRU 4 kW (5 HP) | | | | - | H | 25 | - | H | 25 | - | H | 25 | - | H | 25 |
|---------------------|--|--|--|---|---|----|---|---|----|---|---|----|---|---|----|

6 kW (7-1/2 HP) AND OVER:

| | | | | | | | | | | | | | | | |
|-------------------------|--|--|--|---|------|----|---|------|----|---|------|----|---|------|----|
| UP TO 8 REV/S (500 RPM) | | | | - | H,TH | 43 | - | H,TH | 43 | - | H,TH | 43 | - | H,TH | 43 |
|-------------------------|--|--|--|---|------|----|---|------|----|---|------|----|---|------|----|

| | | | | | | | | | | | | | | | |
|------------------------------|--|--|--|---|------|----|---|------|----|---|------|----|---|------|----|
| 8.1 REV/S (501 RPM) AND OVER | | | | - | H,TH | 25 | - | H,TH | 25 | - | H,TH | 43 | - | H,TH | 43 |
|------------------------------|--|--|--|---|------|----|---|------|----|---|------|----|---|------|----|

FLOOR MOUNTED:

| | | | | | | | | | | | | | | | |
|--------------------|---|---|---|---|---|----|---|---|----|---|---|----|---|---|----|
| UP THRU 4kW (5 HP) | - | D | - | - | S | 25 | - | S | 25 | - | S | 25 | - | S | 25 |
|--------------------|---|---|---|---|---|----|---|---|----|---|---|----|---|---|----|

6 kW (7-1/2 HP) AND OVER:

SELECTION GUIDE FOR VIBRATION ISOLATORS *1

EQUIPMENT LOCATION *2

| EQUIPMENT | ON GRADE | | | 6M (20FT) FLOOR SPAN | | | 9M (30FT) FLOOR SPAN | | | 12M (40FT) FLOOR SPAN | | | 15M (50FT) FLOOR SPAN | | |
|------------------------------------|----------|------|-----|----------------------|-------|-----|----------------------|-------|-----|-----------------------|-------|-----|-----------------------|-------|-----|
| | BASE | ISOL | MIN | BASE | ISOL | MIN | BASE | ISOL | MIN | BASE | ISOL | MIN | BASE | ISOL | MIN |
| UP TO 8 REV/S (500 RPM) | - | D | - | R | S,THR | 43 | R | S,THR | 43 | R | S,THR | 43 | R | S,THR | 43 |
| 8.1 REV/S (501 RPM) AND OVER | - | D | - | - | S,THR | 25 | - | S,THR | 25 | R | S,THR | 43 | R | S,THR | 43 |

IN-LINE CENTRIFUGAL & VANE AXIAL FANS

FLOOR MOUNTED (APR.9)

UP THRU 37 kW (50 HP):

| | | | | | | | | | | | | | | | |
|-------------------------------|---|---|---|---|---|----|---|---|----|---|---|----|---|---|----|
| UP TO 5 REV/S (300 RPM) | - | D | - | R | S | 64 | R | S | 64 | R | S | 64 | R | S | 89 |
| 5.1-8 REV/S (301- 500 RPM) | - | D | - | R | S | 43 | R | S | 43 | R | S | 64 | R | S | 64 |

SELECTION GUIDE FOR VIBRATION ISOLATORS *1

EQUIPMENT LOCATION *2

| EQUIPMENT | ON GRADE | | | 6M (20FT) FLOOR SPAN | | | 9M (30FT) FLOOR SPAN | | | 12M (40FT) FLOOR SPAN | | | 15M (50FT) FLOOR SPAN | | |
|------------------------------|----------|------|-----|----------------------|------|-----|----------------------|------|-----|-----------------------|------|-----|-----------------------|------|-----|
| | BASE | ISOL | MIN | BASE | ISOL | MIN | BASE | ISOL | MIN | BASE | ISOL | MIN | BASE | ISOL | MIN |
| 8.1 REV/S (501 RPM) AND OVER | - | D | - | - | S | 25 | - | S | 25 | R | S | 43 | R | S | 64 |
| 45 kW (60 HP) AND OVER: | | | | | | | | | | | | | | | |
| 5.1-8 REV/S (301-500 RPM) | R | S | 25 | R | S | 43 | R | S | 25 | R | S | 64 | R | S | 89 |
| 8.1 REV/S (501 RPM) AND OVER | R | S | 25 | R | S | 43 | R | S | 25 | R | S | 43 | R | S | 64 |

FLOOR MOUNTED (APR.1): USE "B" TYPE IN LIEU OF "R" TYPE BASE
 SUSPENDED: USE "H" ISOLATORS OF SAME DEFLECTION AS FLOOR MOUNTED

SELECTION GUIDE FOR VIBRATION ISOLATORS *1

EQUIPMENT LOCATION *2

| EQUIPMENT | ON GRADE | | | 6M (20FT) FLOOR SPAN | | | 9M (30FT) FLOOR SPAN | | | 12M (40FT) FLOOR SPAN | | | 15M (50FT) FLOOR SPAN | | |
|-----------|----------|------|-----|----------------------|------|-----|----------------------|------|-----|-----------------------|------|-----|-----------------------|------|-----|
| | BASE | ISOL | MIN | BASE | ISOL | MIN | BASE | ISOL | MIN | BASE | ISOL | MIN | BASE | ISOL | MIN |

ROOF VENTILATORS

ABOVE OCCUPIED AREAS:

| | | | | | | | | | | | | | | | |
|----------------------|---|---|---|----|---|----|----|---|----|----|---|----|----|---|----|
| 4 kW (5 HP) AND OVER | - | - | - | CB | S | 25 | CB | S | 25 | CB | S | 25 | CB | S | 25 |
|----------------------|---|---|---|----|---|----|----|---|----|----|---|----|----|---|----|

CENTRIFUGAL BLOWERS

UP TO 37 kW (50 HP):

| | | | | | | | | | | | | | | | |
|-----------------------------|---|---|---------|---|---|----|---|---|----|---|---|----|---|---|----|
| UP TO 3 REV/S (200 RPM) | B | N | 8 (0.3) | B | S | 64 | B | S | 64 | B | S | 89 | B | S | 89 |
| 3.1-5 REV/S (201 - 300 RPM) | B | N | 8 (0.3) | B | S | 43 | B | S | 64 | B | S | 64 | B | S | 89 |
| 5.1-8 REV/S (301 - 500 RPM) | B | N | 8 (0.3) | B | S | 43 | B | S | 43 | B | S | 64 | B | S | 89 |

SELECTION GUIDE FOR VIBRATION ISOLATORS *1

EQUIPMENT LOCATION *2

| EQUIPMENT | ON GRADE | | | 6M (20FT) FLOOR SPAN | | | 9M (30FT) FLOOR SPAN | | | 12M (40FT) FLOOR SPAN | | | 15M (50FT) FLOOR SPAN | | |
|------------------------------|----------|------|---------|----------------------|------|-----|----------------------|------|-----|-----------------------|------|-----|-----------------------|------|-----|
| | BASE | ISOL | MIN | BASE | ISOL | MIN | BASE | ISOL | MIN | BASE | ISOL | MIN | BASE | ISOL | MIN |
| 8.1 REV/S(501 RPM) AND OVER | B | N | 8 (0.3) | B | S | 25 | B | S | 25 | B | S | 43 | B | S | 64 |
| 45 kW (60 HP) AND OVER: | | | | | | | | | | | | | | | |
| UP TO 5 REV/S (300 RPM) | B | S | 43 | I | S | 64 | I | S | 89 | I | S | 89 | I | S | 89 |
| 5.1-8 REV/S (301 - 500 RPM) | B | S | 43 | I | S | 43 | I | S | 64 | I | S | 89 | I | S | 89 |
| 8.1 REV/S (501 RPM) AND OVER | B | S | 25 | I | S | 43 | I | S | 43 | I | S | 64 | I | S | 64 |

SELECTION GUIDE FOR VIBRATION ISOLATORS *1

EQUIPMENT LOCATION *2

| EQUIPMENT | ON GRADE | | | 6M (20FT) FLOOR SPAN | | | 9M (30FT) FLOOR SPAN | | | 12M (40FT) FLOOR SPAN | | | 15M (50FT) FLOOR SPAN | | |
|-----------|----------|------|-----|----------------------|------|-----|----------------------|------|-----|-----------------------|------|-----|-----------------------|------|-----|
| | BASE | ISOL | MIN | BASE | ISOL | MIN | BASE | ISOL | MIN | BASE | ISOL | MIN | BASE | ISOL | MIN |

COOLING TOWERS

| | | | | | | | | | | | | | | | |
|------------------------------|---|---|---|---|----|----|---|----|----|---|----|----|---|----|----|
| UP TO 8 REV/S (500 RPM) | - | - | - | - | SP | 25 | - | SP | 43 | - | SP | 64 | - | SP | 89 |
| 8.1 REV/S (501 RPM) AND OVER | - | - | - | - | SP | 25 | - | SP | 25 | - | SP | 43 | - | SP | 64 |

ISOLATORS NOT REQUIRED WHERE COOLING TOWER IS LOCATED ON GRADE OR ON ROOF OVER MECHANICAL ROOM

INTERNAL COMBUSTION ENGINES

| | | | | | | | | | | | | | | | |
|--------------------------------|---|---|---------|---|---|---------|---|---|----|---|---|----|---|---|----|
| UP TO 19 kW (25 HP) | I | N | 8 (0.3) | I | N | 8 (0.3) | I | S | 43 | I | S | 64 | I | S | 64 |
| 22 THRU 75 kW (30 THRU 100 HP) | I | N | 8 (0.3) | I | N | 43 | I | S | 64 | I | S | 89 | I | S | 89 |

SELECTION GUIDE FOR VIBRATION ISOLATORS *1

EQUIPMENT LOCATION *2

| EQUIPMENT | ON GRADE | | | 6M (20FT) FLOOR SPAN | | | 9M (30FT) FLOOR SPAN | | | 12M (40FT) FLOOR SPAN | | | 15M (50FT) FLOOR SPAN | | |
|----------------------------|----------|------|---------|----------------------|------|-----|----------------------|------|-----|-----------------------|------|-----|-----------------------|------|-----|
| | BASE | ISOL | MIN | BASE | ISOL | MIN | BASE | ISOL | MIN | BASE | ISOL | MIN | BASE | ISOL | MIN |
| 93 kW (125 HP) AND OVER | I | N | 8 (0.3) | I | N | 64 | I | S | 89 | I | S | 114 | I | S | 114 |

SECTION 23 05 93 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Testing, adjusting, and balancing (TAB) of heating, ventilating and air conditioning (HVAC) systems. TAB includes the following:
 - 1. Planning systematic TAB procedures.
 - 2. Inspecting equipment and installations for conformance with design.
 - 3. Balancing air distribution systems and water distribution systems; adjustment of total system to provide design performance; and testing performance of equipment and automatic controls.
 - 4. Vibration and sound measurements.
 - 5. Recording and reporting results.

- B. Definitions:
 - 1. Basic TAB used in this Section: Chapter 34, "Testing, Adjusting and Balancing" of ASHRAE Handbook, "HVAC Applications".
 - 2. TAB: Testing, Adjusting and Balancing. The process of checking and adjusting HVAC systems to meet design objectives.
 - 3. AABC: Associated Air Balance Council.
 - 4. NEBB: National Environmental Balancing Bureau.
 - 5. Air Systems: Includes all outside air, supply air, return air, exhaust air and relief air systems.
 - 6. Flow rate tolerance: The allowable percentage variation, minus to plus, of actual flow rate from values (design) in the contract documents.

1.2 RELATED WORK

- A. Section 23 05 00 – Common Work Results for HVAC
- B. Section 23 05 48 – Vibration Controls for HVAC
- C. Section 23 07 00 - HVAC Insulation
- D. Section 23 60 00 – Central Cooling Equipment
- E. Section 23 34 00 - HVAC Fans
- F. Section 23 30 00 - HVAC Air Distribution
- G. Section 23 09 00 – Instrumentation and Control for HVAC

1.3 QUALITY ASSURANCE

- A. Refer to Articles, Quality Assurance and Submittals, in Section 23 05 00, COMMON WORK RESULTS FOR HVAC.
- B. TAB Agency Qualification: Current membership in AABC or certification by NEBB.
- C. Test Equipment Criteria: The basic instrumentation requirements and accuracy/calibration required by AABC, National Standards or by NEBB Procedural Standards for Testing, Adjusting and Balancing of Environmental Systems.

- D. Tab Criteria:
1. One or more of the applicable AABC, NEBB or SMACNA publications, supplemented by ASHRAE Handbook "HVAC Applications" Chapter 34, shall be the basis for planning, procedures, and reports.
 2. Flow rate tolerance: Values are based on discussion in ASHRAE Handbook "HVAC Applications", Chapter 34. Air Filter resistance during tests, artificially imposed if necessary, shall be at least 80 percent of final values for filters.
 - a. Air handling unit cubic meters/min (cubic feet per minute): Minus 0 percent to plus 10 percent.
 - b. All other fans: Minus 0 percent to plus 10 percent.
 - c. Air terminal units (Max): Minus 5 percent to plus 10 percent.
 - d. Exhaust hoods/cabinets: Minus 0 percent to plus 10 percent.
 - e. Minimum outside air: Minus 0 percent to plus 10 percent.
 - f. Individual room air outlets and inlets, and air flow rates not mentioned above: Minus 10 percent to plus 10 percent.
 3. Systems shall be adjusted for energy efficient operation as described in PART 3.
 4. Typical TAB procedures and results shall be demonstrated to the Architect/Engineer for one air distribution system (including all fans, three terminal units, three rooms) as follows:
 - a. When field TAB work begins.
 - b. During each partial final inspection and the final inspection for the project if requested by Architect/Engineer or Owner.

1.4 SUBMITTALS

- A. Submit in accordance with Division 01.
- B. TAB Agency qualifications: Submit names and qualifications of company officers and job supervisor. Submit information on three recently completed projects. Submit list of proposed test equipment.
- C. For use by the Architect/Engineer staff, submit one referenced list of applicable AABC or NEBB publications that will be the basis of TAB work.
- D. TAB Reports to be Submitted for Review:
1. Inspection reports covering equipment and systems installation. These reports are to be submitted during early stages of the project in order to allow timely correction of deficiencies.
 2. TAB reports covering flow balance and adjustments, performance tests, vibration tests, and sound tests. These reports shall be submitted prior to or at the time of requesting final inspection, or partial final inspections of contract work.
 3. Include in final reports uncorrected installation deficiencies noted during TAB and applicable explanatory comments on test results that differ from design requirements.

1.5 APPLICABLE PUBLICATIONS

- A. The following publications form a part of this specification to the extent indicated by the reference thereto. In text the publications are referenced to by the initials of the organization.
- B. American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc. (ASHRAE):

- ASHRAE Handbook, 1995 HVAC Applications, Chapter 34, Testing, Adjusting, and Balancing; Chapter 43, Sound and Vibration Control.

- C. Associated Air Balance Council (AABC):
 - AABC National Standards MN-I, 5th Edition, 1989.
- D. National Environmental Balancing Bureau (NEBB):
 - Procedural Standards for Testing, Adjusting, Balancing of Environmental Systems, 5th Edition, September 1991.
 - Procedural Standards for the Measurement and Assessment of Sound and Vibration, 1994 Edition.
- E. Sheet Metal and Air Conditioning Contractors National Association (SMACNA):
 - HVAC SYSTEMS-Testing, Adjusting and Balancing, 2nd Edition, 1993.

PART 2 - PRODUCTS

2.1 PLUGS

- A. Provide plastic or rubber plugs to seal holes drilled in ductwork for test purposes.

2.2 INSULATION REPAIR MATERIAL

- A. Section, INSULATION. Provide for repair of insulation removed or damaged for TAB work.

PART 3 - EXECUTION

3.1 GENERAL

- A. Refer to TAB Criteria in Article, Quality Assurance.
- B. Obtain applicable contract documents and copies of approved submittals for HVAC equipment and automatic control systems.
- C. Coordinate TAB procedures with any phased construction completion requirements for the project. Systems serving completed phases of the project will require TAB for such phases prior to partial final inspections and for final phase inspection.
- D. Allow sufficient time in construction schedule for TAB and submission of reports prior to partial final inspections and for final phase.

3.2 INSPECTING EQUIPMENT AND INSTALLATIONS FOR CONFORMANCE WITH DESIGN

- A. GENERAL: The inspection and report is to be done after air distribution equipment is on site and duct installation has begun, but well in advance of performance testing and balancing work. The purpose of the inspection is to identify and report deviations from design and ensure that systems will be ready for TAB at the appropriate time.
- B. Reports: Follow check list format developed by AABC, NEBB or SMACNA, supplemented by narrative comments, with emphasis on air handling units and fans. Check for conformance with submittals. Verify that diffuser and register sizes are correct. If specified, check air terminal unit installation including flexible duct sizes and routing.

3.3 TAB PROCEDURES

- A. General: During TAB all related system components shall be in full operation. Fan rotation, motor loads and equipment vibration shall be checked and corrected as necessary before proceeding with TAB. Set controls and/or block off parts of distribution systems to simulate design operation of variable volume air for test and balance work.
- B. Air Balance and Equipment Test: Include rooftop air handling units, fans, terminal units, room diffusers/outlets/inlets, and ceiling exhaust fans.
 - 1. Artificially load air filters by partial blanking to produce air pressure drop of at least 80 percent of the design final pressure drop.
 - 2. Adjust fan speeds to provide design air flow. V-belt drives, including fixed pitch pulley requirements, are specified in Section 23 05 00, COMMON WORK RESULTS FOR HVAC. This requirement will be waived for variable frequency controlled drives.
 - 3. Test and balance systems in all specified modes of operation, including variable volume, economizer, and fire emergency modes. Verify that dampers and other controls function properly.
 - 4. Variable air volume (VAV) and Variable Volume-Variable Temperature (VVT) systems as specified:
 - a. Coordinate TAB, including system volumetric controls, with Section 23 09 00, INSTRUMENTATION AND CONTROLS FOR HVAC.
 - b. Record final measurements for air handling equipment performance data sheets.
 - c. Water Balance and Equipment Test: Include circulating pumps, convertors, coils, cooling tower, heat exchangers and condensers:
 - 1) Coordinate water cooling tower balancing with heat exchangers.
 - 2) Adjust flow rates for equipment. Set coils and evaporator to values on equipment submittals, if different from values on contract drawings.
 - 3) Record final measurements for hydronic equipment on performance data sheets. Include entering and leaving water temperatures for heating and cooling coils, and for convertors. Include entering and leaving air temperatures (DB/WB for cooling coils and cooling tower) for air handling units. Make air and water temperature measurements at the same time.

3.4 VIBRATION TESTING

- A. Furnish instruments and perform vibration measurements as specified in Section 23 05 48, VIBRATION CONTROLS FOR HVAC PIPING & EQUIPMENT. Field vibration balancing is specified in Section 23 05 00, COMMON WORK RESULTS FOR HVAC. Provide measurements for all rotating HVAC equipment 373 watts (1/2 horsepower) and larger, including fans and motors.
- B. Record initial and final measurements for each unit of equipment on test forms. Where vibration readings exceed the allowable tolerance and efforts to make corrections have proved unsuccessful, forward a separate report to the Architect/Engineer.

3.5 SOUND TESTING

- A. Perform and record required sound measurements in accordance with Paragraph, QUALITY ASSURANCE in Section 23 05 48, VIBRATION CONTROLS FOR HVAC PIPING & EQUIPMENT.

1. Take readings in rooms, approximately ten percent of total rooms, and provide results to the Architect/Engineer.
 - B. Take measurements with a calibrated sound level meter and octave band analyzer of the accuracy required by AABC or NEBB.
 - C. Sound reference levels, formulae and coefficients shall be according to ASHRAE Handbook, "HVAC Applications", Chapter 43, SOUND AND VIBRATION CONTROL.
 - D. **If specified on the drawings**, determine compliance with specifications as follows:
 1. Where sound pressure levels are specified, including the NC Criteria in Section 23 05 48, VIBRATION CONTROLS FOR HVAC PIPING & EQUIPMENT:
 - a. Reduce the background noise as much as possible by shutting off unrelated audible equipment.
 - b. Measure octave band sound pressure levels with specified equipment "off."
 - c. Measure octave band pressure levels with specified equipment "on."
 - d. Use the DIFFERENCE in corresponding readings to determine the sound pressure due to equipment.

| | | | | | | | |
|-------------|----|---|---|---|---|-------|------------|
| DIFFERENCE: | 0 | 1 | 2 | 3 | 4 | 5 - 9 | 10 or More |
| FACTOR: | 10 | 7 | 4 | 3 | 2 | 1 | 0 |

Sound pressure level due to equipment equals sound pressure level with equipment "on" minus FACTOR.
 - e. Plot octave bands of sound pressure level due to equipment for typical rooms on a graph which also shows noise criteria (NC) curves.
 2. When sound power levels are specified:
 - a. Perform steps 1.a. thru 1.d., as above.
 - b. For indoor equipment: Determine room attenuating effect, i.e., difference between sound power level and sound pressure level. Determined sound power level will be the sum of sound pressure level due to equipment plus the room attenuating effect.
 - c. For outdoor equipment: Use directivity factor and distance from noise source to determine distance factor, i.e., difference between sound power level and sound pressure level. Measured sound power level will be the sum of sound pressure level due to equipment plus the distance factor.
 3. Where sound pressure levels are specified in terms of dB(A), as in Section, COOLING TOWER, measure sound levels using the "A" scale of meter. Single value readings will be used instead of octave band analysis.
 - E. Where measure sound levels exceed specified level, the installing contractor or equipment manufacturer shall take remedial action approved by the Architect/Engineer and the necessary sound tests shall be repeated.
- 3.6 DUCT AIR LEAKAGE TESTING:
- A. Refer Article, Quality Assurance, in Section 23 30 00, HVAC AIR DISTRIBUTION for TAB agency's role and responsibilities.

END OF SECTION

SECTION 23 07 00 - HVAC INSULATION

PART 1 – GENERAL

1.1 DESCRIPTION

- A. Field applied insulation for thermal efficiency and condensation control for HVAC and plumbing piping, ductwork and equipment.
- B. Definitions
 - 1. ASJ: All service jacket, white finish facing or jacket.
 - 2. Air conditioned space: Space directly supplied with heated or cooled air.
 - 3. Cold: Equipment, ductwork or piping handling media at design temperature of 16 °C (60 °F) or below.
 - 4. Concealed: Ductwork and piping above ceilings and in chases, interstitial space, and pipe spaces.
 - 5. Exposed: Piping, ductwork, and equipment exposed to view in finished areas including mechanical and electrical equipment rooms or exposed to outdoor weather. Attics and crawl spaces where air handling units are located are considered to be mechanical rooms. Shafts, chases, interstitial spaces, unfinished attics, crawl spaces and pipe basements are not considered finished areas.
 - 6. FSK: Foil-scrim-kraft facing.
 - 7. Hot: Ductwork handling air at design temperature above 16 °C (60 °F); equipment or piping handling media above 41 °C (105 °F).
 - 8. Kcm : Density, kilograms per cubic meter (Pcf: Density, pounds per cubic foot).
 - 9. Runout: Branch pipe connection up to 25 mm (one inch) nominal size to a floor mounted fan coil unit.
 - 10. Thermal conductance: Heat flow rate through materials.
 - a. Flat surface: Watt per square meter (BTU per hour per square foot).
 - b. Pipe or cylinder: Watt per square meter (BTU per hour per linear foot).
 - 11. Thermal conductivity (k): Watt per meter, per °C (BTU per inch thickness, per hour, per square foot, per °Fahrenheit temperature difference).
 - 12. CWS: Condenser Water Supply.
 - 13. CWR: Condenser Water Return.
 - 14. CTWS: Cooling Tower Water Supply.
 - 15. CTWR Cooling Tower Water Return.
 - 16. CW: Cold Water Potable
 - 17. HW: Hot Water Potable.
 - 18. PC: Pumped condensate.
 - 19. HWH: Hot water heating supply.
 - 20. HHW: High Temperature Hot Water.

1.2 RELATED WORK

- A. Section 23 05 00 – Common Work Results for HVAC
- B. Section 22 30 00 – Plumbing Equipment
- D. Section 23 30 00 - HVAC Air Distribution: Duct Liner and Factory Insulated Flexible Duct

1.3 QUALITY ASSURANCE

- A. Refer to article QUALITY ASSURANCE, in Section 23 05 00, COMMON WORK RESULTS FOR HVAC.

B. Criteria:

1. Comply with NFPA 90A, particularly paragraphs 2-3.3.1 through 2-3.3.6; 2-3.10.1(a); and 3-4.6.4, parts of which are quoted as follows:
 - a. "2-3.3.1 Supplementary materials such as duct coverings, duct linings, vapor barrier facings, adhesives, fasteners, tapes, and core materials added to air ducts, plenums, panels, and duct silencers used in duct systems shall have a flame spread rating not over 25 without evidence of continued progressive combustion and a smoke developed rating no higher than 50. If air duct coverings and linings are to be applied with adhesives, they shall be tested as applied with such adhesives, or the adhesives used shall have a flame spread rating not over 25 and a smoke developed rating no higher than 50 when in the final dry state.....".
 - b. "2-3.3.2 Air duct, panel, and plenum coverings and linings shall not flame, glow, smolder, or smoke when tested in accordance with similar test for pipe covering, ASTM C411, Standard Test Method for Heat-Surface Performance of High Temperature Thermal Insulation, at the temperature to which they are exposed in service. In no case shall the test temperature be below 250 °F (121 °C)".
 - c. "2-3.3.3 Air duct coverings shall not extend through walls or floors required to be fire stopped or required to have a fire resistance rating unless such coverings meet the requirements of 3-4.6.4".
 - d. "2-3.3.4 Air duct linings shall be interrupted at fire dampers so as not to interfere with the operation of devices".
 - e. "2-3.3.5 Air duct coverings shall not be installed so as to conceal or prevent use of any service opening".
 - f. 2-3.3.6 Pipe insulation and coverings shall meet the requirements of 2-3.3.1 and 2-3.3.2 where installed in ducts, plenums, or concealed spaces used as part of the air distribution system".
 - g. "2-3.10.1(a) All materials exposed to the airflow shall be noncombustible or limited combustible and have a smoke developed index no higher than 50...".
 - h. "3-4.6.4 Patching, Filling, and Repairing. Where air ducts pass through walls, floors, or partitions required to have a fire resistance rating and where fire dampers are not required, the opening in the construction around the air duct shall not exceed 25 mm (one inch) average clearance on all sides and shall be filled solid with an approved material capable of preventing the passage of flame and hot gases sufficient to ignite cotton waste when subjected to the same NFPA 251 time-temperature fire condition required for fire barrier penetration....".
2. Test methods: ASTM E84, UL 723, or NFPA 255.
3. Specified k factors are at 24 °C (75 °F) mean temperature unless stated otherwise. Where optional thermal insulation material is used, select thickness to provide thermal conductance no greater than that for the specified material. For pipe, use insulation manufacturer's published heat flow tables. For domestic hot water supply and return, run out insulation and condensation control insulation, no thickness adjustment need be made.
4. All materials shall be compatible and suitable for service temperature, and shall not contribute to corrosion or otherwise attack surface to which applied in either the wet or dry state.
5. Underwriters Laboratories, Inc., label or listing, or satisfactory certified test report from an approved testing laboratory will be required to show that surface burning characteristics for materials to be used do not exceed specified ratings.

- C. Every package or standard container of insulation or accessories delivered to the job site for use must have a manufacturer's stamp or label giving the name of the manufacturer and description of the material.

1.4 SUBMITTALS

- A. Submit in accordance with Division 01.
- B. Manufacturer's Literature and Data:
 - 1. Insulation materials: Each type used. State surface burning characteristics.
 - 2. Insulation facings and jackets: Each type used. Make it clear that white finish will be furnished for exposed ductwork, casings and equipment.
 - 3. Insulation accessory materials: Each type used.
 - 4. Manufacturer's installation and fitting fabrication instructions for flexible unicellular insulation.
 - 5. Make reference to applicable specification paragraph numbers for coordination.
- C. Samples:
 - 1. Each type of insulation: Minimum size 100 mm (4 inches) square for board/block/blanket; 150 mm (6 inches) long, full diameter for round types.
 - 2. Each type of facing and jacket: Minimum size 100 mm (4 inches square).
 - 3. Each accessory material: Minimum 120 ML (4 ounce) liquid container or 120 gram (4 ounce) dry weight for adhesives/cement/mastic.

1.5 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by basic designation only.
- B. Federal Specifications (Fed. Spec.):
 - L-P-535E Plastic Sheet (Sheeting): Plastic Strip; Poly (Vinyl Chloride) and Poly (Vinyl Chloride - Vinyl Acetate)
 - HH-B-100B Barrier Material Vapor (For Pipe, Duct and Equipment Thermal, Insulation)
- C. Military Specifications (Mil. Spec.):
 - MIL-A-3316C AMD 2 Adhesives, Fire-Resistant, Thermal Insulation
 - MIL-A-24179A NOTICE 1 Adhesive, Flexible Unicellular-Plastic Thermal Insulation
 - MIL-C-19565C(1) Coating Compounds, Thermal Insulation, Fire-and Water-Resistant, Vapor-Barrier
 - MIL-C-20079H Cloth, Glass; Tape, Textile Glass; and Thread, Glass and Wire-Reinforced Glass
- D. American Society for Testing and Materials (ASTM):
 - A167-94 Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
 - B209-95 Aluminum and Aluminum-Alloy Sheet and Plate
 - C411 E1-82 Hot-Surface Performance of High-Temperature Thermal Insulation
 - C449M-95 Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement
 - C533-95 Calcium Silicate Block and Pipe Thermal Insulation
 - C534-94 Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form
 - C547-95 Mineral Fiber Preformed pipe Insulation
 - C552-91 Cellular Glass Thermal Insulation

- C553-92 Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications
 - C585-90 Inner and Outer Diameters of Rigid Thermal Insulation for Nominal Sizes of Pipe and Tubing (NPS System)
 - C612-93 Mineral Fiber Block and Board Thermal Insulation
 - C1126-96 Faced or Unfaced Rigid Cellular Phenolic Thermal Insulation
 - D1668-94 Glass Fabrics (Woven and Treated) for Roofing and Waterproofing
 - E84-95 Surface Burning Characteristics of Building Materials
 - E119-95 Fire Tests of Building Construction and Materials
 - E136-94 Behavior of Materials in a Vertical Tube Furnace at 750 °C
- E. National Fire Protection Association (NFPA):
- 90A-96 Installation of Air Conditioning and Ventilating Systems
 - 96-94 Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations
 - 101-97 Life Safety Code
 - 255-96 Surface Burning Characteristics of Building Materials
 - 251-95 Standard Methods of Fire Tests of Building Construction and Materials
- F. Underwriters Laboratories, Inc (UL):
- 723-93 Tests for Surface Burning Characteristics of Building Materials

PART 2 - PRODUCTS

2.1 INSULATION FACINGS AND JACKETS

- A. Vapor Barrier Types I and II: The mold and mildew test requirement is waived.
1. Type I, low vapor transmission (0.02 perm rating), Beach puncture 50 units: Use for insulation facing on exposed ductwork, casings and equipment, and for pipe insulation jackets. Facings and jackets shall be white all service type (ASJ) suitable for painting without sizing.
 2. Type II, medium vapor transmission, Beach puncture 25 units: Foil-Scrim-Kraft (FSK) type for concealed ductwork and equipment.
 3. Presized Glass Cloth Jacket, Beach puncture 100 units: Not less than 240 grams per square meter (7.8 ounces per square yard), with integral vapor barrier where required; for use where specified and in lieu of Type I or Type II jacket at the Contractor's option.
 4. Factory composite materials may be used provided that they have been tested and certified by the manufacturer.
 5. Fire and smoke treatment of jackets and facings shall be permanent. The use of water soluble treatments is not acceptable.
 6. Pipe insulation jackets shall have a minimum 40 mm (1 1/2 inch) lap at longitudinal joints and not less than 75 mm (3 inch) butt strips at end joints. Facing on board, blanket and block insulation shall have 50 mm (2 inch) laps or a minimum 75 mm (3 inch) butt strips. Butt strip material shall be the same as the jacket or facing. Laps and butt strips may be self-sealing type with factory applied pressure sensitive adhesive.
- B. Metal Protective Jacket:
1. Sheet aluminum: ASTM B209, 3003 alloy, H-14 temper, 0.4 mm (0.016 inch) thick. Provide moisture barrier lining for service temperatures 16 °C (60 °F) or less except where applied over a Type I or II jacket. Longitudinal lap shall be at

least 50 mm (2 inches) wide. For service temperatures 16 °C (60 °F) or less, seal all jacket laps.

2. Fitting covers: Factory fabricated from not lighter than 0.5 mm (0.020 inch) thick type 3003 sheet aluminum.
3. Bands: 20 mm (3/4 inch) wide aluminum on maximum 450 mm (18 inch) centers.
4. Provide metal jackets over insulation as follows:
 - a. All piping and ducts exposed to outdoor weather.
 - b. Piping exposed in building, within 1800 mm (6 feet) of the floor, that connects to sterilizers, kitchen, and laundry equipment. Jacket may be applied with pop rivets. Provide aluminum angle ring escutcheons at wall, ceiling or floor penetrations.
 - c. A 50 mm (2 inch) overlap is required at longitudinal and circumferential joints.

2.2 MINERAL FIBER INSULATION

- A. Note the NFPA 90A burning characteristic requirements of 25/50 in paragraph 1.3.B. Refer to paragraph 3.1 for items not to be insulated.
- B. ASTM C612 (Board, Block), Class 1 or 2, $k = 0.037$ Watt per meter, per degree C (0.26), external insulation for temperatures up to 204 °C (400 °F).
 1. Exposed, unlined ductwork and equipment in unfinished areas, mechanical and electrical equipment rooms, and attics containing air handling units, and duct work exposed to outdoor weather:
 - a. 50 mm (2 inch) thick insulation faced with ASJ (white all service jacket): Supply air duct, unlined air handling units, and after filter housing.
 - b. 40 mm (1-1/2 inch) thick insulation faced with ASJ: Return air duct, mixed air plenums and prefilter housing.
 - c. Outside air ducts 40 mm (1 1/2 inch) thick insulation faced with ASJ.
 2. Supply air duct in the warehouse and in the laundry: 25 mm (one inch) thick insulation faced with ASJ.
 3. Cold equipment: 40 mm (1 1/2 inch) thick insulation faced with ASJ.
 - a. Chilled water pumps, water filter, chemical feeder pot or tank.
 - b. Pneumatic, cold water storage and surge tanks.
 4. Hot equipment: 40 mm (1 1/2 inch) thick insulation faced with ASJ.
 - a. Domestic water heaters and hot water storage tank.
- C. Firestop Pipe and Duct Insulation:
 1. Provide firestopping insulation at fire and smoke barriers through penetrations. Fire stopping insulation shall be UL or a U.S. recognized testing lab listed and as defined in Section 07 27 00, AIR BARRIERS.
 2. Pipe and duct penetrations requiring fire stop insulation including, but not limited to the following:
 - a. Pipe risers through mechanical room floors
 - b. Pipe or duct chase walls and floors
 - c. Smoke partitions
 - d. Fire partitions
- D. ASTM C553(Blanket, Flexible) Type I, Class B-3, Density 16 kcm (1 pcf), $k = 0.045$ Watt per meter, per degree C (0.31):
 1. Concealed supply air ductwork.
 - a. Above ceilings at a roof level: 50 mm (2 inch) thick insulation faced with FSK.

- b. Above ceilings for other than roof level: 40 mm (1 1/2 inch) thick insulation faced with FSK.
 - 2. Concealed return air duct above ceilings at a roof level and in chases with external wall or containing steam piping: 40 mm (1 1/2 inch) thick, insulation faced with FSK. Concealed return air ductwork in other locations need not be insulated.
 - 3. Return air duct in interstitial spaces: 40 mm (1 1/2 inch) thick insulation faced with FSK.
 - 4. Concealed outside air duct: 40 mm (1 1/2 inch) thick insulation faced with FSK.
- E. ASTM C547 (Preformed), Class 1, $k = 0.037$ Watt per meter, per degree C (0.26). Pipe and tubing covering, standard thickness by industry standard, for temperatures up to 232 °C (450 °F), in nominal thickness in millimeters and inches specified in table below, for piping above ground:

| Nominal Pipe Size, millimeters (inches): | Nominal Thickness of Insulation | | | |
|--|---------------------------------|-------------------|---------------|----------|
| | 25 (1) & below | 32- 75 (1-1/4- 3) | 100-150 (4-6) | 200 (8) |
| 122-177 °C (251-350 F) (HPS, HPR, MPS, MPR) | 50 (2.0) | 65 (2.5) | 90 (3.5) | 90 (3.5) |
| 100-121 °C (212-250 °F) (LPS, Vents for PRV safety valves receivers and flash tanks) | 25 (1.0) | 50 (2.0) | 50 (2.0) | 50 (2.0) |
| 38-99 °C (100-211 °F) (LPR, PC, HWH, HWHR, GH, GHR) | 25 (1.0) | 40 (1.5) | 50 (2.0) | 50 (2.0) |
| Runouts to fan coil units | 15 (0.5) | - | - | - |
| Runouts to reheat coils air terminal unit reheat coils | 15 (0.5) | - | - | - |
| 4-16 °C (40-60 °F) (CH, CHR, GC, GCR) | 25 (1.0) | 40 (1.5) | 50 (2.0) | 65 (2.5) |
| Runouts to fan coil units | 20 (.75) | - | - | - |
| Ice water piping | 25 (1.0) | 40 (1.5) | 50 (2.0) | - (-) |
| 10 °C (50 °F) and less (RS for DX refrigeration) | 25 (1.0) | 40 (1.5) | - | - |
| Domestic hot water supply and return | 15 (0.50) | 20 (0.75) | 25 (1.0) | 40 (1.5) |

- 1. Condensation control insulation: Minimum 20 mm (0.75 inches) thick for all pipe sizes.
 - a. HVAC: Cooling coil condensation piping to waste piping fixture or inlet. Omit insulation on plastic piping in mechanical rooms or roof installations.
 - b. Plumbing piping as follows:
 - 1) Body of roof and overflow drains horizontal runs and offsets (including elbows) of interior downspout piping in all areas above pipe basement.
 - 2) Waste piping from electric water coolers to drainage system.
 - 3) Waste piping located above basement floor from ice making and film developing equipment and air handling units, from fixture (including trap) to main vertical waste pipe.
 - 4) Cold water piping.
 - 2. Freeze protection of above grade outdoor piping (over heat tracing tape): 25 mm (one inch) thick insulation, with metal jacket, for all pipe sizes 75 mm (3 inches) and smaller, and 40 mm (1 1/2 inch) thick insulation for larger pipe.
- F. ASTM C547 (Preformed), $k = 0.037$ Watt per meter, per degree C (0.26), Molded Pipe Fitting Covering, for temperatures up to 232 °C (450 °F):

1. This factory made fitting insulation may be used at the Contractor's option. Refer to paragraph 3.2 for fitting options.

2.3 RIGID CELLULAR PHENOLIC INSULATION:

- A. Rigid cellular phenolic insulation may be provided for piping, equipment, and duct work for temperatures up to 121 °C (250 °F) in lieu of mineral fiber insulation. Insulating efficiency of rigid cellular phenolic must not be less than that of the specified thickness of mineral fiber insulation, where thickness of rigid cellular phenolic insulation is not specified.
- B. Note the NFPA 90A burning characteristic requirements of 25/50 in paragraph 1.3B. Refer to paragraph 3.1 for items not to be insulated.
- C. Preformed (molded) pipe insulation, ASTM C1126, type III, grade 1, k = 0.021 Watt per meter, per degree C (0.15), for temperatures up to 121 °C (250 °F) with vapor barrier and all service jacket with polyvinyl chloride premolded fitting covering.
- D. Equipment and Duct Insulation, ASTM C 1126, type II, grade 1, k = 0.021 Watt per meter, per degree C (0.15), for temperatures up to 121 °C (250 °F). with rigid cellular phenolic insulation and covering, vapor barrier and all service jacket.
- E. Firestop Pipe and Duct Insulation: As described under Mineral Fiber Insulation paragraph 2.2.
- F. Minimum thickness in millimeters (inches) specified in table below, for piping above ground:

| Nominal Pipe Size millimeters (inches): | Nominal Thickness of Insulation | | | | |
|--|---------------------------------|--------------------|------------------|-------------------|---------------------|
| | 25 (1) & below | 32-75 (1 1/4-3) | 100-150 (4-6) | 200-300 (8-12) | 350 (14) & above |
| 100-121 °C (212-250 °F), LPS, Vents, receivers, flash tanks. | 15 (0.5) | 25 (1) | 25 (1) | -- | -- |
| 38-99 °C (100-211 °F), LPR, PC, HWH, HWHR, GH and GHR. // Run outs to Fan Coil units // reheat coils // | 15 (0.5) | 20 (0.75) | 25 (1) | -- | -- |
| 4-16°C (40-60 °F), CHS, CHR, GC and GCR. Run outs to Fan Coil Units. Ice Water Piping. | 20 (0.75) | 20 (0.75) | 25 (1) | 40 (1.5) | 50 (2.0) |
| 10 °C (50 °F) and less, RS for DX refrigerants. | 15 (0.5) | 20 (0.75) | 25 (1) | -- | -- |
| Domestic hot water supply and return. | 15 (0.5) | 15 (0.5) | 20 (0.75) | 20 (0.75) | -- |

1. Condensation control insulation: Minimum 20 mm (0.75 inch) thick for all pipe sizes.
 - a. HVAC: Cooling coil condensation piping to waste piping fixture or inlet. Omit insulation on plastic piping in mechanical rooms or roof units.
 - b. Plumbing piping as follows:
 - 1) Body of roof and overflow drains horizontal runs and offsets (including elbows) of interior downspout piping in all areas above pipe basement.
 - 2) Waste piping from electric water coolers to drainage system.

- 3) Waste piping located above basement floor from ice making and film developing equipment and air handling units, from fixture (including trap) to main vertical waste pipe.
- 4) Cold water piping
- 2. Freeze protection of above grade outdoor piping (over heat tracing tape): 20 mm (0.75 inch) thick insulation, for all pipe sizes 75 mm (3 inches) and smaller and 25 mm (1 inch) thick insulation for larger pipes. Provide metal jackets for all pipes.

2.4 FLEXIBLE ELASTOMERIC CELLULAR THERMAL INSULATION

- A. ASTM C534, k = 0.033 Watt per meter, per degree C (0.27), flame spread not over 25, smoke developed not over 100, for temperatures from minus 4 °C (40 °F) to 93 °C (200 °F). No jacket required.
- B. Pipe Insulation: Nominal thickness in millimeters (inches as specified in table below for piping above ground:

| Nominal Pipe Size millimeters (inches) | Nominal Thickness of Insulation | | | |
|---|---------------------------------|-----------------|---------------|-----------|
| | 25 (1) & below | 32-75 (1 1/4-3) | 100-150 (4-6) | 150 (6) |
| 38-93 °C(100-200 °F) (HWH, HWHR, GH, GHR) Runouts to // fan coil units // reheat coils // air terminal unit reheat coils // | 25 (1.0) | 40 (1.5) | - | - |
| 4-16 °C (40-60 °F) (CHS, CHR, GC, GCR) Runouts to fan coil units, cooling coil condensate piping. Ice water piping and RS for DX refrigeration. | 25 (1.0) | 40 (1.5) | - | - |
| Domestic hot water supply and return | 15 (0.50) | 20 (0.75) | 25 (1.0) | 40 (1.50) |

Minimum 20 mm (0.75 inch) thick insulation for Pneumatic Control lines for a minimum distance of 6 m (20 feet) from discharge side of the refrigerated dryer.

2.5 CELLULAR GLASS INSULATION

- A. ASTM C552, density 136 kcm (8.5 pcf) nominal, k = 0.055 Watt per meter, per degree C (0.38) flame spread not over 25 and smoke developed not over 50.
- B. Pipe and tubing, covering nominal thickness in millimeters and inches as tabulated below for chilled water and refrigerant piping.

| Millimeters (inches) | Nominal Thickness of Insulation | | | |
|--|---------------------------------|------------------|-------------------|------------------|
| | Thru 38 (1 1/2) | 50- 150 (2-6) | 200-300 (8-12) | over 350 (14) |
| 4-16 °C (40-60 °F) (CHS, CHR, within chiller room, pipe chase and underground) | 50 (2.0) | 80 (3.0) | 80 (3.0) | 100 (4.0) |
| 4-16 °C (40-60 °F) (CH,CHR, outside chiller room) | 40 (1.5) | 50 (2.0) | 50 (2.0) | 65 (2.5) |

- C. Cold Equipment: 50 mm (2 inch) thick insulation faced with ASJ for chilled water pumps, water filters, chemical feeder pots or tanks, expansion tanks, air separators, and air purgers.

2.6 CALCIUM SILICATE INSULATION

A. ASTM C533:

| | Type I | Type II |
|--|--------------|--------------|
| Use temperature, maximum °C (°F) | 649 (1200) | 927 (1700) |
| Density (dry), max kg/m ³ (lb/ft ³) | 240 (15) | 352 (22) |
| Thermal Conductivity: | | |
| W/m K (Btu in/h ft ² °F) @ mean temp of 93 °C (200°F) | 0.065 (0.45) | 0.078 (0.54) |
| Surface Burning Characteristics: | | |
| Flame Spread Index, Max | 0 | 0 |
| Smoke Density Index, Max | 0 | 0 |

2.7 INSULATION ACCESSORY MATERIALS

- A. Insulation inserts at pipe supports: Provide for all insulated piping. Install with metal insulation shields furnished with pipe supports, Section, COMMON WORK RESULTS FOR HVAC.

Material: Premolded, high density mineral fiber blocks, minimum density 320 kcm (20 pcf), of same thickness as adjacent insulation.

| Nominal Pipe Size, Millimeters (Inches) | Insert Blocks Millimeters (Inches) |
|--|---------------------------------------|
| Up through 125 (5) | 150 (6) long |
| 150 (6) | 150 (6) long |
| 200, 250, 300 (8, 10, 12) | 225 (9) long |
| 350, 400 (14, 16) | 300 (12) long |
| 450 through 600 (18 through 24) | 350 (14) long |

- Optional insert material: 82 °C (180 °F) segment of calcium silicate, cellular glass, or mineral fiber 144 kcm (9 pcf) minimum density insert.

B. Adhesive, Mastic, Cement:

- Class 1: Jacket and lap adhesive and protective finish coating for insulation.
- Class 2: Adhesive for laps and for adhering insulation to metal surfaces.
- Type II Class 1: Adhesive for installing flexible unicellular insulation and for laps and general use.
- Type I: Protective finish for outdoor use.
- Type I or Type II: Vapor barrier compound for indoor use.
- ASTM C449: Mineral fiber hydraulic-setting thermal insulating and finishing cement.
- Other: Insulation manufacturers' published recommendations.

C. Mechanical Fasteners:

- Pins, anchors: Welded pins, or metal or nylon anchors with tin-coated or fiber washer, or clips. Pin diameter shall be as recommended by the insulation manufacturer.
- Staples: Outward clinching monel or stainless steel.
- Wire: 1.3 mm thick (18 gage) soft annealed galvanized, or 1.9 mm (14 gage) copper clad steel or nickel copper alloy.
- Bands: 20 mm (3/4 inch) nominal width, brass, galvanized steel, aluminum or stainless steel.

- D. Reinforcement and Finishes:
1. Glass fabric, open weave: ASTM D1668, Type III (resin treated) and Type I (asphalt treated).
 2. Glass fiber fitting tape: Type II, Class 1.
 3. Tape for Flexible Unicellular Insulation: Scotch No. 472, Nashua PE-12, or approved equal recommended by the insulation manufacturer.
 4. Hexagonal wire netting: 25 mm (one inch) mesh, 0.85 mm thick (22 gage) galvanized steel.
 5. Corner beads: 50 mm (2 inch) by 50 mm (2 inch), 0.55 mm thick (26 gage) galvanized steel; or, 25 mm (1 inch) by 25 mm (1 inch), 0.47 mm thick (28 gage) aluminum angle adhered to 50 mm (2 inch) by 50 mm (2 inch) Kraft paper.
 6. PVC fitting cover: Fed. Spec. L-P-535, Composition A, 11-86 Type II, Grade GU, with Form B Mineral Fiber insert, for media temperature °C (40 °F) to 121 °C (250 °F). Below 4 °C (40 °F) and above 121 °C (250 °F) provide double layer insert. Provide color matching, vapor barrier, pressure sensitive tape.
- E. Firestopping Material, Other Than Pipe and Duct Insulation: Refer to Section 07 80 00 FIRESTOPPING..

PART 3 – EXECUTION

3.1 GENERAL INSULATION REQUIREMENTS

- A. Required pressure tests of joints and connections shall be completed and the work approved by the Architect/Engineer or Owner for application of insulation. Surface shall be clean and dry with all foreign materials, such as dirt, oil, loose scale and rust removed.
- B. Except for specific exceptions, insulate entire specified equipment, piping, (pipe, fittings, valves, accessories) and duct systems. Insulate each pipe and duct individually. Do not use scrap pieces of insulation where a full length section will fit.
- C. Where removal of insulation of piping and equipment is required, such areas shall be reinsulated to comply with this specification.
- D. Insulation materials shall be installed in a first class manner with smooth and even surfaces, with jackets and facings drawn tight and smoothly cemented down at all laps. Insulation shall be continuous through all sleeves and openings, except at fire dampers and duct heaters (NFPA 90A). Vapor barriers shall be continuous and uninterrupted throughout systems with operating temperature 16 °C (60 °F) and below. Lap and seal vapor barrier over ends and exposed edges of insulation. Anchors, supports and other metal projections through insulation on cold surfaces shall be insulated and vapor sealed for a minimum length of 150 mm (6 inches).
- E. Construct insulation on parts of equipment such as chilled water pumps and heads of chillers, converters and heat exchangers, that must be opened periodically for maintenance or repair, so insulation can be removed and replaced without damage. Install insulation with bolted 1 MM THICK (20 gage) galvanized steel or aluminum covers as complete units, or in sections, with all necessary supports, and split to coincide with flange/split of the equipment.
- F. Insulation on hot piping and equipment shall be terminated square at items not to be insulated, access openings and nameplates. Cover all exposed raw insulation with white sealer or jacket material.

- G. HVAC work not to be insulated:
1. Internally insulated ductwork and air handling units. Omit insulation on relief air ducts (Economizer cycle exhaust air).
 2. Exhaust air ducts and plenums, and ventilation exhaust air shafts.
 3. Equipment: Expansion tanks, flash tanks, hot water pumps.
 4. In hot piping: Unions, flexible connectors, control valves, PRVs, safety valves and discharge vent piping, vacuum breakers, thermostatic vent valves, steam traps 20 mm (3/4 inch) and smaller, exposed piping through floor for convectors and radiators. Insulate piping to within approximately 75 mm (3 inches) of uninsulated items.
- H. Plumbing water work not to be insulated:
1. Piping and valves of fire protection system.
 2. Chromium plated brass piping.
 3. Water piping in contact with earth.
 4. Piping in pipe basement serving wall hydrants.
 5. Small horizontal cold water branch runs in partitions to individual fixtures may be without insulation for maximum distance of 900 mm (3 feet).
 6. Distilled water piping.
 7. Cold water piping.
- I. Apply insulation materials subject to the manufacturer's recommended temperature limits. Apply adhesives, mastic and coatings at the manufacturer's recommended minimum coverage.

3.2 INSULATION INSTALLATION

- A. Mineral Fiber Board:
1. Faced board: Apply board on pins spaced not more than 300 mm (12 inches) on center each way, and not less than 75 mm (3 inches) from each edge of board. In addition to pins, apply insulation bonding adhesive to entire underside of horizontal metal surfaces. Butt insulation edges tightly and seal all joints with laps and butt strips. After applying speed clips, cut pins off flush and apply vapor seal patches over clips.
 2. Plain board:
 - a. Insulation shall be scored, beveled or mitered to provide tight joints and be secured to equipment with bands spaced 225 mm (nine inches) on center for irregular surfaces or with pins and clips on flat surfaces. Use corner beads to protect edges of insulation.
 - b. For hot equipment: Stretch 25 mm (1 inch) mesh wire, with edges wire laced together, over insulation and finish with insulating and finishing cement applied in one coat, 6 mm (1/4 inch) thick, trowelled to a smooth finish.
 - c. For cold equipment: Apply 3000 mm by 3000 mm (10 ft by 10 ft) mesh glass fabric in a tack coat 1.5 to 1.7 square meter per liter (60 to 70 square feet per gallon) of vapor barrier mastic and finish with mastic at 0.3 to 0.4 square meter per liter (12 to 15 square feet per gallon) over the entire fabric surface.
 - d. Chilled water pumps: Insulate with removable and replaceable 1 mm thick (20 gage) aluminum or galvanized steel covers lined with insulation. Seal closure joints/flanges of covers with gasket material. Fill void space in enclosure with flexible mineral fiber insulation.

B. Flexible Mineral Fiber Blanket:

1. Adhere insulation to metal with 100 mm (4 inch) wide strips of insulation bonding adhesive at 200 mm (8 inches) on center all around duct. Additionally secure insulation to bottom of ducts exceeding 600 mm (24 inches) in width with pins welded or adhered on 450 mm (18 inch) centers. Secure washers on pins. Butt insulation edges and seal joints with laps and butt strips. Staples may be used to assist in securing insulation. Seal all vapor barrier penetrations with mastic. Sagging duct insulation will not be acceptable. Install firestop duct insulation where required.
2. Supply air ductwork to be insulated includes main and branch ducts from fan discharge to room supply outlets, and the bodies of ceiling outlets to prevent condensation. Insulate sound attenuator units, coil casings and damper frames. To prevent condensation insulate trapeze type supports and angle iron hangers for flat oval ducts that are in direct contact with metal duct.

C. Molded Mineral Fiber Pipe and Tubing Covering:

1. Fit insulation to pipe or duct, aligning longitudinal joints. Seal longitudinal joint laps and circumferential butt strips by rubbing hard with a nylon sealing tool to assure a positive seal. Staples may be used to assist in securing insulation. Seal all vapor barrier penetrations on cold piping with a generous application of vapor barrier mastic. Provide inserts and install with metal insulation shields at outside pipe supports. Install freeze protection insulation over heating cable.
2. Contractor's options for fitting, flange and valve insulation:
 - a. Insulating and finishing cement for sizes less than 100 mm (4 inches) operating at surface temperature of 16 °C (61 °F) or more.
 - b. Factory premolded, one piece PVC covers with mineral fiber, (Form B), inserts. Provide two insert layers for pipe temperatures below 4 °C (40 °F), or above 121 °C (250 °F). Secure first layer of insulation with twine. Seal seam edges with vapor barrier mastic and secure with fitting tape.
 - c. Factory molded, ASTM C547 or field mitered sections, joined with adhesive or wired in place. For hot piping finish with a smoothing coat of finishing cement. For cold fittings, 16 °C (60 °F) or less, vapor seal with a layer of glass fitting tape imbedded between two 2 mm (1/16 inch) coats of vapor barrier mastic.
 - d. Fitting tape shall extend over the adjacent pipe insulation and overlap on itself at least 50 mm (2 inches).

D. Rigid Cellular Phenolic Insulation:

1. Provide secure attachment facilities such as welding pins.
2. Apply insulation with joints tightly drawn together.
3. Apply adhesives, coverings, neatly finished at fittings, and valves.
4. Final installation shall be smooth, tight, neatly finished at all edges.

E. Pipe and Duct Insulation at Penetrations of Fire or Smoke Barriers:

1. Wrap pipe or duct with firestop pipe insulation, seal jacket seam and seal end joints to adjacent sections of insulation.
2. Seal opening between insulation and pipe sleeve with firestopping material.
3. Among pipe and duct penetrations requiring fire stop insulation are the following:
 - a. Floor (platform) of interstitial space (ducts & pipes).
 - b. Pipe risers through mechanical room floors.

- c. Pipe or duct chase walls and floors.
- d. Smoke partitions.
- e. Fire partitions.

F. Flexible Elastomeric Cellular Thermal Insulation:

- 1. Apply insulation and fabricate fittings in accordance with the manufacturer's installation instructions.
- 2. Pipe and tubing insulation:
 - a. Use proper size material. Do not stretch or strain insulation.
 - b. To avoid undue compression of insulation, provide cork stoppers or wood inserts at supports as recommended by the insulation manufacturer. Insulation shields are specified under Section 23 05 00, COMMON WORK RESULTS FOR HVAC.
 - c. Where possible, slip insulation over the pipe or tubing prior to connection, and seal the butt joints with adhesive. Where the slip-on technique is not possible, slit the insulation and apply it to the pipe sealing the seam and joints with contact adhesive. Optional tape sealing, as recommended by the manufacturer, may be employed. Make changes from mineral fiber insulation in a straight run of pipe, not at a fitting. Seal joint with tape.
- 3. Apply sheet insulation to flat or large curved surfaces with 100 percent adhesive coverage. For fittings and large pipe, adhere the seams only.

G. Calcium silicate Insulation:

- 1. The installation and fastening method shall be as per manufacturer's recommendations.
- 2. Conform to workmanship and dimensional tolerances as required by ASTM C533 standard.

H. Weatherproofing Outdoor Insulation:

- 1. Piping, round and oval ducts: Protective metal jacket.
- 2. Plenums, casing, fans, rectangular or square ducts and equipment: Apply two coats of weatherproof coating, each trowelled or sprayed in place to a wet thickness of 6 mm (1/4 inch), reinforced with open weave glass fabric. After the second layer of mastic has dried, coat and seal with a layer of asphalt aluminum sealer brushed in place.
- 3. Flexible elastomeric cellular insulation: Finish with two coats of weather resistant finish as recommended by the insulation manufacturer.

END OF SECTION

SECTION 23 08 00 - COMMISSIONING OF HVAC SYSTEMS

PART 1 – GENERAL

1.1 DESCRIPTION

- A. The requirements of this Section apply to all sections of Division 23.
- B. This project will have selected building systems commissioned. The complete list of equipment and systems to be commissioned are specified in Division 01. The commissioning process, which the Contractor is responsible to execute, is defined in Division 01. A Commissioning Agent (CxA) appointed by the Department of Veterans Affairs will manage the commissioning process.

1.2 RELATED WORK

- A. Section 01 00 00 GENERAL REQUIREMENTS.
- B. Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS.
- C. Section 01 33 23 SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

1.3 SUMMARY

- A. This Section includes requirements for commissioning the HVAC systems, subsystems and equipment. This Section supplements the general requirements specified in Division 01.
- B. The commissioning activities have been developed to support the VA requirements to meet guidelines for Federal Leadership in Environmental, Energy, and Economic Performance.
- C. The commissioning activities have been developed to support the United States Green Building Council (USGBC) LEED™ rating program and to support delivery of project performance in accordance with the Contract Documents developed with the approval of the Architect/Engineer and Client.
- D. Refer to Division 01 for more specifics regarding processes and procedures as well as roles and responsibilities for all Commissioning Team members.

1.4 DEFINITIONS

- A. Refer to Division 01 for definitions.

1.5 COMMISSIONED SYSTEMS

- A. Commissioning of a system or systems specified in this Division is part of the construction process. Documentation and testing of these systems, as well as training of the Client's Operation and Maintenance personnel, is required in cooperation with the Client and the Commissioning Agent.
- B. The following HVAC systems will be commissioned:
 - 1. Air Handling Systems (including terminal units and energy recovery units)

2. Air Handling Systems (Fans, motors, Variable Speed Drives, cooling coils and control valves, heating coils and control valves, filters, dampers, safeties such as smoke detectors or freezestats and damper end switches, controls, gages, and vibration isolation).
3. Dehumidification Systems (Energy recovery devices – such as enthalpy wheels, fans, motors, Variable Speed Drives, cooling coils and control valves, heating coils and control valves, filters, dampers, safeties, controls, gages, and vibration isolation).
4. Heating Hot Water Systems (Boilers, controls, instrumentation and gages, flues, heating water pumps and motors, Variable Speed Drives, mixing valves).
5. Exhaust Fans (Fan, motor, Variable Speed Drives, controls and safeties).
6. Direct Digital Control System (BACnet or similar Local Area Network (LAN)).

1.6 SUBMITTALS

- A. The commissioning process requires review of selected Submittals. The Commissioning Agent will provide a list of submittals that will be reviewed by the Commissioning Agent. This list will be reviewed and approved by the Client/Architect prior to forwarding to the Contractor. Refer to Section 01 33 23 SHOP DRAWINGS, PRODUCT DATA, and SAMPLES for further details.
- B. The commissioning process requires Submittal review simultaneously with engineering review. Specific submittal requirements related to the commissioning process are specified in Division 01.

PART 2 - PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.1 PRE-FUNCTIONAL CHECKLISTS

- A. The Contractor shall complete Pre-Functional Checklists to verify systems, subsystems, and equipment installation is complete and systems are ready for Systems Functional Performance Testing. The Commissioning Agent will prepare Pre-Functional Checklists to be used to document equipment installation. The Contractor shall complete the checklists. Completed checklists shall be submitted to the Architect/Engineer, Client and to the Commissioning Agent for review. The Commissioning Agent may spot check a sample of completed checklists. If the Commissioning Agent determines that the information provided on the checklist is not accurate, the Commissioning Agent will return the marked-up checklist to the Contractor for correction and resubmission. If the Commissioning Agent determines that a significant number of completed checklists for similar equipment are not accurate, the Commissioning Agent will select a broader sample of checklists for review. If the Commissioning Agent determines that a significant number of the broader sample of checklists is also inaccurate, all the checklists for the type of equipment will be returned to the Contractor for correction and resubmission. Refer to Division 01 for submittal requirements for Pre-Functional Checklists, Equipment Startup Reports, and other commissioning documents.

3.2 CONTRACTORS TESTS

- A. Contractor tests as required by other sections of Division 23 shall be scheduled and documented in accordance with Section 01 00 00 GENERAL REQUIREMENTS. The Commissioning Agent will witness selected Contractor tests. Contractor tests shall be completed prior to scheduling Systems Functional Performance Testing.

3.3 SYSTEMS FUNCTIONAL PERFORMANCE TESTING:

- A. The Commissioning Process includes Systems Functional Performance Testing that is intended to test systems functional performance under steady state conditions, to test system reaction to changes in operating conditions, and system performance under emergency conditions. The Commissioning Agent will prepare detailed Systems Functional Performance Test procedures for review and approval by the Architect/Engineer. The Contractor shall review and comment on the tests prior to approval. The Contractor shall provide the required labor, materials, and test equipment identified in the test procedure to perform the tests. The Commissioning Agent will witness and document the testing. The Contractor shall sign the test reports to verify tests were performed. See Division 01, for additional details.

3.4 TRAINING OF CLIENT PERSONNEL

- A. Training of the Client's operation and maintenance personnel is required in cooperation with the Architect/ Engineer and Commissioning Agent. Provide competent, factory authorized personnel to provide instruction to operation and maintenance personnel concerning the location, operation, and troubleshooting of the installed systems. The instruction shall be scheduled in coordination with the Architect/ Engineer after submission and approval of formal training plans. Refer to Division 01 and Division 23 Sections for additional Contractor training requirements.

END OF SECTION

SECTION 23 09 00 - INSTRUMENTATION AND CONTROL FOR HVAC

PART 1 – GENERAL

1.1 DESCRIPTION

- A. Control devices and systems to provide the functional requirements of these specifications and as shown on the drawings.
1. Direct Digital Control (DDC) of Heating, Ventilating, and Air Conditioning (HVAC) equipment and systems with electric or electronic positioning of valves and dampers as manufactured by Carrier Corporation – ComfortWorks, Trane, Siebe, Johnson Controls or approved equal.
 2. Electric or electronic control of rooftop HVAC units, fans, heaters, and similar units for control of room conditions.
- B. Definitions:
1. Algorithm: A logical procedure for solving a recurrent mathematical problem. A prescribed set of well-defined rules or processes for the solution of a problem in a finite number of steps.
 2. Analog: A continuously varying signal value (e.g. temperature, current, velocity)
 3. Baud: A Baud is a signal change in a communication link. One signal change can represent one or more bits of information depending on type of transmission scheme. Simple peripheral communication is normally one bit per Baud. (e.g., Baud Rate = 9600 Baud/sec is 9600 bits/sec if one signal change = 1 bit.
 4. Binary: A two-state system where an “on” condition is represented by a high signal level and an “off” condition is represented by a low signal level.
 5. Control Wiring: Includes conduit, wire and wiring devices to install interlocks, thermostats, PE and EP switches, and like devices. Includes all wiring from a DDC cabinet to all sensors and points defined in the input/output summary shown on drawings and required to execute the sequence of operation.
 6. Digital Controller (CU): A control module which is microprocessor based, programmable by the user, may include I/O data processing functions. There could be more than one type of CU for specific applications. For example, Auxiliary Units (ACU's) for air handling units, unitary control units (UCU's) for VAV boxes, fan coil units, etc., and Remote Control Units (RCU's) for supervising ACU's and UCU's, etc.
 7. Distributed Control Panel (DCP): A panel which houses the digital controller (CU), input and output functions, power supplies, relays, transducers, and associated hardware.
 8. Direct Digital Control (DDC): A control loop or subsystem in which digital and analog information is received and processed by a microprocessor based system, and digital control signals are generated based on control algorithms and transmitted to field devices in order to achieve a set of predefined conditions.
 9. Deadband: A temperature range over which no heating or cooling is supplied i.e. 22-25 °C (72-78 °F), as opposed to a single point changeover or overlap).

10. Diagnostic Program: A software test program which is used to detect and report system or peripheral malfunctions and failures. This test is performed at the initial start up of the system.
11. Distributed Control System: A system in which the processing of system data is decentralized and control decisions can and are made at the subsystem level. System operational programs and information are provided to the remote subsystems and status is reported back to the Engineering Control Center (ECC). Upon the loss of communication with the EEC, the subsystems shall be capable of operating in a standalone mode using the last best available data. Digital controllers in a system are linked in a communications network composed of one or more levels of area networks (LAN).
12. Down Load: The electronic transfer of programs and data files from a central computer or operator workstation with secondary memory devices, to remote, distributed computers in a distributed system. Transfer is made over the distributed computers in a distributed system. Transfer is made over the distributed system's communication network.
13. Dynamic Control: A process that optimizes operation of HVAC systems (air handling units, converters, chillers, etc.) by increasing and decreasing setpoints or starting and stopping equipment in response to heating and cooling loads of downstream equipment. A requirement of dynamic control is knowing the heating/cooling demand status of downstream equipment, therefore dynamic control requires controllers connected in a communications network.
14. Engineering Control Center (ECC): The centralized control point for the intelligent control network. The ECC includes operator Workstation(s), network communications control. Operator Workstation includes central Operator's personal-computer based terminal, keyboard, mouse, printer(s), and any additional peripheral devices required to perform the primary man-machine functions of the ECC.
15. Firmware: Firmware is software programmed into read only memory (ROM) chips. Software may not be changed without physically altering the chip.
16. Graphic Sequence of Operation: A drawing or graphic showing all interlocks and control loop sequences between the input and output points. Graphic sequence of operation is a graphical representation of the sequence of operation. The graphic sequence of operation will show all inputs, outputs, and logic blocks.
17. Input/Output (I/O): I/O refers to analog inputs (AI), digital inputs (DI), analog output (AO), and digital output (DO) in a digital controller. Inputs from analog sensors (temperature, pressure, flow, humidity, etc.) and digital sensors (motor status, flow switches, switch position, and pulse output devices).
18. Input/Output Unit: The section of a DDC system through which information is received and transmitted.
19. Man-machine Interface: A method by which an operator is capable of communicating with a DDC system. In the case of a computer, the man-machine interface includes: the keyboard, mouse, monitor, and so on. The Man-machine interfacing allows an operator to command, control, monitor, and program the system.

20. Local Area Network (LAN): A communications bus that interconnects digital controllers for peer-to-peer communications. A LAN shall allow sharing of global information, make it possible to apply building wide control strategies, such as peak demand limiting, permit dynamic control strategies, allow coordinated response to alarm conditions, and permit remote monitoring and programming of digital controllers.
21. Operating System (OS): Software which controls the execution of computer application programs.
22. Peripheral: Input/Output unit used to communicate with the computer, digital controllers, and make copies of system outputs. Peripherals include CRT, printer, tape deck, and diskette.
23. Microprocessor: A microprocessor refers to the central processing unit (CPU) that contains all the registers and logic circuitry that make it possible for digital controllers to do computing.
24. Peer-to-Peer: Peer-to-Peer refers to controllers connected on a communications LAN that act independently, as equals, and communicate with each other and pass information which facilitates control.
25. Resolution: Resolution refers to the number of possible states that input value or output can take and is functional of the digital controller I/O circuitry; the A/D converter for input and the D/A converter for output. Sixteen (16) bit resolution has 65536 possible states and eight (8) bit resolution has 256 possible states.
26. Stand-Alone Control: Stand-Alone Control refers to the digital controller being able to perform required climate control and energy management functions without connection to another digital controller or central site computer. Digital controller requirements for stand-alone control are a time clock, a microprocessor, microchip resident control programs, PID control, a communications port for interfacing with and programming the control, firmware for interrogation and programming, and I/O for sensing and effecting control of its control environment.
27. Virtual Point: A virtual point allows transfer of calculated values between software programs, such as duty cycling, enthalpy, etc. This point resides only in software.

1.2 RELATED WORK

- A. Section 23 05 00, COMMON WORK RESULTS FOR HVAC.
- B. Section 23 05 48, VIBRATION CONTROLS FOR HVAC PIPING & EQUIPMENT.
- C. Section 23 30 00, HVAC AIR DISTRIBUTION.
- D. Section 23 05 93, TESTING, ADJUSTING, AND BALANCING FOR HVAC.
- E. Electrical Work:
 1. Section 26 05 00, COMMON WORK RESULTS FOR ELECTRICAL
 2. Section 26 05 33, RACEWAY SYSTEMS.
 3. Section 26 05 19, LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES.
 4. Section 26 27 26, WIRING DEVICES

1.3 QUALITY ASSURANCE

A. Criteria

1. **Single Source Responsibility of Supplier:** The Contractor shall obtain hardware and software supplied under this section and delegate the responsibility to a single source control supplier. The control supplier shall be responsible for the complete installation and proper operation of the system including debugging and calibration of the CU and all software. The control system supplier shall be in the business of design, installation and service of the computerized building environmental control systems similar in size and complexity to the system specified.
2. **Equipment and Materials:** Equipment and materials shall be cataloged products of manufacturers regularly engaged in production and installation of HVAC control systems. Products shall be manufacturer's latest standard design and have been tested and proven in actual use.
3. The Control System Supplier shall provide a list of no less than five similar projects which have building control systems as specified. These projects must be on-line and functional such that the Owner's representative would observe a direct digital control system in full operation.
4. The supplier shall have **(minimum of five years)** experience in design and installation of computerized building systems similar in performance to that specified. Provide evidence of experience by submitting resumes of the project manager, the local branch manager, project engineer, the application engineering staff, and the electronic technicians to be involved with the supervision, the engineering, and the installation of the system. Information concerning the amount of training and experience shall be included in each resume. Personnel information failing to disclose (at least a five year) the experience record will be a ground for disqualification of the supplier.
5. **Code approval:**
 - a. Computer based electronic equipment shall conform to the requirements of FCC part 15, subpart J, for Class A computing devices governing radio frequency electromagnetic interference (EMI) while continuing to operate normally.
 - b. All equipment and components shall be listed under UL 916 for Energy Management Systems, UL 864 for Control Units for Fire-Protective Signaling Systems, UL 1076 for Proprietary Burglar Alarm Units and systems, and UL 294 for Access Control Systems Units.
 - c. All wiring shall be in accordance with NFPA 70, Articles 725, 760, and 800.
6. All system software and control commands shall support year 2000 and beyond dates for all reporting, control and other system functions.
7. The specification covers minimum requirements and are not intended to preclude provision of equipment or methods that exceed the requirement.

B. Performance Tests

1. Perform pretests and tests in accordance with Article TESTS in Section 01 00 00, GENERAL REQUIREMENTS, and in accordance with Test Plans and Specifications. Submit Test Report including Final Operational Test.
2. Demonstrate to the Architect/Engineer and Owner that all controls are installed, adjusted, and can perform all functions required by the drawings and specifications. When coordinated with the Architect/Engineer and Owner demonstration may be performed in conjunction with instructions to Owner's operations personnel.
3. Final Operational Tests:
 - a. Performance Test Period: Not less than 168 consecutive hours to demonstrate proper functioning of the complete ECC system after complete installation and debugging of the system. Continue test on a day to day basis until the performance standard is met. This test shall be done after complete installation and debugging of the control systems, and before the final inspection of the control system.
 - b. Acceptance Performance Standard: Operation at an average effectiveness level (AEL) of at least 95 percent for the performance test period. Whenever downtime occurs correct defects before resuming test. Failure due to an individual sensor or controller shall not count as system downtime provided that:
 - 1) The system records the fault.
 - 2) The AEL for all sensors and controllers together is at least 95 percent of the test period.
 - c. Equipment Identification: Section 23 05 00, COMMON WORK RESULTS FOR HVAC.

1.4 EXTENDED GUARANTEE PERIOD SERVICES

- A. Comprehensive maintenance and repair related services shall be provided for the automatic controls provided on the project. The items of equipment and systems covered under semi-annually service shall be:
1. The Engineering Control Center (ECC) and associated peripherals (e.g. keyboard, mouse, printer, cathode ray tube (CRT) terminal, hard disks, floppy disks, operating and instructional manuals).
 2. The field data gathering distribution digital control panels local temperature control panels for the HVAC systems.
 3. Automatic temperature and humidity control systems for all occupied areas.
 4. Miscellaneous HVAC control systems and subsystems that are in communications with the ECC. Examples: Mechanical equipment rooms, electrical equipment rooms, elevator machine rooms, emergency generator rooms, telephone equipment rooms, transformer/switchgear rooms, vestibules, smoke control systems, and special exhaust systems.
 5. All automatic control systems interfacing with the central ECC system and other disciplines (e.g. plumbing and electrical trades for measuring and controlling temperature, flow rate, quantities, pressure, demand, and maintaining alarms).
- B. Qualifications: See Section 23 05 00, COMMON WORK RESULTS FOR HVAC.

- C. Replacement Parts: See Section 23 05 00, COMMON WORK RESULTS FOR HVAC
- D. Maintenance of Computer Software Programs: The Contractor's Supplier shall maintain all software programs included in the (ECC) and the local field digital controllers. In addition, all factory upgrades to the system and subsystem software shall be added to the systems, when they become available, at no additional cost to the Owner throughout the warranty period. New features, such as modification in the hardware system are not considered upgrades in this context.
- E. Maintenance of ECC and Local Field Panels: The Contractor's Supplier shall inspect, repair, replace, adjust, and calibrate, as required, the Operator's Workstation, associated peripheral equipment, and local data gathering panels. The Contractor's Supplier shall then furnish a report describing the status of the equipment, problem areas (if any) noticed during service work, and description of the corrective action taken. The report shall clearly certify that the software package is in working condition and all sensors are duly calibrated. Scheduled Maintenance (Computers):
 - 1. Verify proper restart on power failure and battery back-up.
 - 2. Inspect all indicating lamps, switches, interconnecting cables, and electrical.
 - 3. Replace battery pack per the manufacturer's recommendations.
 - 4. Clean floppy disk read/write head.
 - 5. Clean disk cartridge and media where applicable.
 - 6. Any service specifically outlined in the manufacturer's catalogs and not stated above.

1.5 SUBMITTALS

- A. Submit in accordance with Division 01.
- B. Manufacturer's literature and data for all components including the following:
 - 1. A wiring diagram for each type of input device and each type of output device including controllers, modems, repeaters, etc. Diagram shall show how the device is wired and powered, showing typical connections at the digital controllers and each power supply, as well as the device itself. Show for all field connected devices, including but not limited to, control relays, motor starters, electric or electronic actuators, and temperature pressure, flow and humidity sensors and transmitters.
 - 2. A diagram of each terminal strip, including digital controller terminal strips, terminal strip location, termination numbers and the associated point names.
 - 3. Control dampers and control valves schedule.
 - 4. Installation instructions for smoke dampers and combination smoke/fire dampers if specified.
 - 6. Catalog cut sheets of all equipment used. This includes, but is not limited to DDC panels, peripherals, sensors, actuators, and dampers.
 - 7. Proof of availability of specified standards/tested DDC control program submodules.
 - 8. Flow charts for each sequence of operation.
 - 9. Catalog cut sheets of air measuring stations used for the volumetric control system. Include as a separate volumetric control section velocity transmitters, static pressure transmitters, and flow chart for sequence of operation.
 - 10. Explain and describe in a system performance demonstration procedure, the sequence of tests that will be executed to demonstrate that the system performs all specified and proposed functions. Include in the procedure the method by which system accuracy will be demonstrated.

- C. Certificates: Compliance with Article, QUALITY ASSURANCE.
- D. Control Drawings: Show all connections between the ECC, HVAC system, and associated devices using simple line diagrams. Show and identify all HVAC equipment and control devices for all the air systems. Equipment and control labels shall correspond to those shown on the drawings.
- E. As Built Control Drawings:
 - 1. One set of reproducible drawings.
 - 2. One complete set of prints.
 - 3. One stick-file set of applicable system prints wall mounted in each mechanical room.
- F. Operation and Maintenance (O/M) Manuals):
 - 1. Submit in accordance with Article, INSTRUCTIONS, in Section 01 00 00, GENERAL REQUIREMENTS.
 - 2. Include the following documentation:
 - a. General description and specifications for all components.
 - b. Detailed illustrations and complete calibration procedures.
 - c. One copy of the final version of all software.
 - d. Complete troubleshooting procedures and guidelines for all systems.
 - e. Complete operating instructions for all systems.
 - f. Maintenance Instruction: Document all maintenance and repair/replacement procedures. Replacement procedures shall be documented down to the board level. Provide ordering number for each system component, and source of supply. Provide a list of recommended spare parts needed to minimize downtime.

1.5 INSTRUCTIONS

- A. Instruction to Owner's operations personnel: Perform in accordance with Article, INSTRUCTIONS, in Section 01 00 00, GENERAL REQUIREMENTS.
 - 1. First phase: Formal instruction, for a total of 24 hours, conducted sometime between the completed installation and prior to the performance test period, at a time mutually agreeable to the Contractor and the Architect/Engineer or Owner.
 - 2. Second phase: On the job training during start-up, check-out, and performance test period. On the job training shall consist of facilities personnel working with the Contractor's installation and test personnel on a daily basis. During the performance test period, provide five 8-hour periods of instruction.
 - 3. The O/M Manuals shall contain approved submittals as outlined in Article 1.5, SUBMITTALS, and the controls contractor review the manual contents during second phase of the training. In addition, provide diagrammatic layouts of the DDC systems specified. The layouts shall show all DDC cabinets, all connected mechanical systems, locations and function of each sensor, actuator, and equipment cut sheets of the entire system. O/M Manual shall contain a detailed description of the systems and subsystems and a complete listing of all software programs required to perform the sequence of operation. O/M Manual shall describe all commands, operating and troubleshooting instructions, and routine maintenance procedures to be used with the system.

4. Training by independent or franchised dealers who are not direct employees of the temperature control company will not be acceptable.

1.6 JOB CONDITIONS (ENVIRONMENTAL CONDITIONS OF OPERATION)

- A. The ECC and immediate peripheral devices and system support equipment shall be designed to operate in ambient conditions of 20° to 35 °C (65° to 90 °F) at a relative humidity of 20 to 80 percent non-condensing.
- B. Remote equipment:
 1. The DCP's and all associated equipment shall be designed to operate in ambient conditions of 0 to 50 °C (32 to 120 °F) at a relative humidity of 10 to 90 percent non-condensing.
 2. Digital controllers (CU's) shall operate properly with power fluctuations of plus 10 percent to minus 15 percent of nominal supply voltage.
 3. Sensors and controlling devices shall be designed to operate in the environment which they are sensing or controlling but not less severe than for DCP's.
 4. All digital controllers shall be properly mounted and organized in a grounded UL Listed NEMA 1 // NEMA 4 // cabinet (panel). The cabinet shall protect digital controllers from dust, liquids, or accidental blows. The cabinet shall be metal or high strength resin plastic conforming to UL 94 and UL916.

1.7 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. Federal Specifications (Fed. Spec.):
GG-T-321D(2) Thermometers, Self-Indication, liquid-in-glass for Machinery and Piping Systems
- C. American National Standards Institute (ANSI):
B16.22-80 Wrought Copper and Copper Alloys-Solder Joint Pressure Fittings
B19.3-86 Safety Standard for Compressors for Process Industries
- D. American Society of Mechanical Engineers (ASME):
SEC VIII D1-89 Pressure Vessels, Division 1
SEC VIII DI-89 Pressure Vessels, Division 1, Addenda
- E. American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc. (ASHRAE):
1992 HVAC Systems and Equipment Handbook
- F. American Society for Testing and Materials (ASTM):
B888-89 Seamless Copper Water Tubes
B280-88 Seamless Copper Tube for Air Conditioning and Refrigeration Field Service
B486-74 Paste Solder
D635-88 Rate of Burning and/or Extent and Time of Burning of Self-Supporting Plastics in a Horizontal Position
D1693-70 Environmental Stress-Cracking of Ethylene Plastics
- G. Instrument Society of America (ISA):
57.3-75 Quality Standard for Instrument Air (R1981)

- H. National Fire Protection Association (NFPA):
70-96 National Electrical Code
90A-96 Installation of Air Conditioning and Ventilating Systems
- I. Federal Communications Commission (FCC):
Rules and Regulations Volume II - July 1986, Part A Class A Radio Frequency Devices
- J. Underwriters Laboratories (UL):
UL 94-80 Test for Flammability of Plastic Materials for Parts in Devices and Appliances (Third Edition)
UL 555S-83 Leakage Rated Dampers for Use in Smoke Control Systems (First Edition)
UL 916 Energy Management
UL 294 Access Control Systems Units
UL 864 Control Units for Fire-Protective Signaling Systems
UL 1076 Proprietary Burglar Alarm Units and Systems

PART 2 – PRODUCTS

2.1 DIRECT DIGITAL CONTROL SYSTEM

- A. Provide a DDC system as a distributed control system. The system shall have stand-alone direct digital controllers (CU's), a communications network, and the Engineering Control Center (ECC) which includes as a minimum a personal computer (600 MHz, 40 GB hard drive), 19" monitor, laser printer and all system and operating software.
- B. To prevent a single-failure catastrophe, and to minimize the effect of a digital controller failure, multiple CU's shall be provided. Failure of any single controller shall have no effect on other controllers, except where global strategy is involved. The DDC network shall automatically reconfigure on a network break to ensure survivability of global communications among remaining CU's on the network. Failure of the ECC shall have no effect on other controllers, including those involved in global strategies. There could be more than one type of CU for specific applications. For example Auxiliary control units (ACU's) for air handling units shall support, but not necessarily limited to, all the necessary points inputs and outputs to perform the specified control sequences in a totally stand-alone fashion, or unitary control units (UCU's) for VAV boxes, fan coil units, converters, and chillers, etc. address specific applications pertaining to these equipment. These units shall connect to field sensors and control devices. The other type of digital controller could be a remote control unit (RCU) supervising air handling unit controllers and unitary control units. The remote control units RCU's shall communicate with other RCU's and with the ECC over a local network, and shall provide general purpose control functions, global control functions, and history recording function. The RCU's and their associated control units shall communicate over a dedicated communication circuit. Provide the quantity of digital controllers indicated on the drawings that will perform required climate control.
- C. Separate digital controllers shall be provided where shown on the drawings as minimum requirements at least one CU per mechanical room. Additional CU's may be provided as contractor's option.
- D. Direct digital controllers (CU's) shall be microprocessor based with all hardware, software, and communications interfaces. CU's shall have access to data within the network as needed in order to accomplish required global control strategies. Communication shall not be depended upon the ECC. If communication between RCU's or between and RCU and the ECC is disrupted, remaining CU's shall continue to operate in stand-alone mode. Likewise, if communication between an ACU and it's connected

RCU, or between a UCU and its connected RCU is disrupted, remaining CU's shall continue to operate in stand-alone mode. The RCU controllers shall each be either 32 bit or 16 bit microprocessors configured in a true distributed manner where input-output processing is a function of the DDC controller. ACU and UCU controller shall be 8 bit or 16 bit or 32 bit microprocessors as necessary to perform required functions. Remote "slave" gathering panels are not acceptable.

1. The controller shall be modular and wired in a NEMA 4 enclosed Distributed Control Panel (DCP) complete with all relays digital to analog converters, and terminal strips. RCU's shall have sufficient memory, but not less than 1 megabyte and a minimum of 20% spare capacity of its I/O functions. The type of spares shall be in the same proportion as the implemented I/O functions on the panel, but in no case shall there be less than two spare points of each implemented I/O type. The panel I/O functions shall be furnished complete, with no changes or addition necessary to support implementation of space functions. ACU's shall also have a minimum of 10% of its I/O functions as spare capacity.
2. The controllers and I/O function boards shall be designed to operate in the environmental ambient conditions noted in paragraph 1.7B.
3. The system shall utilize EPROM or EEPROM and RAM memory. All DDC algorithms and parameters shall be RAM or EEPROM based for ready access for modification and adjustment. RAM memory shall be provided with 72 hours battery backup minimum. Digital controllers that are downloaded automatically following power fail/restart or that have non-volatile RAM need not have battery back up.
4. Provide hardware resident clock with each central plant/air handling unit and each controller on the highest level local area network (LAN) which shall have its clock backed up by a battery or a capacitor with sufficient capacity to maintain clock operation for a minimum of 72 hours during normal power outage.

E. Input/Output Equipment:

1. Input/Output (I/O) modules shall accept industrial platinum resistance sensors. Analog input resolution shall be 12 bit; 8 bit resolution controllers are not acceptable. Each output point shall be provided with a light emitting diode (LED) which shall indicate status (on-off) of digital outputs. Analog outputs must be true analog for proportional output control. In lieu of LEDs, individual two inch analog or one inch digital display indicators shall be located at each device or at the nearest associated CU. The status and position indication may also be presented on a portable hand held display device. Processor software shall allow for scaling and for calibration of sensor lead length variations to insure display accuracies.
2. The following table indicates the type of sensors and signal that shall be used for input/output to the direct digital controllers. Reference the Hardware section of these specifications for further sensor requirements. Thermistor or thermocouple inputs are not acceptable for ACU's and RCU's. Thermistors may be used for application specific unitary controllers (UCU's) where any non-linear thermistor characteristic is compensated for in software.

| SENSOR/OUTPUT DEVICE | SENSOR RANGE |
|-------------------------|-----------------------|
| RTDs w/Transmitters | 0420 ma, 0-10VDC |
| Platinum Element Direct | 1000 or 3000 ohm |
| RTD or Balco Direct | 500 or 1000 ohm |
| E/P Output Transducer | 20-103 kPa (3-15 PSI) |

| | |
|------------------------------|----------------------|
| Relative Humidity | 4-20 ma, 0-10V, 0-1V |
| Pressure | 4-20 ma, 0-10V, 0-1V |
| Others-i.e. Current, Voltage | 4-20 ma, 0-10V |

3. The CUs and digital output modules shall be capable of performing two and three state output functions to emulate H-O-A switches and contact closures.
- F. UL Listing:
The Control Unit (CU) shall be listed by Underwriter Laboratories per UL 916, UL 876, and UL 1064.
- F. Communication Ports:
1. Controller to Controller LAN Communication Ports: Controllers in the building DDC system shall be connected in a communications network. Network may consist of more than one level of area network and one level may have multiple drops. Communication network shall permit sharing between controllers of sensor and control information, thereby allowing execution of dynamic control strategies and coordinated response to alarm conditions. Minimum baud rate for the lowest level LAN shall be 9600 Baud. Minimum baud rate for the highest level LAN shall be 9600 Baud. Minimum baud rate for a DDC system consisting of a signal LAN shall be 9600 Baud.
 2. On-Site Interface Ports: Provide a RS-232, RS-485, or RJ-11 communications port for each ACUs and RCUs digital controller that allows direct connection of a computer or PDOT (as defined in para 2.1.G) and through which the controller may be fully interrogated, and for downloading and uploading control programs, modifying programs and program data base, and retrieving or accepting trend reports, messages, and alarms. Controller access shall not be limited to access through another controller. On-site interface communication ports shall be in addition to the communications port(s) supporting controller to controller communications. Communication rate shall be 9600 Baud minimum.
 3. Remote Work Station Interface Port: Provide one additional direct connect computer port in each DDC system for permanent connection of a report operator's work station, unless the workstation is a node on the LAN.
- G. Diagnostic Devices (DD):
1. Diagnostic devices are hand held terminals for communication with the direct digital controllers and the ECC.
 2. Each Control Unit (CU) and ECC shall be supplied with connections to which maintenance personnel can connect portable diagnostic operators (PDOT's) for data display, setpoint modifications, and reloading and modification of controller programs.
- I. Electric Outlet:
1. Provide a single phase, 120 VAC electrical service outlet inside or within 2 meters (6 feet) of the RCU and ACU enclosures for use with test equipment.
- J. Spare Equipment:
1. Provide spare digital controller (CU) boards and spare I/O boards as required. It shall be possible for trained owner personnel to replace CU boards and load software via the PPT and the ECC.

2. Provide a minimum of one spare digital controller board of each type and associated parts including batteries to make at least one complete set of DDC control equipment spares.
3. If I/O boards are separate from the CU boards, provide two spare I/O boards for each spare CU board provided above.

2.2 DIRECT DIGITAL CONTROLLER SOFTWARE

- A. The DDC system shall be a network of independent stand-alone CU's. Each CU shall be capable of full control of its assigned functions as a completely independent unit. The sequence of control shall be written to include control operations (such as temperature and pressure control loops), time event operations, energy management functions (night set back, early morning heating using gas rooftop unit, reset schedules, and optimum start routines), push button overrides, demand limiting, safeties, and emergency conditions.
 1. The CU operating system software shall be PROM resident and operate independently of the ECC. The operating system shall provide alarm monitoring and reporting, provide control application packages, and contain built-in automatic diagnostic routines.
 2. Each CU shall contain self-diagnostics that continuously monitor the integrity of the system. Any malfunction of the system will be reported to the ECC to inform the operator of the nature of the malfunction of the CU's affected. The controllers shall have memory error checking. Upon detection of a memory error, the CU shall correct the error or halt to prevent erroneous operation. All halts shall be reported to the ECC.
 3. After a power failure and upon a power restoration, the system shall provide automatic sequential restart of equipment based on current program time and program requirements without operator invention.
- B. All temperature control functions shall execute within the stand-alone control units via DDC algorithms. The Owner shall be able to customize control strategies and sequences of operations defining the appropriate control loop algorithms and choosing the optimum loop parameters. The Owner shall be able to make these changes without having to burn new CU EPROMS, all data file information will be held in EEPROM for ease of access and change. Each CU shall include the following stand-alone functions:
 1. Direct Digital Control algorithm and control sequences are to be CU resident and be capable of stand-alone operation independent of the ECC. All DDC programs shall be custom written as required to meet the performance criteria spelled out in the sequence of operation paragraphs for each controlled mechanical system. PID algorithm shall be employed as appropriate to the application and per sequences or operation.
 2. All CU resident DDC programs shall be capable of being enabled or disabled from the ECC. In the enable mode all DDC loops shall be active and output signals shall be routed to the final control elements. In the disable mode all DDC loop calculations shall continue but outputs to actuators shall go to fail safe mode. (When disabled, control outputs shall stay in the same state or position as commanded from the central or until they are manually set to automatic.)
 3. To eliminate integral windup, all PID programs shall automatically invoke integral windup prevention routines whenever the controlled unit is off, under manual control or under control of an EMS or time initiated program.

- C. **Default Value Operation:**
All CU's shall be capable of being programmed to utilized stored default values for assured fail-safe operation of critical processes. Default values shall be invoked upon sensor failure or, if the primary value is normally provided by the central or another CU, by loss of bus communication. Individual application software packages shall be structured to assume a fail-safe condition upon loss of input sensors. Loss of an input sensor shall result in output of a sensor failed message at the central control and command station. Each ACU and RCU shall have capability for local readouts of all functions. The UCUs shall be read remotely.
- D. **Control loops shall be able to utilize any of the following control modes:**
1. Two position (on-off, slow-fast)
 2. Proportional
 3. Proportional plus integral (PI)
 4. Proportional plus integral plus derivative (PID)
- E. **Standard/Tested DDC Control Program Submodules:**
1. The following list is typical of standard direct digital control submodules that have been written, factory tested, and successfully used on many projects. Proof shall be included in the submittal that such project applicable programs standard has been written, tested, and successfully used by the contractor on at least five other projects.
 - a. Sequenceable analog output submodule
 - b. Sequenceable two-position output submodule
 - c. Reset main temperature setpoint submodule
 - d. Single zone control submodule
 - e. Humidity control submodule
 - f. Dewpoint and humidity control submodule
 - g. Highest of two sensors control submodule
 - h. Controller with summer-winter changeover submodule
 - i. Three input controller submodule
 - j. Fan static pressure control submodule
 - k. Static pressure control with return fan reset submodule
 - l. Differential temperature control submodule
 - m. Binary step output submodule
 - n. Step and proportional output submodule
 - o. Single zone control with heating/cooling submodule
 - p. Single input control with Energy Management Control System (EMCS) submodule flow charts
 2. Provide flow charts for each of the project submodule programs at time of submittal.
- F. **System Diagnostics:**
1. System diagnostic software and hardware diagnostic software stored in non-volatile memory shall be provided for the central computer and each remote DCP CU. Each intelligent board within each remote DCP shall independently execute its own cold-start initialization diagnostic routines. These tests shall assure that the board circuitry is operating properly and that the individual boards within the system communicate with each other properly. If any test within the system detects a problem, a message shall be output to the peripheral devices provided the failure is not within the peripheral devices themselves or within the peripheral communication circuitry. Additionally, LED indicators which are visible while the

board is operating shall be provided to localize the fault. The LED indicators shall operate in addition to the peripheral device reporting.

2. Cold-start initialization diagnostics shall be initiated by power-up and operator keyboard request. Additional hardware and software shall be provided to continuously monitor on-line system operation and detect system faults.

G. Application Software:

1. All application software programs, including power demand, shall be distributed throughout the CUs in the system. Distributed software resident in CUs shall be provides for stand-alone operating independent of the ECC and to improve system throughout and response time by reducing the workload on the central control. All CUs shall contain software, compatible with ECC software, as necessary for scheduling and controlling resident programs, and for data file management. All energy management sensor failures shall be immediately reported to the operator. Each unique application program shall be capable of being enabled or disabled by the operator from the PPT and the ECC.
2. Provide the following programs as specified:
 - a. **Option Bid #1: Power Demand Limiting:** Demand limiting program shall be resident in a CU network with the capability of shedding loads via connected CUs which have sheddable loads. System shall accept a pulse input from the demand meters and calculate demand. Program shall provide minimum off, and maximum off limits for each sheddable load. Where required, demand limit shall be changeable on a time of day basis for the required number of demand periods. Sequential startup of all sheddable loads on system startup or after power failure shall be provided. Loads shall be shed on a priority basis: Low priority loads shed first and restored last. Operator alarm message shall be displayed when all loads have been shed and demand is still increasing.
 - b. **Duty Cycle:** A duty cycle program shall be provided to periodically cycle air handling equipment off. Each load shall be assigned an interval period, a maximum off time and a minimum off time. Based on sensed space temperature values and their deviation from comfort limits the amount of off time shall be varied proportionally between the minimum and maximum off times. Where the air handler serves multizones the lowest temperature of the zones served shall determine the off time for heating and the highest temperature of the zones served shall determine the off time for cooling. Cycling shall not occur when space temperatures are outside of assigned comfort limits. Program shall be applicable to heating only, cooling only, and heating/cooling units. The cycle program must be designed to work with and not interfere with other energy management programs (Power Demand). A priority structure must be provided to assure that duty cycle may only turn loads on that it has turned off. The program default mode in case of loss of space sensing shall be that all duty cycle loads are restored to the ON condition.
 - c. **Optimum Start:** Optimum start program shall automatically delay equipment startup based on outdoor temperature, space temperature, and system response to assure that comfort conditions are reached exactly at scheduled occupancy time. The program is to operate in both heating and cooling cycles. An adaptive algorithm is to be employed which will automatically adjust according to past experiences. Algorithm shall be tested and updated every day. The program shall automatically assign longer lead times for weekend and holiday shutdowns. Space temperature input is to be the highest value of zones served in the cooling mode and the lowest of zones served in the heating mode. It

- shall be possible to assign occupancy start times on a per air handler unit basis. Modification of assigned occupancy start times shall be possible via the central operator's terminal.
- d. Event Initiated Programs (EIP): The system shall provide for a minimum of 200 event initiated programs. Event initiators may be any digital data point in the system, real time values, for any analog alarm limit. The EIPs shall be structured so that one initiator may set and reset the EIP as it goes from normal to off-normal and back to normal, or one initiator reset the program, or reset may be manual via the console keyboard. Setting and EIP shall cause a series of start of stop commands to assigned loads to be executed to EIP's points. EIP's programs in the set mode when desired. The operator's terminal shall have read-write capability for initiator load and priority assignment.
- e. Automatic Restart Programming: Motor in "start" mode shall not restart instantaneously when power is restored after failure. Restart shall be sequenced by the CU network restart program.
- 1) Automatic restart of preassigned field equipment upon resumption of commercial power: Provide a computer software program that will restart field device in preassigned sequence upon restoration of commercial power. The program shall execute the appropriate sequential commands to restore the building to a minimal, satisfactory operating condition. The operator shall be able to assigned equipment to be started, on-line, through the keyboard. Indication of commercial power return as well as program initiation shall be displayed and recorded at the printer.
 - 2) Automatic restart of preassigned field equipment upon application of emergency power: Provide a computer software program that will restart field devices upon application of emergency and commercial power resumption, and shall execute the appropriate sequential minimal, satisfactory operating condition under emergency power conditions. The operator shall be able to assign equipment to be started, on-line through the keyboard.
 - 3) Indication of commercial power failure and emergency power as well as program availability initiation shall be displayed and recorded at the printer. All field cabinet (DCP) power failures shall be printed. A status message shall be printed whenever emergency or commercial power is restored. A hold interval shall be provided before program channel initiation to allow operator intervention.
- f. Prevention Maintenance Instruction (PMI) programming: A preventative maintenance alarm shall be printed indicating maintenance requirements based on run time. The log shall include all equipment listed in the ECC schedule that have reached limit criteria of calendar-date (month-day-year) or high accumulation of totalized run-time (for points with start/stop or run status indication). Each PMI message shall include point description, limit criteria and preventative maintenance instruction assigned to that limit. A minimum of 480 character PMI shall be provided for each component of units such as air handling units. All criteria, PMI and reset-to-zero assignments shall be operator programmable, on-line at the keyboard. Stagger initial alarms to distribute maintenance throughout the year. Program initial PM alarms as follows:
- 1) Air handling units, run time 2000 hours
 - 2) Prefilters, run time 1000, hours, afterfilters, run time 3000 hours
 - 3) Fans, run time 4000 hours

- 4) All other, calendar time 4 months
- g. Sensor and Control Devices:
- 1) General: Provide all remote sensing points and instrumentation as required for the systems. All sensors shall have accuracies as stated hereinafter.
 - 2) Field wiring for each digital device shall be two or three conductor No. 18 AWG, or larger twisted sets of copper conductors 300 volts, thermoplastic. When line voltage is present in conduits or wiring trays the insulation on all conductors shall be 600 volts. For multiconductor wire having four or more conductors, wire size shall be not less than No. 20 AWG solid copper.
 - 3) Temperature Sensors:
 - a) Temperature sensors shall be of the resistance type. Thermo-couples may be used but shall be restricted to temperature range of 260 °C(500 °F) and above. Temperature sensors located outdoors shall have sun shields.
 - b) The following shall apply to temperature sensors:
 1. Stem or tip sensitive types.
 2. Sensing elements shall be hermetically sealed.
 3. Stem and tip construction shall be 304 stainless steel, copper, glass, or epoxy.
 4. All external trim material shall be corrosion resistant designed for the intended application.
 5. Thermometer wells shall be of bronze, stainless steel, copper, or monel materials. Heat transfer compounds shall be compatible with the sensors. At each sensor location in piping provide a well suitable for a glass stem mercury thermometer.
 6. Sensor accuracy: Sensors are only one element in the overall system accuracy to which the CU can respond. That response includes alarm decision, value display, value calculation on which analog values must be multiplied, subtracted, square rooted, etc. As such, the system end-to-end accuracies are herein stated. Sensors that have a tendency to drift with age shall be supplied with self-correction, therefore, the following range/accuracies are stated:

| <u>Typical Range</u> | <u>Accuracy</u> | <u>Typical Application</u> |
|---|--|----------------------------|
| 0 to 20 deg C (30 to 70 deg F) | plus or minus 0.5 deg C (plus or minus 0.5 deg F) | Chilled Water |
| Minus 40 to 40 deg C (Minus 50 to 100 deg F) | plus or minus 1.0 deg C (plus or minus 1.2 deg F) | O.A. |
| Minus 20 to 40 deg C (1 to 100 deg F) | plus or minus 0.5 deg C (plus or minus 0.7 deg F) | Space Temps |
| 10 to 120 deg C (50 to 250 deg F) | plus or minus 1.0 deg C (plus or minus 1.2 deg F) | General Equip |
| Minus 20 to 260 deg C (0 to 500 deg F) | plus or minus 2.0 deg plus or minus 3.0 deg F | High Temp HW |

7. Sensors for differential temperature readings to be read in BTU (kilojoule) calculations shall be a

matched pair with a differential accuracy of plus of minus 0.1 degrees C (0.1 degrees F).

- 4) Differential pressure sensors:
 - a) The entire assembly shall be constructed to shock, vibration and pressure surges of 170 kPa (25 psi) above scale will neither harm the gauge nor affect its accuracy.
 - b) Sensors shall have the following features:
 1. Software adjustable high and low limits.
 2. Suitability for operation in an ambient temperature range of 0 to 60 degrees C (30 to 140 degrees F).
 3. Accuracy within 5 percent of full scale.
 - c) Flow status of fans and pumps, 370 watts (1/2 hp) and larger, shall be proven by differential pressure switches. Provide software resident time delays to prevent false alarms during starting/stopping including printout and application programs.
- 5) Relative Humidity Sensors: The sensor shall be an analog precision capacitance type relative humidity detector. The sensing element shall be rated for the relative humidity range designed into the building environmental control system. The sensor shall have a constant accuracy of plus or minus 2.0 percent relative humidity.

2.3 ENGINEERING CONTROL CENTER (ECC)

- A. The ECC shall function as the primary operator interface (man-machine) device to the distributed control system. As such, it shall be useable by the operator to provide control over the communication system and monitor all connected digital controllers for change of state, change of value, or no respond conditions. The ECC shall contain software that allows it to be used for preparing data bases for any part of the system, for defining system configuration, for adding and deleting points, and for defining control loops. The ECC software shall also provide for historical data storage, archiving of system databases, downloading of data to the DCPs, alarm reporting, tending and other functions not performed by the distributed control systems. Failure of the ECC shall in no way adversely affect the operation of the overall control system.
- B. The system man-machine interface shall be an easy to use, self-guiding, full graphic, menu penetration approach. Key features that shall be included in the interface are as follows:
 1. Full English data addressing and presentation
 2. Interactive operation and help messages
 3. Organization of points into logical groups
 4. Fill-in-the-blanks programming
 5. On-line data file programming
 6. Segregation of information to appropriate terminals
 7. Five levels of system access for security (password protection)
 8. Pictorial representation of data on color graphic terminals with dynamic data
 9. Capability to alternate between graphic and text displays
 10. Use of Windowing software
 11. All point-related data accessible to user PC software via Microsoft Dynamic Data Exchange (DDE) software feature.
- C. The ECC hardware to be furnished shall consist of a central microcomputer-based operator work station with keyboard, mouse device, 19" color graphic monitor, hard disk,

one high density floppy disks (1.44 megabyte) 3-1/2 inch disk, logging printer, alarm printer, network modem, and a power supply with filtered a.c. input. The system shall be designed so that additional workstations and/or peripheral equipment can be added in the future.

1. The workstation microprocessor shall be DOS or OS/2 and shall not be less than Pentium 600 MHz microprocessor based PC with 164 Mbytes of RAM memory, 40 Gbytes hard disc drive, and 12X speed CD ROM drive, and one 90 mm (3.5 inch) floppy diskette, and a battery backed clock capable of counting seconds, minutes, hours, days, months, and years.
2. Color Monitor: 430 mm (19 inch) nominal, with a minimum resolution of 1024 by 768 pixels, non interlaced, dot pitch 0.28 pitch maximum. The video output card shall have a 1 megabyte video RAM installed and shall be high resolution supporting 1024 by 768 pixels and 256 colors.
3. Keyboards: ASCII standards enhanced 101-key consisting of dedicated function keys and a 12-key numeric data entry section. Keys shall have tactile feedback and be permanently and clearly labeled. In addition, a set of arrow keys shall be provided for moving from the current screen of data to "next screen" and back to "previous screen". The operator interface shall minimize the use of a typewriter style keyboard through the use of a mouse device, and "point and click" approach to menu selection. Users shall be able to start and stop equipment or change set points from graphical displays through the use of a mouse device.
4. Alarm Printer: The dot matrix printer shall have a minimum 96 character standard ASCII character set based on ANSI x3.64 and ANSI x3.154 and dot graphics capability. The printer shall have adjustable sprockets for paper width up to 15 inches, print at least 32 columns per line and have a minimum speed of 100 characters per second. Character spacing shall be selectable at 10, 12, or 17 characters per inch. The printer shall utilize sprocket-fed fanfold paper. The units shall have programmable control of top-of-form. Furnish four cases of printer paper.
5. Logging Printer: The laser printer resolution shall be 300 dots per inch and be provided with a minimum of 2 megabytes of RAM. Printing speed shall be a minimum of eight pages per minute, with a 100 sheet paper cassette and with manual feed. A parallel interface shall be provided for connection to the computer. (1 to 100 deg F).
6. Provide a 110 volt terminal strip with surge protection.

2.4 ECC SOFTWARE

- A. Operator Workstation software shall include but not necessarily be limited to the operating system (OS), database definition process, operator interface, operator-initiated override control program, system services and global command software.
- B. Disk resident alternate control strategies for the distributed direct digital controllers shall be available as required for reloading controller programs of changing control sequences (i.e., a heating season mode of operation and a cooling season mode of operation).
- C. The system shall be completely field programmable from the common operations keyboard thus allowing hard disk storage of all data automatically. All programs for the CUs shall be able to be downline loaded from the hard disk.

1. Provide a real-time multitasking operating system supporting real-time application programs. The OS shall coordinate all task activities and provide the following services as a minimum.
 - a. Input/Output control
 - b. Error Control
 - c. Peripheral I/O device drivers
 - d. Command control
 - e. ECC definition process
 - f. CU definition process
 - g. Upline/downline load
 - h. Communications handler
 - i. Hard disk control
 - j. Floppy disk control 140 mm (5-1/4 inch) and 90 mm (3-1/2 inch)
 - k. Windowing

2. Operator Interface software shall be provided to control display formats, alarm displays and printouts, report formats, interpret keyboard inputs, and requests for data from and commands to remote distributed direct digital control processors.
 - a. The operator interface software shall perform the following monitor functions.
 - 1) Automatic display of and printout of alarms
 - 2) Automatic update of currently displayed data
 - 3) Display of points and groups of points on operator request
 - 4) Display of dynamic data on all graphics
 - 5) Alarm summary reports
 - 6) Trend reports
 - 7) Energy usage report
 - 8) Multiple alarm buffering
 - 9) Historical data retrieval
 - b. The operator interface software shall perform the following control functions:
 - 1) Operator sign-on/sign-off including recognition of five separate levels of access.
 - 2) Assignment of operator levels and passwords.
 - 3) Issuing of manual commands to digital and analog points including DDC setpoints.
 - 4) Assign/delete points or groups from scan.
 - 5) Terminate reports.
 - 6) Manual initiation of diagnostics and time/event programs.
 - 7) Set and display time/data.
 - 8) Initiate top of form and clear screen.
 - 9) Print screen display function.
 - c. Operator interface software shall perform the following Data Fire Modification functions:
 - 1) Password modification
 - 2) Disable/add/change points or logical groups in ECC and CU's
 - 3) Modify schedules
 - 4) Invoke temporary time schedules
 - 5) Enable/disable/add/change programs
 - 6) Enable/disable/add/change time and even program initiators
 - 7) Change/add/modify all DDC parameters
 - 8) Analog limit modification
 - 9) Create new DDC CU strategies
 - 10) Definition of ACU and UCU control parameters through fill-in-the-blank process

- d. Any point in alarm will be identified on the CRT by a flashing condition and reverse video background or by a change in display color. All alarms are to be printed as they occur along with time stamp and a description with a minimum of 32 characters.
- e. For normal operator functions, the system shall display a list of menu items which together with appropriate prompts shall lead the operator through system penetration to the point level.
- f. Request of a log shall result in a menu listing of the reports available to the operator. Reports to be furnished shall be:
 - 1) All Point Report: List by logical group/system the current status of all connected points. The group descriptor shall be printed out as a header followed by a one point per line listing of the points in the group.
 - 2) Each point listed shall have a full point description, capable of printing up to 32 characters, the current state (ON, OFF, NORMAL, or ALARM) and value for analogs or set points 27 deg C (80 deg F) or 15 deg C (60 deg F). For analog inputs the currently assigned high and low limits shall also be recorded. Points which are operator DISABLED, are NOT RESPONDING, or are LOCKED OUT shall list this condition for the point. Points may be assigned to more than one logical group.
 - 3) Alarm Summary Report: A listing of points currently in the alarm state. Points shall be listed by logical groups with the group descriptor as a header followed by the alarm points.
- g. Points listings shall include point description for limits for analog and current state or value, and the assigned limits for analog.
- h. Analog points with alarm limits that float in relationship to control setpoints shall list the assigned differential above and below set point and be uniquely flagged as floating limit points.
 - 1) Trend Report: The system shall allow operator selective tending to disk of not less than 100 different trend groups composed of no less than seven (7) data points in each trend group. The trend interval shall be user selectable, unique for each log of five minutes to 24 hours. A menu driven implementation trend report routine shall be provided to allow user entry of the trend report starting and stopping time and date, as well as menu driven printout retrieval routine. The trend report outputs shall be in column and cure format.
 - 2) Historical Storage and Archiving: The system shall have a hard disk of at least 240 megabytes and shall historically store all system alarm and return to normal events and operator sign ON-OFF activity complete with time stamp. The system shall also include an interactive menu driven sorting routine to allow subsequent printed reports by any selected historical time window and by any selected point, logical group or total system.
 - 3) Historical Loss: All alarms, in addition to immediate visual and audible annunciation on the CRT and printer, shall be time stamped and disk stored. This shall include off normal data base alarms as well as system supervisory alarms.

D. The following control programs shall be provided for definition in the ECC and execution in the CU's.

- 1. A Temporary Scheduler program which will allow the operator to override preset time clock operation of equipment.

2. A Time and Event Program which will initiate a controlled sequence of events for execution at a specific time or upon the occurrence of an event.
 3. System Services: Provide a set of routines to supply common software services to applications and operator interface programs as follows:
 - a. A psychometric routine is to be provided to convert direct measurements of dry bulb and dewpoint or relative humidity (RH) to humidity ratio and enthalpy values usable by the EMS application programs.
 - b. An alarm lockout routine shall be provided to inhibit nuisance alarms.
 - c. A floating alarm limit routine is required which will allow analog alarm limits to automatically adjust upward or downward with application program control or manual adjustment of set points. Alarm differentials above and below setpoint are to be field adjustable.
- E. System Graphics: Graphic system software shall provide graphical representation of the building(s), the building mechanical systems, and the DDC system. The current value and point of every I/O point shall be shown on at least one graphic and its appropriate physical location relative to building and mechanical systems. The intent of the graphic based software is to provide an ergonomic interface to the DDC system that encourages effective and efficient interaction with the system. Overlaying alphanumeric and graphics shall be provided. The keyboard or the mouse device shall provide a means for the operator to reconfigure and create new control graphics, display system schematics, provide graphic and alphanumeric CRT displays, and select color. In addition, the system shall be provided with the following:
1. Graphics shall closely follow the style of the control diagrams showing on the project drawings in representing mechanical systems, sensors, controlled devices, and point names.
 2. Graphics shall have identifying title visible when the graphic is being viewed.
 3. Point data shall update dynamically on the graphics when the workstation is on line with the control system.
 4. For systems without graphics to give the same hierarchical affect provided by graphic penetration.
 5. Graphic based software shall have graphics of the mechanical systems, and shall have capability for additional floor plans, building exterior views and building sections. Mechanical System Graphics: Provide two dimensional drawings to symbolize mechanical equipment; do not use line drawings. Show controlled or sensed mechanical equipment. Each graphic shall consist of a single mechanical system; for example, graphic for an air handling unit, a graphic for a VAV box, a graphic for a heating hot water system, and a graphic for a chilled water system, etc. Place sensors and controlled devices associated with mechanical equipment in their appropriate locations. Place point name and point value adjacent to sensor or controlled device. Provide visual indication of each point in alarm. Condition, such as zone temperature, associated with mechanical system shall be shown on the graphic. Point values shall update dynamically on the graphic.
 6. Operator editing, as recommended by the software supplier, shall be included in the graphic based software. Graphics may be created, deleted, and modified, and text added. Provide capability to store graphic symbols in a symbol directory and incorporate these symbols into graphics. A minimum of 16 colors shall be available. Also, provide full editing capability for deleting, adding, and modifying dynamic point on graphics.
 7. Trend data shall be displayed graphically, with control variable and process variable plotted as functions of time on the same chart. Graphic display of trend data shall be a capability internal to the workstation software and not a capability resulting from download of trend data into a third-party spreadsheet program such as Lotus, unless such transfer is automatic and transparent to the operator,

and the third-party software is included with the workstation software package. At the operator's discretion trend data shall be plotted real time.

F. CCRT Screen Segregation:

1. A portion of the CRT screen shall be dedicated to change of status (COS) displays. A header line is to be provided for information relative to current conditions, and shall continuously display day of week in full English, day, month, and year. Outdoor air temperature, outdoor air relative humidity, and the initials of the operator currently signed on shall be displayed in this dedicated area. The dedicated display shall indicate the type of COS, such as Smoke Alarm, Mechanical Alarm, Mechanical Alarm Acknowledge, and Trouble Condition, followed by the time of concurrence and an appropriate action taken message. Also provide a complete English language description of the point. Description, display and printout shall include physical location, such as Mechanical Bay 4-3 100-AH61 discharge air.
2. Alarm display: Alarm conditions shall generate an audible alarm and cause a flashing alphanumeric display in the dedicated area on the screen. In addition, a graphic diagram of the mechanical system of floor plan associated with alarm shall be automatically indexed. Depressing the execute button shall display the graphic. The displayed graphic shall show all related system points, their values and status. Acknowledgment of the COS condition shall cause the audible to silence. When the alarm is acknowledged the displayed value or status will stop flashing. Multiple alarm occurrences shall be displayed and printed out. The alarms are to be buffered and displayed sequentially in order of priority.
3. The windowing environment of the Operator interface shall allow the user to simultaneous view several graphics at the same time to analyze total building operation, or to allow the display of a graphic associated with an alarm to be viewed without interrupting work in program. The graphic system software shall also have capability to split screen, half portion of the screen with graphical representation and half with sequence of operation of the same HVAC system.
4. The CRT shall display real-time data, allow operator commands, report system activity and shall be capable of performing all programming functions specified.

2.5 SYSTEM SIGNAL TRANSMISSION

- A. All CU input signal circuits shall be in metal conduit or in approved shielding cable or both. All network communications between CUs and from CUs to the ECC must be installed in metal conduit.
1. Communications between RCU controllers shall utilize a commercially available local area network which operates at 2.5 megabaud or faster. The LAN shall be capable of operating at distances of at least 1,000 meters (3300 feet) between most distant nodes. The system shall automatically reconfigure itself upon failure and restoration of line failures. Communication between RCU's and ACU's, and between RCU's and USU's shall be via RS-485 which shall operate at 9600 baud or faster.
 2. Transmission line shall be electrically isolated from the CU's and the ECC at each interface to prevent any voltages in the transmission lines from damaging any of the electronic circuits.

3. Lightning Protection: All cables entering or exiting a building which serve as communication links (DCP to ECC or between DCPs) shall have lightning arrestor networks installed near the point where the cable penetrates the building. Both primary detection devices (such as a three electrode gas type surge arrestor or equal) and secondary protectors shall be installed as a minimum and shall be as required to reduce dangerous voltages to nondamage levels. Fuses are not permitted as communication line lightning protection devices. Suitable forms are zener diodes, optical isolation, varistors and combinations of these with the proper interconnection circuitry. Transient protection shall protect against spikes up to 1000 volts peak voltage with a one microsecond delay time. The protective device shall be automatic, self restarting, and on duty at all times. Circuit design and protective devices shall be selected assuming a maximum of 25 ohms grounding condition.
4. All transmission bus connected devices, DCP's, shall be such that loss of any single device shall not disrupt or interfere with communication to other devices on the bus. Loss of communication with the ECC shall not cause any DCP to halt operation or to cease to perform its intended function (i.e., each DCP shall continue to operate on a stand-alone basis).

B. INTERCOMPUTER COMMUNICATION:

1. Intercomputer communication shall support true global control strategies as well as allow data status and values connected to one DCP to be used within application programs of another DCP.
2. The system shall provide a network communication facility to support global calculation and control strategies to be continuously implemented in the distributed system. The system shall provide for events detected in any area of the total network to initiate commands to any other device within the network. The system shall also provide for connection of calculated data to be continuously shared between any or all controllers within the total network.
3. Provide an industry standard IEEE 802.3 or 802.4 protocol for the highest level LAN. Communications must be of a deterministic nature to assure calculable performance under worst-case network loading.

2.7 THERMOSTATS AND HUMIDISTATS

- A. Room thermostats controlling heating and cooling devices shall have three modes of operation (heating - null or dead band - cooling). Wall mounted thermostats shall have polished or brushed aluminum finish, setpoint and temperature display and external adjustment.
1. Pneumatic thermostats shall be 2-pipe, non-bleed or relay type design fully proportional with adjustable throttling range, setpoint dial stops, adjustable sensitivity setting of 7 to 30 kPa per degree C (1 to 4 psi per degree F), and a test port to measure the output to controlled devices.
 2. Electronic Thermostats:
 - a. Public Space Thermostat: Public space thermostat shall be a platinum sensor and shall not have a visible means of setpoint adjustment. Adjustment shall be via the controller to which it is connected.
 - b. Room thermostats: Provide a platinum space temperature sensor with setpoint adjustment and a setpoint indicator.
- B. Strap-on thermostat shall be enclosed in a dirt-and-moisture proof housing with fixed temperature switching point and single pole, double throw switch.

- C. Freezestat shall have a minimum of 300 mm (one linear foot) of sensing element per 0 to 10 square meter (square foot) of coil area. A freezing condition at any increment of 300 mm (one foot) anywhere along the sensing element shall be sufficient to operate the thermostatic element.
- D. Room Humidistats: Provide fully proportioning humidistats with adjustable throttling range for accuracy of settings and conservation. The humidistats shall have setpoint scales shown in percent of relative humidity located on the instrument. Systems showing moist/dry or high/low are not acceptable.
- E. Room sensor and humidistat covers shall be similar to match room thermostat covers in style.

2.8 FINAL CONTROL ELEMENTS AND OPERATORS

- A. Fail Safe Operation: Design and install control valves and dampers to "fail safe" in either the normally open or normally closed position as required for freeze, moisture, smoke or fire protection.
- B. Spring Ranges: Provide range as required for system sequencing and to provide tight close-off.
- C. Power Operated Control Dampers (other than VAV Boxes): Provide factory fabricated, balanced type dampers. All modulating dampers shall be opposed blade type.
 - 1. Maximum leakage in closed position shall not exceed 7 L/S (15 CFMs) differential pressure for outside air and exhaust dampers and 200 L/S / 1 square meter (40 CFM / sq. ft.) at 50 mm (2 inches) differential pressure for other dampers.
 - 2. Frame shall be galvanized steel channel with seals as required to meet leakage criteria.
 - 3. Blades shall be galvanized steel or aluminum, 200 mm (8 inch) maximum width, with edges sealed as required. Blades for two-position, duct mounted dampers shall be parallel, airfoil (streamlined) type for minimum noise generation and pressure drop.
 - 4. Bearing shall be nylon, bronze sleeve or ball type.
 - 5. Hardware shall be zinc-plated steel. Connected rods and linkage shall be non-slip. Working parts of joints shall be brass, bronze, nylon or stainless steel.

2.9 AIR FLOW CONTROL

- A. Air flow and static pressure shall be controlled via digital controller (CUs) with inputs from air flow control measuring stations and static pressure inputs as specified. Controller outputs shall be true analog output signals to pneumatic positioners. Pulse width modulation outputs are not acceptable. The CUs shall include the capability to control via simple proportional (P) control, proportional plus integral (PI), proportional plus integral plus derivative (PID), and on-off. The air flow control programs shall be factory tested programs that are documented in the literature of the control manufacturer. direct digital controller CU. The differential pressure transducers

PART 3 – EXECUTION

3.1 INSTALLATION

- A. General:

1. Workmanship: Provide properly trained skilled technicians, regularly employed in installation of DDC systems, qualified for the work and directed by experienced engineers.
2. Work Coordination: Section 01 00 00, GENERAL REQUIREMENTS.
3. Electrical Work and Safety Requirements: NFPA 70 and ANSI C2, and referenced electrical sections of these specifications.
4. Wiring: Comply with Section 26 05 00, COMMON WORK RESULTS FOR ELECTRICAL; Section 26 05 33, RACEWAY SYSTEMS; Section 26 05 19, LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES; and, Section 26 27 26, WIRING DEVICES. The term wiring is construed to include furnishing of wire, conduit, miscellaneous material and labor to install a working system. Outdoor installations shall be of waterproof construction or in NEMA 3R or 4 enclosures.
5. Welding and Piping: Perform in accordance with Section 23 20 00, HVAC PIPING AND PUMPS if specified.
6. Except for short apparatus connections, run conduit and pneumatic tubing parallel to or at right angles to the building structure. Conceal conduit and tubing in finished spaces. Pressure test tubing for one hour at 150 percent of working pressure
7. Install pneumatic control tubing underground in conduit of sufficient strength to prevent damage to tubing.
8. Do not run tubing and conduit concealed under insulation or inside ducts. Mount control devices, tubing and conduit located on ducts or apparatus with external insulation on stand-off support to avoid interference with insulation.
9. Run tubing and wire connecting devices on or in control cabinets parallel with the sides of the cabinet neatly racked to permit tracing. Rack connections bridging a cabinet door along hinge side and protect from damage. Provide grommets, sleeves, or vinyl tape to protect plastic tubing or wires from sharp edges of panels, conduit and other items.
10. Equipment and Materials Identification: Section 23 05 00, COMMON WORK RESULTS FOR HVAC.

B. Field Materials:

1. Sensors and Controls:
 - a. Provide all remote sensors and instrumentation.
 - b. Permanently mark terminal blocks for identification. Protect all circuits to avoid interruption of service due to short-circuiting or other conditions. Line-protect all wiring that comes from external sources to the site from lightning and static electricity.
 - c. Label or code each field wire at each end. Permanently label or code each point of all field terminal strips to show the instrument or item served. Color-coded cable with cable diagrams may be used to accomplish cable identification.
 - d. Temperature Sensors:
 - 1) Temperature sensors shall be readily accessible and adaptable to each type of application in such a manner as to permit for quick, each replacement and servicing without special tools or skills. Calibrate sensors to accuracy specified. In no case will sensors designed for one application be installed for another application such as replacing a duct sensor with a room sensor. Room temperature sensor should not be mounted on exterior walls when other locations are available. Mount center line of room sensor at 1.5 meters (5 feet) above finished floor.

- 2) Mount duct sensors in locations to sense the correct temperature of the air only, within the vibration and velocity limits of the sensing element. Mount extended surface element, when used, securely within the duct and position to measure the best average temperature. Do not locate sensors in dead air spaces or positions obstructed by ducts or equipment. Thermally isolate elements from brackets and supports to respond to air temperature only. Surely seal duct penetrations.
- 3) String duct averaging sensors between two rigid supports in a serpentine position to sense average conditions. Thermally isolate the sensing elements from supports.
- 4) Locate freeze protection sensors in appropriate locations to sense lowest temperatures, to avoid potential problems with air stratification.
- 5) Provide outside air temperature sensors on north side of the building, away from exhaust hoods, air intakes and other areas that may effect temperature readings. Provide sun shields to protect outside air sensors from direct sunlight.
- 6) Provide thermometers at locations indicated. Mount thermometers to allow readability when standing on the floor.

2. Damper Actuators: Actuators shall not be mounted in the air stream.

3. Pressure Sensors:

- a. Provide all pressure sensor and gauges.
- b. Install pressure sensing tips in locations to sense appropriate pressure conditions and at locations shown on the drawings.
- c. Install high pressure side of the differential switch between pump discharge and check valve.
- d. Install snubbers and isolation valves on steam pressure sensing applications.

4. Digital Controllers: Install in accordance with manufacturer's published instructions and requirements.

C. Signal Transmission System Equipment:

1. General: Install all system components in accordance with the National Electrical Code and other applicable codes as necessary in accordance with the manufacturer's recommendations.

- a. Splices: Splices in shielded and coaxial cables shall consist of terminations and the use of shielded cable couplers. Terminations shall be in accessible locations. Cables shall be harnessed with cable ties.
- b. Equipment: Fit all equipment contained in cabinets or panels with service loops, each loop being at least 300 mm (12 inches) long. Equipment for fiber optics system shall be rack mounted, as applicable, in ventilated, self-supporting, code gauge steel enclosure. Cables shall be supported for minimum sag.
- c. Cable runs:
 - 1) Keep cable runs as short as possible. Allow extra length fro connecting to the terminal board.
 - 2) Do not bend flexible coaxial cables in a radius less than ten times the cable outside diameter.
 - 3) Use vinyl tape, sleeves, or grommets to protect cables from vibration at points where they pass around sharp corners, through walls, panel cabinets, etc.

2. Grounding: Ground system per manufacturer's requirements for proper and safe operation.

3.2 FIELD TEST AND INSPECTIONS

A. GENERAL

1. Demonstrate function of the heating, ventilating and air-conditioning systems in compliance with the contract documents. Furnish personnel, instrumentation, and equipment necessary to perform calibration and site testing. Ensure that tests are performed by competent employees of the DDC system manufacturer regularly employed in the testing and calibration of DDC systems.
2. Testing will include the field tests and the performance verification tests. Field tests shall demonstrate proper calibration of input and output devices, and the operation of specific equipment. Performance verification tests shall ensure proper execution of the sequence of operation and proper tuning of control loops.
3. Contractor shall schedule the performance verification tests and coordinate with the Architect/Engineer or Owner. Contractor shall also furnish the field test documentation to the Architect/Engineer or Owner that the installed system(s) has been calibrated, tested, and ready for the performance verification test.
4. The testing shall not be done during scheduled seasonal off-periods of heating and cooling systems.

B. Field Testing and Performance Verification Tests:

1. Document all tests with detailed test results. Explain in detail the nature of each failure and corrective action taken.
2. During and after completion of the Field Tests, and again after the performance verification test, identify, determine causes, replace, repair, or calibrate equipment that fails to meet the contract specification, and deliver a written report to Owner.
3. Application Software Operation Test:
 - a. Test application software for ability to communicate with the digital controllers, uploading and downloading of control programs.
 - b. Demonstrate the software ability to edit the control program off line.
 - c. Demonstrate reporting of alarm conditions for each alarm and ensure that workstations receives these alarms.
 - d. Demonstrate ability of software to receive an save trend and status reports.
4. Performance Verification Test:
 - a. Conduct the performance verification tests to demonstrate control system maintain setpoints, control loops are tuned, and controllers are programmed for the correct sequence of operation. Conduct performance verification test during --- of continuous HVAC and DDC systems operation and before final acceptance of work. The performance verification test shall demonstrate the following as a minimum:
 - 1) Furnish the graphed trends to show the sequence of operation is executed in correct order. And that the HVAC system operates

properly through the complete sequence of operation, for example seasonal, occupied/unoccupied, warm up.

- 2) Demonstrate hardware interlocks and safeties work, and that the control system perform the correct sequence of control after a loss of power.
- 3) Furnish the graphed trends of control loops to demonstrate the control loop is stable and that setpoint is maintained. Control loop response shall respond to setpoints and stabilize in 1 minute. Control loop trend data shall be instantaneous and the time between data points shall not be greater than 1 minute.

C. Inspection and Adjustment:

1. Observe the HVAC system in its shut down condition. Check dampers and valves for proper normal positions. Document each position for the test report.
2. Check the operation of each output to verify correct operation. Command digital outputs on and off. Command analog outputs to minimum range, such as 4mA, and maximum range--10mA, measure and record commanded and actual values. Document each command and result for the test report.
3. With the digital controller, apply a control signal to each actuator and verify that the actuator operates properly from its normal position to full range of stroke position. Record actual spring ranges and normal positions for all modulating control valves and dampers. Include documentation in the test report.
4. Demonstrate that programming is not lost after power failure, and digital controllers automatically resume proper control after a power failure.

D. Signal Transmission System Equipment:

1. Ground Rod Tests: Before any wire is connected to the ground rods, use a portable ground testing instrument to test each ground or group of grounds.
2. Coaxial Cable Tests: Implement NEMA WC41 as a minimum.

E. Performance Tests: Perform in accordance with Article, QUALITY ASSURANCE.

F. Instructions: Article, INSTRUCTIONS.

END OF SECTION

SECTION 23 21 13 - HYDRONIC PIPING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Water piping to connect HVAC equipment, including the following:
 - 1. Chilled water, condenser water, heating hot water and drain piping.
 - 2. Extension of domestic water make-up piping.
 - 3. Glycol-water piping.

1.2 RELATED WORK

- A. Section 01 00 00 – General Requirements
- B. Section 01 33 23 – Shop Drawings, Product Data, and Samples
- C. Section 23 05 11 – Common Work Results for HVAC: General mechanical requirements and items, which are common to more than one section of Division 23.
- D. Section 23 21 23 – Hydronic Pumps: Pumps.
- E. Section 23 07 00 – HVAC Insulation
- F. Section 23 60 00 – Central Cooling Equipment

1.3 QUALITY ASSURANCE

- A. Section 23 05 00, COMMON WORK RESULTS FOR HVAC, which includes welding qualifications.
- B. Submit prior to welding of steel piping a certificate of Welder's certification. The certificate shall be current and not more than one year old.
- C. For mechanical pressed sealed fittings, only tools of fitting manufacturer shall be used.
- D. Mechanical pressed fittings shall be installed by factory trained workers.
- E. All grooved joint couplings, fittings, valves, and specialties shall be the products of a single manufacturer. Grooving tools shall be the same manufacturer as the grooved components.
 - 1. All castings used for coupling housings, fittings, valve bodies, etc., shall be date stamped for quality assurance and traceability.

1.4 SUBMITTALS

- A. Submit in accordance with Division 01.
- B. Manufacturer's Literature and Data:
 - 1. Pipe and equipment supports.
 - 2. Pipe and tubing, with specification, class or type, and schedule.
 - 3. Pipe fittings, including miscellaneous adapters and special fittings.

4. Flanges, gaskets and bolting.
 5. Grooved joint couplings and fittings.
 6. Valves of all types.
 7. Strainers.
 8. Flexible connectors for water service.
 9. Pipe alignment guides.
 10. Expansion joints.
 11. Expansion compensators.
 12. All specified hydronic system components.
 13. Water flow measuring devices.
 14. Gages.
 15. Thermometers and test wells.
 16. Electric heat tracing systems.
- C. Manufacturer's certified data report, Form No. U-1, for ASME pressure vessels:
1. Heat Exchangers (Water to Water)
 2. Air separators.
 3. Expansion tanks.
- D. Submit the welder's qualifications in the form of a current (less than one year old) and formal certificate.
- E. Coordination Drawings: Refer to Article, SUBMITTALS of Section 23 05 00, COMMON WORK RESULTS FOR HVAC.
- F. As-Built Piping Diagrams: Provide drawing as follows for chilled water, condenser water, and heating hot water system and other piping systems and equipment.
1. One wall-mounted stick file with complete set of prints. Mount stick file in the chiller plant or control room along with control diagram stick file.
 2. One complete set of reproducible drawings.
 3. One complete set of drawings in electronic Autocad and pdf format.

1.5 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only. American National Standards Institute, Inc.
- B. American Society of Mechanical Engineers/American National Standards Institute, Inc. (ASME/ANSI):
- | | |
|-------------------|--|
| B1.20.1-83(R2006) | Pipe Threads, General Purpose (Inch) |
| B16.4-06 | Gray Iron Threaded Fittings B16.18-01 Cast Copper Alloy Solder joint Pressure fittings |
| B16.23-02 | Cast Copper Alloy Solder joint Drainage fittings |
| B40.100-05 | Pressure Gauges and Gauge Attachments |
- C. American National Standards Institute, Inc./Fluid Controls Institute (ANSI/FCI):
- | | |
|-----------|----------------------------|
| 70-2-2006 | Control Valve Seat Leakage |
|-----------|----------------------------|
- D. American Society of Mechanical Engineers (ASME):
- | | |
|------------|---|
| B16.1-98 | Cast Iron Pipe Flanges and Flanged Fittings |
| B16.3-2006 | Malleable Iron Threaded Fittings: Class 150 and 300 |
| B16.4-2006 | Gray Iron Threaded Fittings: (Class 125 and 250) |

| | |
|------------|--|
| B16.5-2003 | Pipe Flanges and Flanged Fittings: NPS ½ through NPS 24 Metric/Inch Standard |
| B16.9-07 | Factory Made Wrought Butt Welding Fittings |
| B16.11-05 | Forged Fittings, Socket Welding and Threaded |
| B16.18-01 | Cast Copper Alloy Solder Joint Pressure Fittings |
| B16.22-01 | Wrought Copper and Bronze Solder Joint Pressure Fittings. |
| B16.24-06 | Cast Copper Alloy Pipe Flanges and Flanged Fittings |
| B16.39-06 | Malleable Iron Threaded Pipe Unions |
| B16.42-06 | Ductile Iron Pipe Flanges and Flanged Fittings |
| B31.1-08 | Power Piping |

| | |
|--------------------|--|
| E. | American Society for Testing and Materials (ASTM): |
| A47/A47M-99 (2004) | Ferritic Malleable Iron Castings |
| A53/A53M-07 | Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless |
| A106/A106M-08 | Standard Specification for Seamless Carbon Steel Pipe for High-Temperature Service |
| A126-04 | Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings |
| A183-03 | Standard Specification for Carbon Steel Track Bolts and Nuts |
| A216/A216M-08 | Standard Specification for Steel Castings, Carbon, Suitable for Fusion Welding, for High Temperature Service |
| A234/A234M-07 | Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service |
| A307-07 | Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength |
| A536-84 (2004) | Standard Specification for Ductile Iron Castings |
| A615/A615M-08 | Deformed and Plain Carbon Steel Bars for Concrete Reinforcement |
| A653/A 653M-08 | Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) By the Hot-Dip Process |
| B32-08 | Standard Specification for Solder Metal |
| B62-02 | Standard Specification for Composition Bronze or Ounce Metal Castings |
| B88-03 | Standard Specification for Seamless Copper Water Tube |
| B209-07 | Aluminum and Aluminum Alloy Sheet and Plate |
| C177-04 | Standard Test Method for Steady State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded Hot Plate Apparatus |
| C478-09 | Precast Reinforced Concrete Manhole Sections |
| C533-07 | Calcium Silicate Block and Pipe Thermal Insulation |
| C552-07 | Cellular Glass Thermal Insulation |
| D3350-08 | Polyethylene Plastics Pipe and Fittings Materials |
| C591-08 | Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation |
| D1784-08 | Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compound |
| D1785-06 | Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80 and 120 |
| D2241-05 | Poly (Vinyl Chloride) (PVC) Pressure Rated Pipe (SDR Series) |
| F439-06 | Standard Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80 |
| F441/F441M-02 | Standard Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80 |
| F477-08 | Elastomeric Seals Gaskets) for Joining Plastic Pipe |

- F. American Water Works Association (AWWA):
 - C110-08 Ductile Iron and Grey Iron Fittings for Water
 - C203-02 Coal Tar Protective Coatings and Linings for Steel Water Pipe Lines Enamel and Tape Hot Applied
- G. American Welding Society (AWS):
 - B2.1-02 Standard Welding Procedure Specification
- H. Copper Development Association, Inc. (CDA):
 - CDA A4015-06 Copper Tube Handbook
- I. Expansion Joint Manufacturer's Association, Inc. (EJMA):
 - EMJA-2003 Expansion Joint Manufacturer's Association Standards, Ninth Edition
- J. Manufacturers Standardization Society (MSS) of the Valve and Fitting Industry, Inc.:
 - SP-67-02a Butterfly Valves
 - SP-70-06 Gray Iron Gate Valves, Flanged and Threaded Ends
 - SP-71-05 Gray Iron Swing Check Valves, Flanged and Threaded Ends
 - SP-80-08 Bronze Gate, Globe, Angle and Check Valves
 - SP-85-02 Cast Iron Globe and Angle Valves, Flanged and Threaded Ends
 - SP-110-96 Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends
 - SP-125-00 Gray Iron and Ductile Iron In-line, Spring Loaded, Center-Guided Check Valves
- K. National Sanitation Foundation/American National Standards Institute, Inc. (NSF/ANSI):
 - 14-06 Plastic Piping System Components and Related Materials
 - 50-2009a Equipment for Swimming Pools, Spas, Hot Tubs and other Recreational Water Facilities – Evaluation criteria for materials, components, products, equipment and systems for use at recreational water facilities
 - 61-2008 Drinking Water System Components – Health Effects
- G. Tubular Exchanger Manufacturers Association: TEMA 9th Edition, 2007

1.6 SPARE PARTS

- A. For mechanical pressed sealed fittings provide tools required for each pipe size used at the facility.

PART 2 – PRODUCTS

2.1 PIPE AND EQUIPMENT SUPPORTS, PIPE SLEEVES, AND WALL AND CEILING PLATES

- A. Provide in accordance with Section 23 05 00, COMMON WORK RESULTS FOR HVAC.

2.2 PIPE AND TUBING

- A. Heating Hot Water, and Glycol-Water, and Vent Piping:
 - 1. Steel: ASTM A53 Grade B, seamless or ERW, Schedule 40.
 - 2. Copper water tube option: ASTM B88, Type K or L, hard drawn.
- B. Extension of Domestic Water Make-up Piping: ASTM B88, Type K or L, hard drawn copper tubing.

- C. Cooling Coil Condensate Drain Piping:
 1. From air handling units: Copper water tube, ASTM B88, Type M, or schedule 40 PVC plastic piping.
 2. From fan coil or other terminal units: Copper water tube, ASTM B88, Type L for runouts and Type M for mains.
- D. Chemical Feed Piping for Condenser Water Treatment: Chlorinated polyvinyl chloride (CPVC), Schedule 80, ASTM F441.
- E. Pipe supports, including insulation shields, for above ground piping: Section 23 05 00, COMMON WORK RESULTS FOR HVAC and STEAM GENERATION.

2.3 FITTINGS FOR STEEL PIPE

- A. 50 mm (2 inches) and Smaller: Screwed or welded joints.
 1. Butt welding: ASME B16.9 with same wall thickness as connecting piping.
 2. Forged steel, socket welding or threaded: ASME B16.11.
 3. Screwed: 150 pound malleable iron, ASME B16.3. 125 pound cast iron, ASME B16.4, may be used in lieu of malleable iron. Bushing reduction of a single pipe size, or use of close nipples, is not acceptable.
 4. Unions: ASME B16.39.
 5. Water hose connection adapter: Brass, pipe thread to 20 mm (3/4 inch) garden hose thread, with hose cap nut.
- B. 65 mm (2-1/2 inches) and Larger: Welded or flanged joints. Contractor's option: Grooved mechanical couplings and fittings are optional.
 1. Butt welding fittings: ASME B16.9 with same wall thickness as connecting piping. Elbows shall be long radius type, unless otherwise noted.
 2. Welding flanges and bolting: ASME B16.5:
 - a. Water service: Weld neck or slip-on, plain face, with 6 mm (1/8 inch) thick full face neoprene gasket suitable for 104 degrees C (220 degrees F).
 - 1) Contractor's option: Convolute, cold formed 150 pound steel flanges, with teflon gaskets, may be used for water service.
 - b. Flange bolting: Carbon steel machine bolts or studs and nuts, ASTM A307, Grade B.
- C. Welded Branch and Tap Connections: Forged steel weldolets, or branchlets and threadolets may be used for branch connections up to one pipe size smaller than the main. Forged steel half-couplings, ASME B16.11 may be used for drain, vent and gage connections.
- D. Grooved Mechanical Pipe Couplings and Fittings (Contractor's Option): Grooved Mechanical Pipe Couplings and Fittings may be used, with cut or roll grooved pipe, in water service up to 110 degrees C (230 degrees F) in lieu of welded, screwed or flanged connections. All joints must be rigid type.
 1. Grooved mechanical couplings: Malleable iron, ASTM A47 or ductile iron, ASTM A536, fabricated in two or more parts, securely held together by two or more track-head, square, or oval-neck bolts, ASTM A449 and A183.
 2. Gaskets: Rubber product recommended by the coupling manufacturer for the intended service.

3. Grooved end fittings: Malleable iron, ASTM A47; ductile iron, ASTM A536; or steel, ASTM A53 or A106, designed to accept grooved mechanical couplings. Tap-in type branch connections are acceptable.

2.4 FITTINGS FOR COPPER TUBING

A. Joints:

1. Solder Joints: Joints shall be made up in accordance with recommended practices of the materials applied. Apply 95/5 tin and antimony on all copper piping.
2. Contractor's Option: Mechanical press sealed fittings, double pressed type, NSF 50/61 approved, with EPDM (ethylene propylene diene monomer) non-toxic synthetic rubber sealing elements for up to 65 mm (2-1/2 inch) and below are optional for above ground water piping only.
3. Mechanically formed tee connection in water and drain piping: Form mechanically extracted collars in a continuous operation by drilling pilot hole and drawing out tube surface to form collar, having a height of not less than three times the thickness of tube wall. Adjustable collaring device shall insure proper tolerance and complete uniformity of the joint. Notch and dimple joining branch tube in a single process to provide free flow where the branch tube penetrates the fitting.

B. Bronze Flanges and Flanged Fittings: ASME B16.24.

C. Fittings: ANSI/ASME B16.18 cast copper or ANSI/ASME B16.22 solder wrought copper.

2.5 FITTINGS FOR PLASTIC PIPING

A. Schedule 40, socket type for solvent welding.

B. Schedule 40 PVC drain piping: Drainage pattern.

C. Chemical feed piping for condenser water treatment: Chlorinated polyvinyl chloride (CPVC), Schedule 80, ASTM F439.

2.6 DIELECTRIC FITTINGS

A. Provide where copper tubing and ferrous metal pipe are joined.

B. 50 mm (2 inches) and Smaller: Threaded dielectric union, ASME B16.39.

C. 65 mm (2 1/2 inches) and Larger: Flange union with dielectric gasket and bolt sleeves, ASME B16.42.

D. Temperature Rating, 99 degrees C (210 degrees F).

E. Contractor's option: On pipe sizes 2" and smaller, screwed end brass ball valves may be used in lieu of dielectric unions.

2.7 SCREWED JOINTS

A. Pipe Thread: ANSI B1.20.

B. Lubricant or Sealant: Oil and graphite or other compound approved for the intended service.

2.8 VALVES

- A. Asbestos packing is not acceptable.
- B. All valves of the same type shall be products of a single manufacturer.
- C. Provide chain operators for valves 150 mm (6 inches) and larger when the centerline is located 2400 mm (8 feet) or more above the floor or operating platform.
- D. Shut-Off Valves
 - 1. Ball Valves (Pipe sizes 2" and smaller): MSS-SP 110, screwed or solder connections, brass or bronze body with chrome-plated ball with full port and Teflon seat at 2760 kPa (400 psig) working pressure rating. Provide stem extension to allow operation without interfering with pipe insulation.
 - 2. Butterfly Valves (Pipe Sizes 2-1/2" and larger): Provide stem extension to allow 50 mm (2 inches) of pipe insulation without interfering with valve operation. MSS-SP 67, flange lug type or grooved end rated 1205 kPa (175 psig) working pressure at 93 degrees C (200 degrees F). Valves shall be ANSI Leakage Class VI and rated for bubble tight shut-off to full valve pressure rating. Valve shall be rated for dead end service and bi-directional flow capability to full rated pressure. Not permitted for direct buried pipe applications.
 - a. Body: Cast iron, ASTM A126, Class B. Malleable iron, ASTM A47 electro-plated, or ductile iron, ASTM A536, Grade 65-45-12 electro-plated.
 - b. Trim: Bronze, aluminum bronze, or 300 series stainless steel disc, bronze bearings, 316 stainless steel shaft and manufacturer's recommended resilient seat. Resilient seat shall be field replaceable, and fully line the body to completely isolate the body from the product. A phosphate coated steel shaft or stem is acceptable, if the stem is completely isolated from the product.
 - c. Actuators: Field interchangeable. Valves for balancing service shall have adjustable memory stop to limit open position.
 - 1) Valves 150 mm (6 inches) and smaller: Lever actuator with minimum of seven locking positions, except where chain wheel is required.
 - 2) Valves 200 mm (8 inches) and larger: Enclosed worm gear with handwheel, and where required, chain-wheel operator.
 - 3) 3. Gate Valves (Contractor's Option in lieu of Ball or Butterfly Valves):
 - a) 50 mm (2 inches) and smaller: MSS-SP 80, Bronze, 1034 kPa (150 psig), wedge disc, rising stem, union bonnet.
 - b) 65 mm (2 1/2 inches) and larger: Flanged, outside screw and yoke. MSS-SP 70, iron body, bronze mounted, 861 kPa (125 psig) wedge disc.
- E. Globe and Angle Valves
 - 1. Globe Valves
 - a. 50 mm (2 inches) and smaller: MSS-SP 80, bronze, 1034 kPa (150 lb.) Globe valves shall be union bonnet with metal plug type disc.
 - b. 65 mm (2 1/2 inches) and larger: 861 kPa (125 psig), flanged, iron body, bronze trim, MSS-SP-85 for globe valves.
 - 2. Angle Valves:

- a. 50 mm (2 inches) and smaller: MSS-SP 80, bronze, 1034 kPa (150 lb.) Angle valves shall be union bonnet with metal plug type disc.
- b. 65 mm (2 1/2 inches) and larger: 861 kPa (125 psig), flanged, iron body, bronze trim, MSS-SP-85 for angle.

F. Check Valves

- 1. Swing Check Valves:
 - a. 50 mm (2 inches) and smaller: MSS-SP 80, bronze, 1034 kPa (150 lb.), 45 degree swing disc.
 - b. 65 mm (2 1/2 inches) and larger: 861 kPa (125 psig), flanged, iron body, bronze trim, MSS-SP-71 for check valves.
- 2. Non-Slam or Silent Check Valve: Spring loaded double disc swing check or internally guided flat disc lift type check for bubble tight shut-off. Provide where check valves are shown in chilled water and hot water piping. Check valves incorporating a balancing feature may be used.
 - a. Body: MSS-SP 125 cast iron, ASTM A126, Class B, or steel, ASTM A216, Class WCB, or ductile iron, ASTM 536, flanged, grooved, or wafer type.
 - b. Seat, disc and spring: 18-8 stainless steel, or bronze, ASTM B62. Seats may be elastomer material.

G. Water Flow Balancing Valves: For flow regulation and shut-off. Valves shall be line size rather than reduced to control valve size.

- 1. Ball style valve.
- 2. A dual purpose flow balancing valve and adjustable flow meter, with bronze or cast iron body, calibrated position pointer, valved pressure taps or quick disconnects with integral check valves and preformed polyurethane insulating enclosure.
- 3. Provide a readout kit including flow meter, readout probes, hoses, flow charts or calculator, and carrying case.

H. Automatic Balancing Control Valves: Factory calibrated to maintain constant flow (plus or minus five percent) over system pressure fluctuations of at least 10 times the minimum required for control. Provide standard pressure taps and four sets of capacity charts. Valves shall be line size and be one of the following designs:

- 1. Gray iron (ASTM A126) or brass body rated 1205 kPa (175 psig) at 93 degrees C (200 degrees F), with stainless steel piston and spring.
- 2. Brass or ferrous body designed for 2067 kPa (300 psig) service at 121 degrees C (250 degrees F), with corrosion resistant, tamper proof, self-cleaning piston/spring assembly that is easily removable for inspection or replacement.
- 3. Combination assemblies containing ball type shut-off valves, unions, flow regulators, strainers with blowdown valves and pressure temperature ports shall be acceptable.
- 4. Provide a readout kit including flow meter, probes, hoses, flow charts and carrying case.

I. Manual Radiator/Convactor Valves: Brass, packless, with position indicator.

2.9 WATER FLOW MEASURING DEVICES

- A. Minimum overall accuracy plus or minus three percent over a range of 70 to 110 percent of design flow. Select devices for not less than 110 percent of design flow rate.

- B. Venturi Type: Bronze, steel, or cast iron with bronze throat, with valved pressure sensing taps upstream and at the throat.
- C. Wafer Type Circuit Sensor: Cast iron wafer-type flow meter equipped with readout valves to facilitate the connecting of a differential pressure meter. Each readout valve shall be fitted with an integral check valve designed to minimize system fluid loss during the monitoring process.
- D. Self-Averaging Annular Sensor Type: Brass or stainless steel metering tube, shutoff valves and quick-coupling pressure connections. Metering tube shall be rotatable so all sensing ports may be pointed down-stream when unit is not in use.
- E. Insertion Turbine Type Sensor: Section 23 09 23, DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC.
- F. Flow Measuring Device Identification:
 - 1. Metal tag attached by chain to the device.
 - 2. Include meter or equipment number, manufacturer's name, meter model, flow rate factor and design flow rate in l/m (gpm).
- G. Portable Water Flow Indicating Meters:
 - 1. Minimum 150 mm (6 inch) diameter dial, forged brass body, beryllium-copper bellows, designed for 1205 kPa (175 psig) working pressure at 121 degrees C (250 degrees F).
 - 2. Bleed and equalizing valves.
 - 3. Vent and drain hose and two 3000 mm (10 feet) lengths of hose with quick disconnect connections.
 - 4. Factory fabricated carrying case with hose compartment and a bound set of capacity curves showing flow rate versus pressure differential.
 - 5. Provide one portable meter for each range of differential pressure required for the installed flow devices.
- H. Permanently Mounted Water Flow Indicating Meters: Minimum 150 mm (6 inch) diameter, or 450 mm (18 inch) long scale, for 120 percent of design flow rate, direct reading in lps (gpm), with three valve manifold and two shut-off valves.

2.10 STRAINERS

- A. Basket or Y Type.
 - 1. Screens: Bronze, monel metal or 18-8 stainless steel, free area not less than 2-1/2 times pipe area, with perforations as follows: 1.1 mm (0.045 inch) diameter perforations for 100 mm (4 inches) and larger: 3.2 mm (0.125 inch) diameter perforations.
- B. Suction Diffusers: Specified in Section 23 21 23, HYDRONIC PUMPS.

2.11 FLEXIBLE CONNECTORS FOR WATER SERVICE

- A. Flanged Spool Connector:
 - 1. Single arch or multiple arch type. Tube and cover shall be constructed of chlorobutyl elastomer with full faced integral flanges to provide a tight seal

without gaskets. Connectors shall be internally reinforced with high strength synthetic fibers impregnated with rubber or synthetic compounds as recommended by connector manufacturer, and steel reinforcing rings.

2. Working pressures and temperatures shall be as follows:
 - a. Connector sizes 50 mm to 100 mm (2 inches to 4 inches), 1137 kPa (165psig) at 121 degrees C (250 degrees F).
 - b. Connector sizes 125 mm to 300 mm (5 inches to 12 inches), 965 kPa (140 psig) at 121 degrees C (250 degrees F).
3. Provide ductile iron retaining rings and control units.

- B. Mechanical Pipe Couplings:
See other fittings specified under Part 2, PRODUCTS.

2.12 EXPANSION JOINTS

- A. Factory built devices, inserted in the pipe lines, designed to absorb axial cyclical pipe movement which results from thermal expansion and contraction. This includes factory-built or field-fabricated guides located along the pipe lines to restrain lateral pipe motion and direct the axial pipe movement into the expansion joints.
- B. Manufacturing Quality Assurance: Conform to Expansion Joints Manufacturers Association Standards.
- C. Bellows - Internally Pressurized Type:
1. Multiple corrugations of Type 304 or Type A240-321 stainless steel.
 2. Internal stainless steel sleeve entire length of bellows.
 3. External cast iron equalizing rings for services exceeding 340 kPa (50 psig).
 4. Welded ends.
 5. Design shall conform to standards of EJMA and ASME B31.1.
 6. External tie rods designed to withstand pressure thrust force upon anchor failure if one or both anchors for the joint are at change in direction of pipeline.
 7. Integral external cover.
- D. Bellows - Externally Pressurized Type:
1. Multiple corrugations of Type 304 stainless steel.
 2. Internal and external guide integral with joint.
 3. Design for external pressurization of bellows to eliminate squirm.
 4. Welded ends.
 5. Conform to the standards of EJMA and ASME B31.1.
 6. Threaded connection at bottom, 25 mm (one inch) minimum, for drain or drip point.
 7. Integral external cover and internal sleeve.
- E. Expansion Compensators:
1. Corrugated bellows, externally pressurized, stainless steel or bronze.
 2. Internal guides and anti-torque devices.
 3. Threaded ends.
 4. External shroud.
 5. Conform to standards of EJMA.
- F. Expansion Joint (Contractor's Option): 2415 kPa (350 psig) maximum working pressure, steel pipe fitting consisting of telescoping body and slip-pipe sections, PTFE modified

polyphenylene sulfide coated slide section, with grooved ends, suitable for axial end movement to 75 mm (3 inch).

- G. Expansion Joint Identification: Provide stamped brass or stainless steel nameplate on each expansion joint listing the manufacturer, the allowable movement, flow direction, design pressure and temperature, date of manufacture, and identifying the expansion joint by the identification number on the contract drawings.
- H. Guides: Provide factory-built guides along the pipe line to permit axial movement only and to restrain lateral and angular movement. Guides must be designed to withstand a minimum of 15 percent of the axial force which will be imposed on the expansion joints and anchors. Field-built guides may be used if detailed on the contract drawings.
- I. Supports: Provide saddle supports and frame or hangers for heat exchanger. Mounting height shall be adjusted to facilitate gravity return of steam condensate. Construct supports from steel, weld joints.

2.13 HYDRONIC SYSTEM COMPONENTS

- A. Heat Exchanger (Water to Water): Shell and tube type, U-bend removable tube bundle, heating fluid in shell, heated fluid in tubes, equipped with support cradles.
 - 1. Maximum tube velocity: 2.3 m/s (7.5 feet per second).
 - 2. Tube fouling factor: TEMA Standards, but not less than 0.001.
 - 3. Materials:
 - a. Shell: Steel.
 - b. Tube sheet and tube supports: Steel or brass.
 - c. Tubes: 20 mm (3/4 inch) OD copper.
 - d. Head or bonnet: Cast iron or steel.
 - 4. Construction: In accordance with ASME Pressure Vessel Code for 861 kPa (125 psig) working pressure for shell and tubes. Provide manufacturer's certified data report, Form No. U-1.
- B. Plate and Frame Heat Exchanger:
 - 1. Fixed frame with bolted removable corrugated channel plate assembly, ASME code stamped for 150 psig working pressure.
 - 2. Corrugated channel plates shall be type 316 or 304 stainless steel.
 - 3. Channel plate ports to be double gasketed to prevent mixing or cross-contamination of hot side and cold side fluids. Gaskets to be EPPM.
 - 4. Channel plate carrying bars to be carbon steel with zinc yellow chromate finish.
 - 5. Fixed frame plates and moveable pressure plates to be corrosion resistant epoxy painted carbon steel.
 - 6. Piping connections 2" and smaller to be carbon steel NPT tappings. Piping connections 4" and larger to be studded port design to accept ANSI flange connections. Connection ports to be integral to the frame or pressure plate.
 - 7. Finished units to be provided with OSHA required, formed aluminum splash guards to enclose exterior channel plate and gasket surfaces.
 - 8. Provide two sets of replacement gaskets and provide one set of wrenches for disassembly of plate type heat exchangers.
 - 9. Performance: As scheduled on drawings.
- C. Optional Heat Transfer Package: In lieu of field erected individual components, the Contractor may provide a factory or shop assembled package of converters, pumps, and other components supported on a welded steel frame. Refer to Section 23 22 13, STEAM and STEAM CONDENSATE HEATING PIPING, for additional requirements

- D. Air Purger: Cast iron or fabricated steel, 861 kPa (125 psig) water working pressure, for in-line installation.
- E. Tangential Air Separator: ASME Pressure Vessel Code construction for 861 kPa (125 psig) working pressure, flanged tangential inlet and outlet connection, internal perforated stainless steel air collector tube designed to direct released air into expansion tank, bottom blowdown connection. Provide Form No. U-1. If scheduled on the drawings, provide a removable stainless steel strainer element having 5 mm (3/16 inch) perforations and free area of not less than five times the cross-sectional area of connecting piping.
- F. Diaphragm Type Pre-Pressurized Expansion Tank: ASME Pressure Vessel Code construction for 861 kPa (125 psig) working pressure, welded steel shell, rust-proof coated, with a flexible elastomeric diaphragm suitable for a maximum operating temperature of 116 degrees C (240 degrees F). Provide Form No. U-1. Tank shall be equipped with system connection, drain connection, standard air fill valve and be factory pre-charged to a minimum of 83 kPa (12 psig).
- G. Closed Expansion (Compression) Tank: ASME Pressure Vessel Code construction for 861 kPa (125 psig) working pressure, steel, rust-proof coated. Provide gage glass, with protection guard, and angle valves with tapped openings for drain (bottom) and plugged vent (top). Provide Form No. U-1.
 - 1. Horizontal tank: Provide cradle supports and following accessories:
 - a. Air control tank fittings: Provide in each expansion tank to facilitate air transfer from air separator, or purger, into tank while restricting gravity circulation. Fitting shall include an integral or separate air vent tube, cut to length of about 2/3 of tank diameter, to allow venting air from the tank when establishing the initial water level in the tank.
 - b. Tank drainer-air charger: Shall incorporate a vent tube, cut to above 2/3 of tank diameter, and drain valve with hose connection draining and recharging with air.
 - 2. Vertical floor-mounted expansion tank: Provide gage glass, system or drain connection (bottom) and air charging (top) tappings. Provide gate valve and necessary adapters for charging system. Tank support shall consist of floor mounted base ring with drain access opening or four angle iron legs with base plates.
- H. Pressure Reducing Valve (Water): Diaphragm or bellows operated, spring loaded type, with minimum adjustable range of 28 kPa (4 psig) above and below set point. Bronze, brass or iron body and bronze, brass or stainless steel trim, rated 861 kPa (125 psig) working pressure at 107 degrees C (225 degrees F).
- I. Pressure Relief Valve: Bronze or iron body and bronze or stainless steel trim, with testing lever. Comply with ASME Code for Pressure Vessels, Section 8, and bear ASME stamp.
- J. Automatic Air Vent Valves (where shown): Cast iron or semi-steel body, 1034 kPa (150 psig) working pressure, stainless steel float, valve, valve seat and mechanism, minimum 15 mm (1/2 inch) water connection and 6 mm (1/4 inch) air outlet. Air outlet shall be piped to the nearest floor drain.

2.14 GAGES, PRESSURE AND COMPOUND

- A. ASME B40.100, Accuracy Grade 1A, (pressure, vacuum, or compound for air, oil or water), initial mid-scale accuracy 1 percent of scale (Qualify grade), metal or phenolic

case, 115 mm (4-1/2 inches) in diameter, 6 mm (1/4 inch) NPT bottom connection, white dial with black graduations and pointer, clear glass or acrylic plastic window, suitable for board mounting. Provide red "set hand" to indicate normal working pressure.

- B. Provide brass lever handle union cock. Provide brass/bronze pressure snubber for gages in water service.
- C. Range of Gages: Provide range equal to at least 130 percent of normal operating range.
 - 1. For condenser water suction (compound): Minus 100 kPa (30 inches Hg) to plus 700 kPa (100 psig).

2.15 PRESSURE/TEMPERATURE TEST PROVISIONS

- A. Pete's Plug: 6 mm (1/4 inch) MPT by 75 mm (3 inches) long, brass body and cap, with retained safety cap, nordel self-closing valve cores, permanently installed in piping where shown, or in lieu of pressure gage test connections shown on the drawings.
- B. Provide one each of the following test items to the Resident Engineer:
 - 1. 6 mm (1/4 inch) FPT by 3 mm (1/8 inch) diameter stainless steel pressure gage adapter probe for extra long test plug. PETE'S 500 XL is an example.
 - 2. 90 mm (3-1/2 inch) diameter, one percent accuracy, compound gage, —100 kPa (30 inches) Hg to 700 kPa (100 psig) range.
 - 3. 0 - 104 degrees C (220 degrees F) pocket thermometer one-half degree accuracy, 25 mm (one inch) dial, 125 mm (5 inch) long stainless steel stem, plastic case.

2.16 THERMOMETERS

- A. Mercury or organic liquid filled type, red or blue column, clear plastic window, with 150 mm (6 inch) brass stem, straight, fixed or adjustable angle as required for each in reading.
- B. Case: Chrome plated brass or aluminum with enamel finish.
- C. Scale: Not less than 225 mm (9 inches), range as described below, two degree graduations.
- D. Separable Socket (Well): Brass, extension neck type to clear pipe insulation.
- E. Scale ranges:
 - 1. Chilled Water and Glycol-Water: 0-38 degrees C (32-100 degrees F).
 - 2. Hot Water and Glycol-Water: -1 – 116 degrees C (30-240 degrees F).

2.17 FIRESTOPPING MATERIAL .

- A. Refer to Section 23 05 00, COMMON WORK RESULTS FOR HVAC and 07 80 00 FIRESTOPPING.

2.18 ELECTRICAL HEAT TRACING SYSTEMS

- A. Systems shall meet requirements of the National Electrical Code (NEC), Section 427.

- B. Provide tracing for outdoor piping subject to freezing temperatures (Below 38 degrees F).
- C. Heat tracing shall be provided to the extent shown on the drawings (Floor plans and Elevations). Heat tracing shall extend below grade to below the defined frost line.
- D. Heating Cable: Flexible, parallel circuit construction consisting of a continuous self-limiting resistance, conductive inner core material between two parallel copper bus wires, designed for cut-to-length at the job site and for wrapping around valves and complex fittings. Self-regulation shall prevent overheating and burnouts even where the cable overlaps itself.
 - 1. Provide end seals at ends of circuits. Wire at the ends of the circuits is not to be tied together.
 - 2. Provide sufficient cable, as recommended by the manufacturer, to keep the pipe surface at 2.2 degrees C (36 degrees F) minimum during winter outdoor design temperature, but not less than the following:
 - a. 75 mm (3 inch) pipe and smaller with 25 mm (1 inch) thick insulation: 4 watts per foot of pipe.
 - b. 100 mm (4 inch) pipe and larger 38 mm (1-1/2 inch) thick insulation: 8 watts per feet of pipe.
- E. Electrical Heating Tracing Accessories:
 - 1. Power supply connection fitting and stainless steel mounting brackets. Provide stainless steel worm gear clamp to fasten bracket to pipe.
 - 2. 13 mm (1/2 inch) wide fiberglass reinforced pressure sensitive cloth tape to fasten cable to pipe at 300 mm (12 inch) intervals.
 - 3. Pipe surface temperature control thermostat: Cast aluminum, NEMA 4 (watertight) enclosure, 13 mm (1/2 inch) NPT conduit hub, SPST switch rated 20 amps at 480 volts AC, with capillary and copper bulb sensor. Set thermostat to maintain pipe surface temperature at not less than 1.1 degrees C (34 degrees F).
 - 4. Signs: Manufacturer's standard (NEC Code), stamped "ELECTRIC TRACED" located on the insulation jacket at 3000 mm (10 feet) intervals along the pipe on alternating sides.

PART 3 - EXECUTION

3.1 GENERAL

- A. The drawings show the general arrangement of pipe and equipment but do not show all required fittings and offsets that may be necessary to connect pipes to equipment, fan-coils, coils, radiators, etc., and to coordinate with other trades. Provide all necessary fittings, offsets and pipe runs based on field measurements and at no additional cost to the government. Coordinate with other trades for space available and relative location of HVAC equipment and accessories to be connected on ceiling grid. Pipe location on the drawings shall be altered by contractor where necessary to avoid interferences and clearance difficulties.
- B. Store materials to avoid excessive exposure to weather or foreign materials. Keep inside of piping relatively clean during installation and protect open ends when work is not in progress.
- C. Support piping securely. Refer to PART 3, Section 23 05 00, COMMON WORK RESULTS FOR HVAC. Install heat exchangers at height sufficient to provide gravity flow of condensate to the flash tank and condensate pump.

- D. Install piping generally parallel to walls and column center lines, unless shown otherwise on the drawings. Space piping, including insulation, to provide 25 mm (one inch) minimum clearance between adjacent piping or other surface. Unless shown otherwise, slope drain piping down in the direction of flow not less than 25 mm (one inch) in 12 m (40 feet). Provide eccentric reducers to keep bottom of sloped piping flat.
- E. Locate and orient valves to permit proper operation and access for maintenance of packing, seat and disc. Generally locate valve stems in overhead piping in horizontal position. Provide a union adjacent to one end of all threaded end valves. Control valves usually require reducers to connect to pipe sizes shown on the drawing. Install butterfly valves with the valve open as recommended by the manufacturer to prevent binding of the disc in the seat.
- F. Offset equipment connections to allow valving off for maintenance and repair with minimal removal of piping. Provide flexibility in equipment connections and branch line take-offs with 3-elbow swing joints where noted on the drawings.
- G. Tee water piping runouts or branches into the side of mains or other branches. Avoid bull-head tees, which are two return lines entering opposite ends of a tee and exiting out the common side.
- H. Provide manual or automatic air vent at all piping system high points and drain valves at all low points. Install piping to floor drains from all automatic air vents.
- I. Connect piping to equipment as shown on the drawings. Install components furnished by others such as:
 - 1. Water treatment pot feeders and condenser water treatment systems.
 - 2. Flow elements (orifice unions), control valve bodies, flow switches, pressure taps with valve, and wells for sensors.
- J. Thermometer Wells: In pipes 65 mm (2-1/2 inches) and smaller increase the pipe size to provide free area equal to the upstream pipe area.
- K. Firestopping: Fill openings around uninsulated piping penetrating floors or fire walls, with firestop material. For firestopping insulated piping refer to Section 07 80 00 FIRESTOPPING..
- L. Where copper piping is connected to steel piping, provide dielectric connections.

3.2 PIPE JOINTS

- A. Welded: Beveling, spacing and other details shall conform to ASME B31.1 and AWS B2.1. See Welder's qualification requirements under "Quality Assurance" in Section 23 05 00, COMMON WORK RESULTS FOR HVAC.
- B. Screwed: Threads shall conform to ASME B1.20; joint compound shall be applied to male threads only and joints made up so no more than three threads show. Coat exposed threads on steel pipe with joint compound, or red lead paint for corrosion protection.
- C. Mechanical Joint: Pipe grooving shall be in accordance with joint manufacturer's specifications. Lubricate gasket exterior including lips, pipe ends and housing interiors to prevent pinching the gasket during installation. Lubricant shall be as recommended by coupling manufacturer.

- D. 125 Pound Cast Iron Flange (Plain Face): Mating flange shall have raised face, if any, removed to avoid overstressing the cast iron flange.
- E. Solvent Welded Joints: As recommended by the manufacturer.

3.3 EXPANSION JOINTS (BELLOWS AND SLIP TYPE)

- A. Anchors and Guides: Provide type, quantity and spacing as recommended by manufacturer of expansion joint and as shown. A professional engineer shall verify in writing that anchors and guides are properly designed for forces and moments which will be imposed.
- B. Cold Set: Provide setting of joint travel at installation as recommended by the manufacturer for the ambient temperature during the installation.
- C. Preparation for Service: Remove all apparatus provided to restrain joint during shipping or installation. Representative of manufacturer shall visit the site and verify that installation is proper.
- D. Access: Expansion joints must be located in readily accessible space. Locate joints to permit access without removing piping or other devices. Allow clear space to permit replacement of joints and to permit access to devices for inspection of all surfaces and for adding.

3.4 LEAK TESTING ABOVEGROUND PIPING

- A. Inspect all joints and connections for leaks and workmanship and make corrections as necessary, to the satisfaction of the Resident Engineer. Tests may be either of those below, or a combination, as approved by the Resident Engineer.
- B. An operating test at design pressure, and for hot systems, design maximum temperature.
- C. A hydrostatic test at 1.5 times design pressure. For water systems the design maximum pressure would usually be the static head, or expansion tank maximum pressure, plus pump head. Factory tested equipment (convertors, exchangers, coils, etc.) need not be field tested. Isolate equipment where necessary to avoid excessive pressure on mechanical seals and safety devices.

3.5 FLUSHING AND CLEANING PIPING SYSTEMS

- A. Water Piping: Clean systems as recommended by reputable suppliers of chemicals..
 - 1. Initial flushing: Remove loose dirt, mill scale, metal chips, weld beads, rust, and like deleterious substances without damage to any system component. Provide temporary piping or hose to bypass coils, control valves, exchangers and other factory cleaned equipment unless acceptable means of protection are provided and subsequent inspection of hide-out areas takes place. Isolate or protect clean system components, including pumps and pressure vessels, and remove any component which may be damaged. Open all valves, drains, vents and strainers at all system levels. Remove plugs, caps, spool pieces, and components to facilitate early debris discharge from system. Sectionalize system to obtain debris carrying velocity of 1.8 m/S (6 feet per second), if possible. Connect dead-end supply and return headers as necessary. Flush bottoms of risers. Install temporary strainers where necessary to protect down-stream equipment. Supply and remove flushing water and drainage by various type hose, temporary and

permanent piping and Contractor's booster pumps. Flush until clean as approved by the Resident Engineer.

2. Cleaning: Using products supplied by reputable suppliers, circulate systems at normal temperature to remove adherent organic soil, hydrocarbons, flux, pipe mill varnish, pipe joint compounds, iron oxide, and like deleterious substances not removed by flushing, without chemical or mechanical damage to any system component. Removal of tightly adherent mill scale is not required. Keep isolated equipment which is "clean" and where dead-end debris accumulation cannot occur. Sectionalize system if possible, to circulate at velocities not less than 1.8 m/S (6 feet per second). Circulate each section for not less than four hours. Blow-down all strainers, or remove and clean as frequently as necessary. Drain and prepare for final flushing.
3. Final Flushing: Return systems to conditions required by initial flushing after all cleaning solution has been displaced by clean make-up. Flush all dead ends and isolated clean equipment. Gently operate all valves to dislodge any debris in valve body by throttling velocity. Flush for not less than one hour.

3.7 WATER TREATMENT

- A. Install water treatment equipment and provide water treatment system piping.
- B. Close and fill system as soon as possible after final flushing to minimize corrosion.
- C. Charge systems with chemicals specified by manufacturer.
- D. Utilize this activity, by arrangement with the Resident Engineer, for instructing VA operating personnel.

3.8 ELECTRIC HEAT TRACING

- A. Install tracing as recommended by the manufacturer.
- B. Coordinate electrical connections.

3.9 OPERATING AND PERFORMANCE TEST AND INSTRUCTION

- A. Refer to PART 3, Section 23 05 00, COMMON WORK RESULTS FOR HVAC and STEAM GENERATION.
- B. Adjust red set hand on pressure gages to normal working pressure.

END OF SECTION

SECTION 23 21 23 - HYDRONIC PUMPS

PART 1 – GENERAL

1.1 DESCRIPTION

- A. Hot water and cooling tower circulating pumps.

1.2 RELATED WORK

- A. Section 23 05 00, COMMON WORK RESULTS FOR HVAC.
- B. Division 26, ELECTRICAL.

1.3 QUALITY ASSURANCE

- A. Circulator Pumps:
 - 1. Components shall be furnished by a single manufacturer and the system shall be the standard cataloged product of the manufacturer.
 - 2. Shop Test: Unit and its component parts shall undergo a thorough electric and hydraulic operating test prior to shipment. Tests shall include a system operating flow test from zero to 100 percent of design flow rate under specified suction and system pressure conditions. Certified performance curves shall be furnished.
- B. Employee Instructions: Furnish the services of a competent, factory-trained engineer or technician for eight hours to instruct operating and maintenance personnel concerning the domestic water booster system.

1.4 SUBMITTALS

- A. Submit in accordance with Section 01 60 00, PRODUCT REQUIREMENTS.
- B. Manufacturer's Literature and Data:
 - 1. Pump:
 - a. Manufacturer and model.
 - b. Operating speed.
 - c. Capacity.
 - d. Characteristic performance curves.
 - 2. Motor:
 - a. Manufacturer, frame and type.
 - b. Speed.
 - c. Current Characteristics and W (HP).
 - d. Efficiency.
- C. Provide certified performance curves.
- D. Certified copies of all the factory and construction site test data sheets and reports.
- E. Complete operating and maintenance manuals including wiring diagrams, technical data sheets and information for ordering replaceable parts:
 - 1. Include complete connection, which indicate all components of the system.
 - 2. Include complete diagrams of the internal wiring for each item of equipment.
 - 3. Diagrams shall have their terminals identified to facilitate installation, operation and maintenance.

1.5 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. National Electrical Manufacturers Association (NEMA):
 - ICS-6-93 Industrial Control and Systems Enclosures
 - 250-91 Enclosures for Electrical Equipment (1000 Maximum)
- C. American Society of Mechanical Engineers (ASME):
 - Boiler and Pressure Vessel Code: 1995
 - Section VIII Pressure Vessels, Division I and II.
- D. Underwriters' Laboratories, Inc. (UL):
 - 508-94 Safety Industrial Control Equipment

PART 2 - PRODUCTS

2.1 CIRCULATING PUMP

- A. Use for hot water and therapeutic pool systems. Pump for hot water system shall be designed for 65 degrees C (150 degrees F) water service. Centrifugal, single stage, constructed to prevent contact of water with metal other than nonferrous, except casing. Driver shall be electric motor, close coupled or connected by flexible coupling.
- B. Mounting shall be either of the following:
 - 1. In-line mounted.
 - 2. Floor mounted set on common bed plate with drip lip.
- C. Casings: Cast iron, vertically or horizontally split.
- D. Impeller: High grade, cast brass or bronze, accurately machined and properly balanced.
- E. Motors: Maximum 40 degrees C ambient temperature rise, drip proof, for operation with current of voltage, phase and cycle shown in schedule on Electrical drawings, conforming to NEMA 250-Type 4. Capacity to be such to operate pump without overloading. In-line pump motors shall not exceed 1800 rpm and be provided with spring mountings or other devices to assure quiet operation.
- F. Pump shall operate continuously with "on-off" switch for shut down.

PART 3 - EXECUTION

3.1 TEST

- A. Make tests under actual or simulated operating conditions and prove full compliance with design and specified requirements. Tests of the various items of equipment shall be performed simultaneously with the system of which each item is an integral part.
- B. When any defects are detected, correct defects and repeat test.

END OF SECTION

SECTION 23 30 00 - HVAC AIR DISTRIBUTION

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Ductwork and accessories for HVAC including the following:
 - 1. Supply air, return air, outside air, exhaust, and relief systems.
- B. Definitions:
 - 1. SMACNA Standards as used in this specification means the HVAC Duct Construction Standards, Metal and Flexible.
 - 2. Seal or Sealing: Use of liquid or mastic sealant, with or without compatible tape overlay, or gasketing of flanged joints, to keep air leakage at duct joints, seams and connections to an acceptable minimum.
 - 3. Duct Pressure Classification: SMACNA HVAC Duct Construction Standards, Metal and Flexible.
 - 4. Exposed Duct, if specified: Exposed to view in a finished room.

1.2 RELATED WORK

- A. Section 23 05 00 – Common Work Results for HVAC
- B. Section 23 05 48 – Vibration Controls for HVAC Piping and Equipment
- C. Section 22 10 00 – Plumbing Piping and Pumps
- D. Section 23 34 00 – HVAC Fans
- E. Section 23 40 00 – HVAC Air Cleaning Devices
- F. Section 23 09 00 – Instrumentation and Control for HVAC
- G. Section 23 05 93 – Testing, Adjusting, and Balancing for HVAC

1.3 QUALITY ASSURANCE

- A. Refer to article, QUALITY ASSURANCE, in Section 23 05 00, COMMON WORK RESULTS FOR HVAC.
- B. Fire Safety Code: Comply with NFPA 90A.
- C. Duct System Construction and Installation: Referenced SMACNA Standards are the minimum acceptable quality.
- D. Duct Sealing, Air Leakage Criteria, and Air Leakage Tests:
 - 1. All ducts shall be sealed as per SMACNA duct sealing requirements in section 1 of SMACNA HVAC Air Duct Leakage Test Manual for actual duct pressure classes shown on the drawings. All ducts less than 500 Pa (2 inches w.g.) pressure classification shall meet requirements of class C seal.
 - 2. At the beginning of the work, leak test representative samples of the duct construction for each pressure class greater than 750 Pa (3 inches w.g.). The

sample specimen shall be minimum 25% of the ductwork of the selected system representing each pressure class, and shall include at least five transverse joints, typical seams, an access door, and at least two typical branch connections and an elbow. The sample specimen shall be part of the actual ductwork to be installed for the project.

3. The leakage amount shall not exceed the permissible leakage rate in CFM per 100 square feet of duct surface for the pressure and leakage classes shown in table below. The permissible leakage rate shall be calculated as per section 4 of SMACNA HVAC Air Duct Leakage Test Manual.

| DUCT CONSTRUCTION CLASS (Representing Pressure Class) | LEAKAGE CLASS |
|--|---------------|
| 2490 pa (10 inches w.g.) and above | 3 |
| 1500 pa (6 inches w.g.) | 6 |
| 1000 pa (4 inches w.g.) | 6 |
| 750 pa (3 inches w.g.) | 12 |

4. Follow leakage testing procedures, test apparatus, and test reports to be submitted to the Resident Engineer as per SMACNA HVAC Air Duct Leakage Test Manual. All tests shall be performed in the presence of the Resident Engineer. The Test and Balance agency shall measure and record duct leakage as specified herein, and shall report any unusual conditions to the Resident Engineer and identify leakage source.
5. If a specimen fails to meet the permissible leakage level, the contractor shall modify all ductwork installed represented by this specimen to bring it into compliance and shall retest it until acceptable leakage is demonstrated to the Architect/Engineer.
6. Tests and re-tests and necessary repairs shall be completed prior to insulation and concealment of ducts.

- E. Duct accessories exposed to the air stream, such as dampers of all types (except smoke dampers) and access openings, shall be of the same material as the duct or provide at least the same level of corrosion resistance.

1.4 SUBMITTALS

- A. Submit in accordance with Division 01.
- B. Manufacturer's Literature and Data:
 1. Rectangular ducts:
 - a. Schedules of duct systems, materials and selected SMACNA construction alternatives for joints, sealing, gage and reinforcement.
 - b. Duct liner.
 - c. Sealants and gaskets.
 - d. Access doors.
 2. Round and flat oval duct construction details:
 - a. Manufacturer's details for duct fittings.
 - b. Duct liner.
 - c. Sealants and gaskets.
 - d. Access sections.
 - e. Installation instructions.
 3. Volume dampers, back draft dampers.
 4. Upper hanger attachments.
 5. Fire dampers, fire doors, and smoke dampers with installation instructions.
 6. Sound attenuators, including pressure drop and acoustic performance.

7. Flexible ducts and clamps, with manufacturer's installation instructions.
 8. Flexible connections.
 9. Air intake/exhaust hoods.
 10. Instrument test fittings.
 11. Perforated distribution plates.
 12. Diffusers, registers, grilles and accessories.
 13. Details and design analysis of alternate or optional duct systems.
- C. Coordination Drawings: Refer to article, SUBMITTALS, in Section 23 05 00, COMMON WORK RESULTS FOR HVAC.

1.5 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. Air Diffusion Council Test Code:
1062R4 Certification, Rating, and Test Manual (1977)
- C. Air Moving and Conditioning Association (AMCA):
500-75 Test Method and Louvers, Dampers and Shutters
- D. American Society for Testing and Materials (ASTM):
A167-94 Standard Specification for Stainless and Heat-Resisting Chromium-Nickel, Steel Plate, Sheet and Strip
A527-90 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Lock-Forming Quality
A569-91 Standard Specification for Steel, Carbon (0.15 Maximum, Percent), Hot-Rolled Sheet and Strip, Commercial Quality
B209-95 Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
C1071-91 Standard Specification for Thermal and Acoustical Insulation (Mineral Fiber, Duct Lining Material)
E84-95 Standard Test Method for Surface Burning Characteristics of Building Materials
- E. National Fire Protection Association (NFPA):
90A-96 Standard for the Installation of Air Conditioning and Ventilating Systems
96-94 Standard for the Installation of Equipment for the Removal of Smoke and Grease-Laden Vapors from Commercial Cooking Equipment
- F. Sheet Metal and Air Conditioning Contractors National Association (SMACNA):
HVAC Duct Construction Standards, Metal and Flexible, 2nd Edition - 1995
HVAC Air Duct Leakage Test Manual, 1st Edition, 1985
Fibrous Glass Duct Construction Standards, 6th Edition - 1992
- G. Underwriters Laboratories, Inc. (UL):
33-87 UL Standard for Safety Heat Responsive Links for Fire Protection Service
181-90 UL Standard for Safety Factory-Made Air Ducts and Connectors
555-90 UL Standard for Fire Dampers
555S-83 UL Standard for Safety Leakage Rated Dampers for Use in Smoke Control Systems

PART 2 - PRODUCTS

2.1 DUCT MATERIALS AND SEALANTS

- A. General: Except for systems specified otherwise, construct ducts, casings, and accessories of galvanized sheet steel, ASTM A527, coating G90; or, aluminum sheet, ASTM B209, alloy 1100, 3003 or 5052.
- B. Specified Corrosion Resistant Systems: Stainless steel sheet, ASTM A167, Class 302 or 304, Condition A (annealed), Finish No. 4 for exposed ducts and Finish No. 2B for concealed duct or ducts located in mechanical rooms.
- C. Optional Duct Materials:
 - 1. PVC Coated Duct: Duct internally coated with PVC may be furnished in lieu of stainless steel for laboratory fume hood or corrosive exhaust duct if specified.
 - a. Duct shall be galvanized sheet steel, ASTM A527, coating G90, coated inside before fabrication with four mil dry film thickness of polyvinyl chloride (PVC) plastic suitable for temperature to 120 °C (250 °F). Material shall comply with UL 181, Class 1 (flame spread rating of not more than 25 and a smoke developed rating of 50 or less in accordance with ASTM E84). Duct exterior may be uncoated or coated with PVC. Provide compatible joint sealant and material for field coating of damaged areas.
 - b. Damper frames, damper blades and shafts, shall be stainless steel or PVC coated galvanized steel, with non-ferrous bearing material.
 - 2. Grease Duct if specified: Double wall Metalbestos Model PS, factory-built grease duct, UL labeled and complying with NFPA 96 may be furnished in lieu of specified materials for kitchen and grill hood exhaust duct. Installation and accessories shall comply with the manufacturers catalog data. Outer jacket of exposed ductwork shall be stainless steel. Square and rectangular duct shown on the drawings will have to be converted to equivalent round size.
- D. Joint Sealing: Refer to SMACNA Standards, paragraph S1.8 and S1.9.
 - 1. Sealant: Elastomeric compound, gun or brush grade, maximum 25 flame spread and 50 smoke developed (dry state) compounded specifically for sealing ductwork as recommended by the manufacturer. Generally provide liquid sealant, with or without compatible tape, for low clearance slip joints and heavy, permanently elastic, mastic type where clearances are larger. Oil base caulking and glazing compounds are not acceptable because they do not retain elasticity and bond.
 - 2. Tape: Use only tape specifically designated by the sealant manufacturer and apply only over wet sealant. Pressure sensitive tape shall not be used on bare metal or on dry sealant.
 - 3. Gaskets in Flanged Joints: Soft neoprene.
- E. Approved factory made joints such as DUCTMATE SYSTEM may be used.

2.2 DUCT CONSTRUCTION AND INSTALLATION

- A. Follow SMACNA HVAC Duct Construction Standards.
- B. Duct Pressure Classes: As shown on the drawings under HVAC schedules.
- C. Seal Classes: As shown on the drawings and in accordance with SMACNA HVAC Air Duct Leakage Test Manual.
- D. Round and Flat Oval Ducts: Furnish duct and fittings made by the same manufacturer to insure good fit of slip joints. When submitted and approved in advance, round and flat

oval duct, with size converted on the basis of equal pressure drop, may be furnished in lieu of rectangular duct design shown on the drawings.

1. Elbows: Diameters 80 through 200 mm (3 through 8 inches) shall be two section die stamped, all others shall be gored construction, maximum 18 degree angle, with all seams continuously welded or standing seam. Coat galvanized areas of fittings damaged by welding with corrosion resistant aluminum paint or galvanized repair compound.
2. Provide bellmouth, conical tees or taps, laterals, reducers, and other low loss fittings as shown in SMACNA Standards.
3. Ribbed Duct Option: Lighter gage round/oval duct and fittings may be furnished provided certified tests indicating that the rigidity and performance is equivalent to SMACNA standard gage ducts are submitted.
 - a. Ducts: Manufacturer's published standard gage, G90 coating, spiral lock seam construction with an intermediate standing rib.
 - b. Fittings: May be manufacturer's standard as shown in published catalogs, fabricated by spot welding and bonding with neoprene base cement or machine formed seam in lieu of continuous welded seams.
4. Provide flat side reinforcement of oval ducts as recommended by the manufacturer and SMACNA Standard S3.13. Because of high pressure loss, do not use internal tie-rod reinforcement unless approved by the Resident Engineer.

M. Fibrous Glass Ducts (only if specified or shown on drawings):

1. Construct ductwork operating at or below 500 Pa (2 inches wg) static pressure, 600 m/min (2000 fpm) velocity and 120 °C (250 °F) air temperature of 25 mm (one inch) thick fibrous glass duct board meeting the requirements of the SMACNA Fibrous Glass Duct Construction Standard.
2. Fabricate and install duct and fittings in accordance with SMACNA Fibrous Glass Duct Construction Standard. Closure systems for longitudinal seams and transverse joints shall be in accordance with procedures necessary to comply with Section III, CLOSURES of the Standard.

N. Casings and Plenums: Construct in accordance with SMACNA Standards Section VI, including curbs, access doors, pipe penetrations, eliminators and drain pans. Access doors shall be hollow metal, insulated, with latches and door pulls, 500 mm (20 inches) wide by 1200 - 1350 mm (48 - 54 inches) high. Provide viewport in the doors where shown. Provide drain for outside air louver plenum. Outside air plenum shall have exterior insulation. Drain piping shall be routed to the nearest floor drain.

O. Volume Dampers: Single blade or opposed blade, multi-louver type as detailed in SMACNA Standards.

P. Duct Hangers and Supports: Refer to SMACNA Standards Section IV. Avoid use of trapeze hangers for round duct.

2.3 DUCT LINER (WHERE INDICATED ON DRAWINGS)

- A. Duct sizes shown on drawings for lined duct are clear opening inside lining.
- B. Rectangular Duct or Casing Liner: ASTM C1071, Type I (flexible), or Type II (board), 25 mm (one inch) minimum thickness, applied with mechanical fasteners and 100 percent coverage of adhesive in conformance with SMACNA, Duct Liner Application Standard.
- C. Round and Oval Duct Liner: Factory fabricated double-walled with 25 mm, (one inch) thick sound insulation and inner perforated galvanized metal liner. Construction shall comply

with flame and smoke rating required by NFPA 90A. Metal liner shall be 1.0 to 0.60 mm (20 to 24 gage) having perforations not exceeding 2.4 mm (3/32 inch) diameter and approximately 22 percent free area. Metal liner for fittings need not be perforated. Assemblies shall be complete with continuous sheet mylar liner, 2 mil thickness, between the perforated liner and the insulation to prevent erosion of the insulation. Provide liner couplings/spacer for metal liner. At the end of insulated sections, provide insulation end fittings to reduce outer shell to liner size. Provide liner spacing/concentricity leaving airway unobstructed.

2.4 DUCT ACCESS DOORS, PANELS AND SECTIONS

- A. Provide access doors, sized and located for maintenance work, upstream, in the following locations:
 - 1. Each duct mounted coil and humidifier.
 - 2. Each fire damper (for link service), smoke damper and automatic control damper.
 - 3. Each duct mounted smoke detector.
 - 4. For cleaning room supply air duct and kitchen hood exhaust duct, locate access doors at 6 m (20 feet) intervals and at each change in duct direction.
- B. Openings shall be as large as feasible in small ducts, 300 mm by 300 mm (12 inch by 12 inch) minimum where possible. Access sections in insulated ducts shall be double-wall, insulated. Transparent shatterproof covers are preferred for uninsulated ducts.
 - 1. For rectangular ducts: Refer to SMACNA Standards (Figure 2-12).
 - 2. For round and flat oval duct: Access sections shall be not less than 1.0 mm (20 gage) housing welded or riveted to a duct section.

2.5 FIRE DAMPERS

- A. Galvanized steel, interlocking blade type, UL listing and label, 1-1/2 hour rating, 70 °C (160 °F) fusible line, 100 percent free opening with no part of the blade stack or damper frame in the air stream.
- B. Fire dampers in fume hood exhaust or wet air exhaust shall be stainless steel construction, all others may be galvanized steel.
 - 1. The damper frame may be of design and length as to function as the mounting sleeve, thus eliminating the need for a separate sleeve, as allowed by UL 555. Otherwise provide sleeves and mounting angles, minimum 1.9 mm (14 gage), required to provide installation equivalent to the damper manufacturer's UL test installation.
 - 2. Submit manufacturer's installation instructions conforming to UL rating test.
 - 3. Combination fire and smoke dampers: Multi-louver or curtain type units meeting all requirements of both dampers shall be used where shown and may be used at the Contractor's option where applicable.

2.6 SMOKE DAMPERS, IF REQUIRED

- A. Maximum air velocity, through free area of open damper, and pressure loss: Low pressure and medium pressure duct (supply, return, exhaust, outside air): 450 m/min (1500 fpm). Maximum static pressure loss: 32 Pa (0.13 inch WG).

- B. Maximum air leakage, closed damper: 0.32 cubic meters /min/square meter (4.0 cfm per square foot) at 750 Pa (3 inches wg) differential pressure.
- C. Minimum requirements for dampers:
 - 1. Meet requirements of Table 6-1 of UL 555S, except the Fire Endurance and Hose Stream Test.
 - 2. Frame: Galvanized steel channel with side, top and bottom stops or seals.
 - 3. Blades: Galvanized steel, parallel type preferably, 300 mm (12 inch) maximum width, edges sealed with neoprene, rubber or felt, if required to meet minimum leakage. Airfoil (streamlined) type for minimum noise generation and pressure drop are preferred for duct mounted dampers.
 - 4. Shafts: Galvanized steel.
 - 5. Bearings: Nylon, bronze sleeve or ball type.
 - 6. Hardware: Zinc plated.
 - 7. Operation: Automatic open/close. No smoke damper that requires manual reset or link replacement after actuation is acceptable. See drawings for required control operation.
- D. Motor operator (actuator): Provide electric automatic control system, externally mounted on stand-offs to allow complete insulation coverage.

2.7 FIRE DOORS

- A. Galvanized steel, interlocking blade type, UL listing and label, 71 °C (160 °F) fusible link, 3 hour rating and approved for openings in Class A fire walls with rating up to 4 hours, 100 percent free opening with no part of the blade stack or damper frame in the air stream.

2.8 FLEXIBLE AIR DUCT CONNECTORS

- A. General: Factory fabricated, complying with NFPA 90A for connectors not passing through floors of buildings. Flexible ducts shall not penetrate any fire or smoke barrier which is required to have a fire resistance rating of one hour or more. Flexible duct length shall not exceed 1.5 m (5 feet). Provide insulated acoustical air duct connectors in supply air duct systems and elsewhere as shown.
- B. Flexible ducts shall be listed by Underwriters Laboratories, Inc., complying with UL 181. Ducts larger than 200 mm (8 inches) in diameter shall be Class 1. Ducts 200 mm (8 inches) in diameter and smaller may be Class 1 or Class 2.
- C. Insulated Flexible Air Duct: Factory made including mineral fiber insulation with maximum C factor of 0.25 at 24 °C (75 °F) mean temperature, encased with a low permeability moisture barrier outer jacket, having a puncture resistance of not less than 50 Beach Units. Acoustic insertion loss shall not be less than 3 dB per 300 mm (foot) of straight duct, at 500 Hz, based on 150 mm (6 inch) duct, of 750 m/min (2500 fpm).
- D. Application Criteria:
 - 1. Temperature range: -18 to 93 °C (0 to 200 °F) internal.
 - 2. Maximum working velocity: 1200 m/min (4000 feet per minute).
 - 3. Minimum working pressure, inches of water gage: 2500 Pa (10 inches) positive, 500 Pa (2 inches) negative.
- E. Duct Clamps: 100 percent nylon strap, 80 kg (175 pounds) minimum loop tensile strength manufactured for this purpose or stainless steel strap with cadmium plated worm gear

tightening device. Apply clamps with sealant and as approved for UL 181, Class 1 installation.

2.9 FLEXIBLE CONNECTIONS

- A. Where duct connections are made to fans and air handling units, install a non-combustible flexible connection of 822 g (29 ounce) neoprene coated fiberglass fabric approximately 150 mm (6 inches) wide. For connections exposed to sun and weather provide hypalon coating in lieu of neoprene. Burning characteristics shall conform to NFPA 90A. Securely fasten flexible connections to round ducts with stainless steel or zinc-coated iron draw bands with worm gear fastener. For rectangular connections, crimp fabric to sheet metal and fasten sheet metal to ducts by screws 50 mm (2 inches) on center. Fabric shall not be stressed other than by air pressure. Allow at least 25 mm (one inch) slack to insure that no vibration is transmitted.

2.10 SOUND ATTENUATING UNITS, IF SPECIFIED

- A. Casing, not less than 1.0 mm (20 gage) galvanized sheet steel, or 1.3 mm (18 gage) aluminum fitted with suitable flanges to make clean airtight connections to ductwork. Sound-absorbent material faced with glass fiber cloth and covered with not less than 0,6 mm (24 gage) or heavier galvanized perforated sheet steel, or 0.85 mm (22 gage) or heavier perforated aluminum. Perforations shall not exceed 4 mm (5/32-inch) diameter, approximately 25 percent free area. Sound absorbent material shall be long glass fiber acoustic blanket meeting requirements of NFPA 90A.
- B. Entire unit shall be completely air tight and free of vibration and buckling at internal static pressures up to 2000 Pa (8 inch water gage) at operating velocities.
- C. Pressure drop through each unit: Not to exceed indicated value at design air quantities indicated.
- D. Submit complete independent laboratory test data showing pressure drop and acoustical performance.
- E. Cap open ends of attenuators at factory with plastic, heavy duty paper, cardboard, or other appropriate material to prevent entrance of dirt, water, or any other foreign matter to inside of attenuator. Caps shall not be removed until attenuator is installed in duct system.

2.11 GRAVITY TYPE AIR INTAKE/EXHAUST HOODS IF SPECIFIED

- A. Aluminum, ASTM B209, louvered, spun, or fabricated using panel sections with roll-formed edges, 13 mm (1/2 inch) mesh aluminum or galvanized welded wire bird screen, with gravity or motorized dampers where shown, accessible interior, designed for 100 mph winds.
- B. See hood schedule on the drawings. Sizes shown designate throat size. Area of hood perimeter opening shall be not less than the throat area.
- C. Dampers For Gravity Ventilators Without Duct Connection: Construct damper of the same material as the ventilator and design to completely close opening or remain wide open. Hold damper in closed position by a brass chain and catch. Extend chains 300 mm (12 inches) below and engage catch when damper is closed.

2.12 PREFABRICATED ROOF CURBS

- A. Galvanized steel or extruded aluminum 350 mm (14 inches) above finish roof service, continuous welded corner seams, treated wood nailer, 40 mm (1-1/2 inch) thick, 48

kg/cubic meter (3 pound/cubic feet) density rigid mineral fiberboard insulation with metal liner, built-in cant strip (except for gypsum or tectum decks). For surface insulated roof deck, provide raised cant strip (recessed mounting flange) to start at the upper surface of the insulation. Curbs shall be constructed for pitched roof or ridge mounting as required to keep top of curb level.

2.13 EQUIPMENT SUPPORTS

- A. Section 23 05 00, COMMON WORK RESULTS FOR HVAC.

2.14 FIRESTOPPING MATERIAL

- A. Refer to Section 07 80 00, FIRESTOPPING.

2.15 THERMOMETER (AIR)

- A. Section 23 09 00, INSTRUMENTATION AND CONTROL FOR HVAC.

2.16 INSTRUMENT TEST FITTINGS

- A. Manufactured type with a minimum 50 mm (two inch) length for insulated duct, and a minimum 25 mm (one inch) length for duct not insulated. Test hole shall have a flat gasket for rectangular ducts and a concave gasket for round ducts at the base, and a screw cap to prevent air leakage.
- B. Provide instrument test holes at each duct or casing mounted temperature sensor or transmitter, and at entering and leaving side of each heating coil, cooling coil, and heat recovery unit.

2.17 AIR OUTLETS AND INLETS

- A. Materials:
 - 1. Steel or aluminum. Provide manufacturer's standard gasket.
 - 2. Exposed Fastenings: The same material as the respective inlet or outlet. Fasteners for aluminum may be stainless steel.
 - 3. Contractor shall review all ceiling drawings and details and provide all ceiling mounted devices with appropriate dimensions and trim for the specific locations.
- B. Performance Test Data: In accordance with Air Diffusion Council code 1062R4. Refer to Section 23 05 48, VIBRATION CONTROLS FOR HVAC PIPING AND EQUIPMENT for NC criteria.
- C. Air Supply Outlets:
 - 1. Ceiling Diffusers: Suitable for surface mounting, exposed T-bar or special tile ceilings, off-white finish, square or round neck connection as shown on the drawings. Provide plaster frame for units in plaster ceilings.
 - a. Square, louver, fully adjustable pattern: Round neck, surface mounting unless shown otherwise on the drawings. Provide equalizing or control grid and volume control damper.
 - b. Louver face type: Square or rectangular, removable core for 1, 2, 3, or 4 way directional pattern. **Provide equalizing or control grid and opposed blade damper.**
 - c. Perforated face type: Manual adjustment for 1, 2, 3, or 4 way horizontal air distribution pattern without change of air volume or pressure. Provide equalizing or control grid and opposed blade over overlapping blade

damper. Perforated face diffusers for VAV systems shall have the pattern controller on the inner face, rather than in the neck and designed to discharge air horizontally at the ceiling maintaining a constant effect.

- d. Slot diffuser/plenum:
 - 1) Galvanized steel boot lined with 13 mm (1/2 inch) thick fiberglass conforming to NFPA 90A and complying to UL 181 for erosion. Form slots or use adjustable pattern controllers, to provide stable, horizontal air flow pattern over a wide range of operating conditions.
 - 2) Provide inlet connection diameter equal to duct diameter shown on drawings or provide transition coupling if necessary.
 - 3) Maximum pressure drop at design flow rate: 37 Pa (0.15 inch) wg.
 - 2. Linear Grilles and Diffusers: Extruded aluminum, manufacturer's standard finish, positive holding concealed fasteners.
 - a. Margin: Flat, 20 mm (3/4 inch) wide.
 - b. Bars: Minimum 5 mm (3/16 inch) wide by 20 mm (3/4 inch) deep, zero deflection unless otherwise shown. Reinforce bars on 450 mm (18 inch) center for sidewall units and on 150 mm (6 inch) center for units installed in floor or sills.
 - c. **Provide opposed blade damper and equalizing or control grid where specified.**
 - 3. Registers: Double deflection type with horizontal face bars and opposed blade damper with removable key operator.
 - a. Margin: Flat, 30 mm (1-1/4 inches) wide.
 - b. Bar spacing: 20 mm (3/4 inch) maximum.
 - c. Finish: Off white baked enamel for ceiling mounted units. Wall units shall have a prime coat for field painting, or shall be extruded with manufacturer's standard finish.
 - 4. Grilles: Same as registers but without the opposed blade damper.
- D. Return and Exhaust Registers and Grilles: Provide opposed blade damper without removable key operator for registers.
- 1. Finish: Off-white baked enamel for ceiling mounted units. Wall units shall have a prime coat for field painting, or shall be extruded aluminum with manufacturer's standard aluminum finish.
 - 2. Standard Type: Fixed horizontal face bars set at 30 to 45 degrees, approximately 30 mm (1-1/4 inch) margin.
 - 3. Perforated Face Type: To match supply units.
 - 4. Grid Core Type: 13 mm by 13 mm (1/2 inch by 1/2 inch) core with 30 mm (1-1/4 inch) margin.
 - 5. Linear Type: To match supply units.
 - 6. Door Grilles: Are furnished with the doors.
 - 7. Filter Grilles: Standard face hinged to a mounting frame with space for a 25 mm (one inch) throwaway filter. Hold face closed by a locking screw. Provide retaining clips to hold filter in place. Provide one inch thick fiberglass throwaway filter.

2.18 WIRE MESH GRILLE

- A. Fabricate grille with 2 x 2 mesh 13 mm (1/2 inch) galvanized steel or aluminum hardware cloth in a spot welded galvanized steel frame with approximately 40 mm (1-1/2 inch) margin.
- B. Use grilles where shown in unfinished areas such as mechanical rooms.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with provisions of Section 23 05 00, COMMON WORK RESULTS FOR HVAC, particularly regarding coordination with other trades and work in existing buildings.
- B. Fabricate and install ductwork and accessories in accordance with referenced SMACNA Duct Construction Standards, Metal & Flexible, 2nd Edition, for 2" W.C. Static Pressure for high pressure ducts:
 - 1. Drawings show the general layout of ductwork and accessories but do not show all required fittings and offsets that may be necessary to connect ducts to equipment, boxes, diffusers, grilles, etc., and to coordinate with other trades. Fabricate ductwork based on field measurements. Provide all necessary fittings and offsets at no additional cost to the owner. Coordinate with other trades for space available and relative location of HVAC equipment and accessories on ceiling grid. Duct sizes on the drawings are outside dimensions which shall be altered by Contractor to other dimensions with the same air handling characteristics where necessary to avoid interferences and clearance difficulties.
 - 2. Provide duct transitions, offsets and connections to dampers, coils, and other equipment in accordance with SMACNA Standards, Section II. Provide streamliner, when an obstruction cannot be avoided and must be taken in by a duct. Repair galvanized areas with galvanizing repair compound.
 - 3. Provide bolted construction and tie-rod reinforcement in accordance with SMACNA Standards, Section VI.
 - 4. Construct casings, eliminators, and pipe penetrations in accordance with SMACNA Standards, Section VI. Design casing access doors to swing against air pressure so that pressure helps to maintain a tight seal.
- C. Install duct hangers and supports in accordance with SMACNA Standards, Section IV.
- D. Install fire dampers in accordance with the manufacturer's instructions to conform to the installation used for the rating test.
- E. Seal openings around duct penetrations of floors and fire rated partitions with fire stop material as required by NFPA 90A.
- F. Flexible duct installation: Refer to SMACNA Standards, Section III. Ducts shall be continuous, single pieces not over 1.5 m (5 feet) long (NFPA 90A), as straight and short as feasible, adequately supported. Centerline radius of bends shall be not less than two duct diameters. Make connections with clamps as recommended by SMACNA. Clamp per SMACNA S3.33 and S3.34 with one clamp on the core duct and one on the insulation jacket. Flexible ducts shall not penetrate floors, or any chase or partition designated as a fire or smoke barrier, including corridor partitions fire rated one hour or two hour. Support ducts SMACNA Standards.
- G. Where diffusers, registers and grilles cannot be installed to avoid seeing inside the duct, paint the inside of the duct with flat black paint to reduce visibility.
- H. Control Damper Installation:
 - 1. Provide necessary blank-off plates required to install dampers that are smaller than duct size. Provide necessary transitions required to install dampers larger than duct size.

2. Assemble multiple sections dampers with required interconnecting linkage and extend required number of shafts through duct for external mounting of damper motors.
 3. Provide necessary sheet metal baffle plates to eliminate stratification and provide air volumes specified. Locate baffles by experimentation, and affix and seal permanently in place, only after stratification problem has been eliminated.
 4. Install all damper control/adjustment devices on stand-offs to allow complete coverage of insulation.
- I. Air Flow Measuring Devices (AFMD), if specified: Install units with minimum straight run distances, upstream and downstream as recommended by the manufacturer.
 - J. Duct Liner: Install in accordance with SMACNA Duct Construction Standards, Metal & Flexible, 2nd Edition, for 2" W.C. Static Pressure and interior liner velocity 2500 fpm to 6000 fpm (Section 2.6).
 - K. Protection and Cleaning: Adequately protect equipment and materials against physical damage. Place equipment in first class operating condition, or return to source of supply for repair or replacement, as determined by Architect/Engineer. Protect equipment and ducts during construction against entry of foreign matter to the inside and clean both inside and outside before operation and painting. When new ducts are connected to existing ductwork, clean both new and existing ductwork by mopping and vacuum cleaning inside and outside before operation.

3.2 DUCT LEAKAGE TESTS AND REPAIR

- A. Perform tests as required. See article, QUALITY ASSURANCE.
- B. Seal all openings in ducts.

END OF SECTION

SECTION 23 34 00- HVAC FANS

PART 1 – GENERAL

1.1 DESCRIPTION

- A. Fans for heating, ventilating and air conditioning.
- B. Product Definitions: AMCA Publication 99, Standard I-66.

1.2 RELATED WORK

- A. Section 23 05 00, COMMON WORK RESULTS FOR HVAC.
- B. Section 23 05 48, VIBRATION CONTROLS FOR HVAC PIPING & EQUIPMENT.

1.3 QUALITY ASSURANCE

- A. Refer to paragraph, QUALITY ASSURANCE, in Section, COMMON WORK RESULTS FOR HVAC.
- B. Fans and power ventilators shall be listed in the current edition of AMCA 26I, and shall bear the AMCA performance seal.
- C. Operating Limits for Centrifugal Fans: AMCA 99 (Class I, II, and III).
- D. Fans and power ventilators shall comply with the following standards:
 - 1. Testing and Rating: AMCA 210.
 - 2. Sound Rating: AMCA 300.
- E. Vibration Tolerance for Fans and Power Ventilators: Section, VIBRATION CONTROLS FOR HVAC PIPING AND EQUIPMENT.
- F. Performance Criteria:
 - 1. The fan schedule shows cubic meters per minute (CFM) and design static pressure. Scheduled fan motors, 0.37 kw (1/2 horsepower) and larger, are sized for design cubic meters per minute (CFM) at 110 percent design static pressure, but not to exceed 185 Pa (3/4-inch) additional pressure.
 - 2. Provide fans and motors capable of stable operation at design conditions and at 110 percent pressure as stated above.
 - 3. Lower than design pressure drop of approved individual components may allow use of a smaller fan motor and still provide the safety factor. When submitted as a deviation a smaller motor may be approved in the interest of energy conservation.
 - 4. Select fan operating point as follows:
 - a. Forward curved and axial fans: Right hand side of peak pressure point.
 - b. Airfoil, backward inclined or tubular: Near the peak of static efficiency.
- G. Safety Criteria: Provide manufacturer's standard screen on fan inlet and discharge exposed to operating and maintenance personnel.
- H. Corrosion Protection:
 - 1. All steel shall be mill-galvanized, or phosphatized and coated with minimum two coats, corrosion resistant enamel paint. Manufacturers paint and paint system

shall meet the minimum specifications of: ASTM D1735 water fog; ASTM B117 salt spray; ASTM D3359 adhesion; and ASTM G23 weathermeter.

I.4 SUBMITTALS

- A. Submit in accordance with Division 01.
- B. Manufacturers Literature and Data:
 - 1. Fan sections, motors and drives.
 - 2. Centrifugal fans, motors, drives, accessories and coatings.
 - a. In-line centrifugal fans.
 - b. Utility fans and vent sets.
 - 3. Prefabricated roof curbs.
 - 4. Roof and wall power ventilators.
 - 5. Centrifugal ceiling fans.
- C. Sound power levels for each fan.
- D. Maintenance and operating manuals in accordance with Division 01.
- E. Fan curves for each fan showing cubic meters per minute (CFM) versus static pressure, efficiency, and horsepower for design point of operation and at 110 percent of design static pressure. Include product application data to indicate the effect of capacity control devices such as inlet vane dampers on flow, pressure and KW (horsepower).

1.5 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. Air Moving and Control Association (AMCA):
 - 99-86 Standards Handbook
 - 210-85 Laboratory Methods of Testing Fans for Rating Purposes
 - 261 Directory of Products Licensed To Bear The AMCA Certified Ratings Seal - Published Annually
 - 300-85 Reverberant Room Method for Sound Testing of Fans
- C. American Society for Testing and Materials (ASTM):
 - B117-94 Standard Method of Salt Spray(Fog) Testing
 - D1735-92 Standard Practice for Testing Water Resistance of Coatings Using Water Fog Apparatus
 - D3359-95 Standard Test Method for Measuring Adhesion by Tape Test
 - G23-95 Standard Practice for Operating Light-Exposure Apparatus(Carbon-Arc Type) with and without Water for Exposure of Non-Metallic Materials
- D. Anti-Friction Bearing Manufacturers Association, Inc. (AFBMA):
 - 9-90 Load Ratings and Fatigue Life for Ball Bearings
- E. National Fire Protection Association (NFPA):
 - NFPA 96-94 Standard for the Installation of Equipment for the Removal of Smoke and Grease-Laden Vapors from Commercial Cooking Equipment
- F. National Sanitation Foundation (NSF):
 - 37-R85 Air Curtains for Entrance Ways in Food Establishments

PART 2 - PRODUCTS

2.1 CENTRIFUGAL FANS

- A. Standards and Performance Criteria: Refer to Paragraph, QUALITY ASSURANCE. Record factory vibration test results on the fan or furnish to the Contractor.
- B. Fan arrangement, unless noted or approved otherwise:
 - 1. DWDI fans: Arrangement 3.
 - 2. SWSI fans: Arrangement I, 3, 9 or I0
- C. Construction: Wheel diameters and outlet areas shall be in accordance with AMCA standards.
 - 1. Housing: Low carbon steel, arc welded throughout, braced and supported by structural channel or angle iron to prevent vibration or pulsation, flanged outlet, inlet fully streamlined. Provide lifting clips, and casing drain. Provide manufacturer's standard access door. Provide 12.5 mm (1/2") wire mesh screens for fan inlets without duct connections.
 - 2. Wheel: Steel plate with die formed blades welded or riveted in place, factory balanced statically and dynamically.
 - 3. Shaft: Designed to operate at no more than 70 percent of the first critical speed at the top of the speed range of the fans class.
 - 4. Bearings: Heavy duty ball or roller type sized to produce a B10 life of not less than 40,000 hours, and an average fatigue life of 200,000 hours. Extend lubrication tubes for interior bearings or ducted units to outside of housing.
 - 5. Motor, adjustable motor base, drive and guard: Furnish from factory with fan. Refer to Section, COMMON WORK RESULTS FOR HVAC for specifications. Provide protective sheet metal enclosure for fans located outdoors.
 - 6. Furnish variable speed fan motor controllers where shown on the drawings. Refer to Section, ELECTRICAL. Refer to Section, COMMON WORK RESULTS FOR HVAC for controller/motor combination requirements.
- D. In-line Centrifugal Fans, if specified: In addition to the requirements of paragraphs A and C, provide inlet and outlet flanges, bolted access door and arrangement I, 4 or 9 supports as required.
- E. Utility Fans, Vent Sets, and Small Capacity Fans, if specified: Class I design, arc welded housing, spun intake cone. Applicable construction specifications, paragraphs A and C, for centrifugal fans shall apply for wheel diameters 300 mm (12 inches) and larger. Requirement for AMCA seal is waived for wheel diameters less than 300 mm (12 inches) and housings may be cast iron.

2.2 PREFABRICATED ROOF CURBS

- A. Construction: Galvanized steel, with continuous welded corner seams, two inch wall thickness, treated wood nailer, 38 mm (1-1/2 inch) thick, 48 kg per cubic meter (3 pound) density rigid mineral fiberboard insulation with metal liner, built-in cant strip, (except for gypsum or tectum decks). For surface insulated roof deck provide raised cant strip to start at the upper surface of the insulation. Curbs shall be built for pitched roof or ridge mounting as required to keep top of curb level. Provide vibration isolation on curb.
- B. Curb Height: 14 inches overall curb height.

2.3 ROOF OR WALL POWER VENTILATOR, IF SPECIFIED

- A. Standards and Performance Criteria: Refer to Paragraph, QUALITY ASSURANCE.

- B. Type: Centrifugal fan, backward inclined blades.
- C. Construction: Steel or aluminum, completely weatherproof, for curb or wall mounting, exhaust cowl or entire drive assembly readily removable for servicing, aluminum bird screen on discharge, UL approved safety disconnect switch, conduit for wiring, vibration isolators for wheel, motor and drive assembly. Provide self acting back draft damper.
- D. Motor and Drive: Refer to Section, COMMON WORK RESULTS FOR HVAC. Bearings shall be pillow block with B-10 average life of 200,000 hours.
- E. Prefabricated Roof Curb: As specified in this section.
- F. TRV Unit: Top discharge exhauster, motor out of air stream, grease trough on base.

2.4 CENTRIFUGAL CEILING FANS (Small Cabinet Fan)

- A. Standards and Performance Criteria: Refer to Paragraph, QUALITY ASSURANCE.
- B. Steel housing, baked enamel finish, direct connected fan assembly, attached grille. Provide back draft assembly, aluminum wall cap and insect screen.
- C. Acoustical Lining: 12.5 mm (One-half inch) thick mineral fiber, dark finish.
- D. Motor: Shaded pole or permanent split capacitor, sleeve bearings, supported by steel brackets in combination with rubber isolators.
- E. Ceiling Grille, (Where indicated): White plastic egg crate design, 80 percent free area.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install fan, motor and drive in accordance with manufacturer's instructions.
- B. Align fan and motor sheaves to allow belts to run true and straight.
- C. Bolt equipment to curbs with galvanized lag bolts.

3.2 PRE-OPERATION MAINTENANCE

- A. Grease bearings.
- B. Rotate impeller by hand and check for shifting during shipment and check all bolts, collars, and other parts for tightness.

3.3 START-UP AND INSTRUCTIONS

- A. Check vibration and correct as necessary for air balance work.
- B. After air balancing is complete and permanent sheaves are in place perform necessary field mechanical balancing to meet vibration tolerance in Section, VIBRATION CONTROLS FOR HVAC PIPING AND EQUIPMENT.

END OF SECTION

SECTION 23 40 00 - HVAC AIR CLEANING DEVICES

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Air filters for heating, ventilating and air conditioning.
- B. Definitions: Refer to ASHRAE 52.1-92 for definitions of face velocity, net effective filtering area, media velocity, resistance (pressure drop), atmospheric dust spot efficiency and dust-holding capacity.

1.2 RELATED WORK

- A. Section 23 05 00, COMMON WORK RESULTS FOR HVAC.
- B. Section 23 60 00, CENTRAL COOLING EQUIPMENT.

1.3 QUALITY ASSURANCE

- A. Air Filter Performance Report For Extended Surface Filters:
 - 1. Submit a test report for each Grade of filter being offered. The report shall be less than five years old and will have been prepared by an independent testing laboratory using test equipment, method and duct section as specified by ASHRAE Standard 52.1-92 for type filter under test and acceptable to Resident Engineer, indicating that filters comply with the requirements of this specification. Test for 150 m/min (500 fpm) will be accepted for lower velocity rated filters provided the test report of an independent testing laboratory complies with all the requirements of this specification.
 - 2. Selection procedures: All filters tested shall have been procured by the independent testing laboratory from the open market independent of manufacturer of these filters and a statement to this effect must accompany test report.
- B. Filter Supplier Warranty for Extended Surface Filters: Guarantee the filters against leak, blow-outs, and other deficiencies during their normal useful life. Defective filters shall be replaced at no cost to the Government.
- C. Nameplates: Each filter shall bear a label or name plate indicating manufacturer's name, filter size, rated efficiency, UL classification, and file number.

1.4 SUBMITTALS

- A. Submit in accordance with Division 01.
- B. Manufacturer's Literature and Data:
 - 1. Extended surface filters.
 - 2. Holding frames. Identify locations.
 - 3. Side access housings. Identify locations, verify insulated doors.
- C. Air filter performance reports.
- D. Suppliers warranty.

1.5 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by basic designation only.
- B. American Society of Heating, Refrigerating and Air-conditioning Engineers, Inc. (ASHRAE):
 - 52.1-92 Methods of Testing Air Cleaning Devices Used in General Ventilation For Removing Particulate Matter
- C. Underwriters Laboratories, Inc. (UL):
 - 586-90 UL Standard for Safety High-Efficiency, Particulate, Air Filter Units
 - 900-87 UL Standard for Safety Test Performance of Air Filter Units
- D. Federal Specification (Fed. Spec.):
 - A-A-I419D Filter, Element Air Conditioning (Viscous-Impingement and Dry Type, Replaceable).

PART 2 - PRODUCTS

2.1 REPLACEMENT FILTER ELEMENTS TO BE FURNISHED

- A. To allow temporary use of HVAC systems for testing and in accordance with Paragraph, TEMPORARY USE OF MECHANICAL AND ELECTRICAL SYSTEMS in Section 01 01 00, GENERAL REQUIREMENTS, provide one complete set of additional (replacement) filter elements.
- B. The Architect/Engineer will direct whether these additional filters will either be installed as replacements for dirty units or turned over to owner for future use as replacements.

2.2 EXTENDED SURFACE AIR FILTERS

- A. Use factory assembled air filters of the extended surface type with supported or non-supported cartridges for removal of particulate matter in air conditioning, heating and ventilating systems. Filter units shall be of the extended surface type fabricated for disposal when the dust-load limit is reached as indicated by maximum (final) pressure drop.
- B. Filter Classification: UL approved Class 1 or Class 2 conforming to UL Standard 900.
- C. Filter Grades, Percent, Nominal Efficiency and Application:
 - 1. Grade A: 90-95 after-filter.
 - 2. Grade B: 80-85 after-filter.
 - 3. Grade C: 50-60 pre-filter.
 - 4. Grade D: 25-30 pre-filter.
- D. Filter Efficiency and Arrestance: Efficiency and arrestance of filters shall be determined in accordance with ASHRAE 52.1-92. Atmospheric dust spot efficiency and synthetic dust weight arrestance shall not be less than the following:

| | Percentage of Initial Efficiency | Percentage of Average Efficiency | Percentage of Average Arrestance |
|------|----------------------------------|----------------------------------|----------------------------------|
| Grad | 75.4 | 86.4 | 99.0 |
| Grad | 58.0 | 79.0 | 98.0 |
| Grad | 25.0 | 53.0 | 97.0 |
| Grad | Less than 20.0 | 22.0 | 89.0 |

- E. Maximum initial and final resistance, Pa (inches of water), for each filter cartridge when operated at 150 m/min (500 feet per minute) face velocity:

| | Initial Resistance | Final Resistance |
|-------------------------|--------------------|------------------|
| Grade A (Bag) | 130 (0.52) | 250 (1.00) |
| Grade A (Rigid Pleated) | 185 (0.74) | 250 (1.00) |
| Grade B (Bag) | 100 (0.40) | 250 (1.00) |
| Grade B (Rigid Pleated) | 150 (0.60) | 250 (1.00) |
| Grade C (Bag) | 70 (0.28) | 200 (0.80) |
| Grade C (Rigid Pleated) | 85 (0.35) | 200 (0.80) |
| Grade D (2-inch deep) | 80 (0.32) | 175 (0.70) |
| Grade D (4-inch deep) | 65 (0.27) | 175 (0.70) |

- F. Dust Holding Capacity: When tested to 250 Pa (1.00-inch water) at 150 m/min (500 fpm) face velocity, the dust holding capacity for each 600 mm by 600 mm (24 inches by 24 inches) (face area) filter shall be at least the values listed below. For other filter sizes the dust holding capacity shall be proportionally higher or lower to the face area.

| | |
|-------------------------|-----------|
| Grade A (Bag) | 300 grams |
| Grade A (Rigid Pleated) | 90 grams |
| Grade B (Bag) | 430 grams |
| Grade B (Rigid Pleated) | 175 grams |
| Grade C (Bag) | 910 grams |
| Grade C (Rigid Pleated) | 250 grams |
| Grade D (2 inch deep) | 150 grams |
| Grade D (4 inch deep) | 300 grams |

- G. Minimum Media Area: The minimum net effective media area in square meter (square feet) for each 600 mm by 600 mm (24 inches by 24 inches) (face area) filter at 150 m/min (500 fpm) face velocity shall be at least the values listed below. For other filter sizes the net effective media area shall be proportionally higher or lower.

| | |
|-------------------------|------------|
| Grade A (Bag) | 8.5 (91.0) |
| Grade A (Rigid Pleated) | 5.3 (57.0) |
| Grade B (Bag) | 8.5 (91.0) |
| Grade B (Rigid Pleated) | 5.3 (57.0) |
| Grade C (Bag) | 8.5 (91.0) |
| Grade C (Rigid Pleated) | 5.3 (57.0) |
| Grade D (2-inch deep) | 1.4 (14.8) |
| Grade D (4-inch deep) | 2.1 (23.0) |

- I. Side Servicing Housings:

1. Minimum 1.6 mm (16 gage galvanized steel, or aluminum, completely factory assembled with upstream and downstream flanges for connection into the duct system. Furnish housing length sufficient to provide for fully extended operating filter elements.
2. Access doors: Double skin insulated, at each end of the housing with continuous gasketing on the perimeter and positive locking devices. Design doors to withstand a minimum positive/negative 1.0 kPa (four inches of water) static pressure.

3. Filter slide channels: Channels shall incorporate a positive-sealing gasket material to seal the top and bottom of the filter cartridge frames to prevent bypass. Provide factory installed gasketing to prevent leakage between cartridges, and between cartridges and doors.

J. Holding Frame System:

1. Minimum 1.6 mm (16 gage) galvanized steel, 100 mm (4 inches) deep, factory complete with hardware necessary for field assembly, suitable for either upstream or downstream filter servicing. All members shall be cut to size and prepunched for easy assembly into modules of the size and capacity noted in the schedules.
2. The framing members shall be permanently gasketed to prevent the bypass of unfiltered air. If required, furnish suitable vertical support members to prevent deflection of horizontal members. The vertical support members shall not interfere with either the installation or operation of the filters.
3. The framing system shall incorporate a factory installed positive sealing device for each row of filters. This device shall allow for easy installation and removal of cartridges and shall insure the seal between the gasketed filter elements while the bank is in operation.

- K. Magnehelic Differential Pressure Filter Gages, if specified: Nominal 100 mm (four inch) diameter, zero to 500 Pa (zero to two inch water gage) range, flush mounted in aluminum panel board, complete with static tips, copper or aluminum tubing, and accessory items to provide zero adjustment. Provide one gage for each extended surface filter section. Provide Petcocks for each gauge.

- L. Equipment Identification: Section 23 05 00, COMMON WORK RESULTS FOR HVAC.

2.3 HEPA FILTERS, IF SPECIFIED

- A. High Efficiency Particulate Air (HEPA) filters shall be individually tested and certified to be 99.97 percent minimum efficient when handling 0.3 micron particles in accordance with DOP test method. Filters shall be factory scanned. The DOP efficiency along with filter serial number and name of manufacturer shall be marked on the filter. HEPA filter shall have maximum pressure drop of 250 Pa (1" WG) when clean at rated flow with a final pressure drop of 500 Pa (2" WG).
- B. Filter media: Factory constructed by pleating a continuous sheet of media into closely spaced pleats with kraft or aluminum separators. Sealer shall be self-extinguishing.
- C. Enclosing frame shall be 16 gauge galvanized steel. Provide pre-filters in the same housing with a separate removal assembly that operates independently from the HEPA filters.
- D. Pre-filter: Type D, 2 inches deep. See paragraph 2.2
- E. Bag-In/Bag-Out Housing for HEPA Filters:
1. Housing shall be fabricated of 15 gauge type 304 stainless steel.
 2. Housing shall be equipped with weather covers, drilled face flanges and factory mounted Magnehelic gauges with Petcocks housed in stainless steel brackets.
 3. Housing shall be pressure tested in factory for high quality to withstand a positive or negative pressure of 10" WG. If HEPA filters are specified for TB Isolation Rooms, perform a quantitative leakage and filter performance DOP (Dioctyl Phthalate Penetration) field test in addition to factory test at the initial installation recommended by the Center for Disease Control (CDC).

4. Housing shall incorporate a spring loaded clamping mechanism that is operated from outside and which is capable of exerting a 5340 N (1,200 lb.) sealing force across the top and bottom of each filter.
5. Each housing shall have a bagging ring around the access port that is sealed by a removable, gasketed access door. The bagging ring shall have two (2) continuous ribs to secure the plastic change-out bag and be hemmed on its outer edge to prevent the bag from tearing.
6. One 87 mil thick PVC change-out bag shall be supplied for each access door. The bag shall include approximately 300 mm (12 inches) of transparent PVC at the open end and three glove sleeves built into the body to assist in filter change-out. Bag-In/Bag-Out housings shall be manufactured under a quality assurance program that addresses the requirements of ANSI N45.2, "Quality Assurance Requirements for Nuclear Power Plants."

2.4 ELECTRONIC AIR FILTERS, IF SPECIFIED

- A. Provide and install manufacturer's electronic air filter as specified on the drawings or approved equal.
- B. Electronic air filter shall be UL and/or cUL listed.
- C. Installation shall comply with manufacturer's installation instructions and code.

2.5 IN DUCT AIR PURIFIERS

- A. Provide and install manufacturer's ActivTek Environmental Induct air purifiers, as specified on the drawings or approved equal.
- B. Air purifiers shall be certified to be in compliance with Standard for Safety of Luminaries, UL 1558 and C22.2.
- C. Installation shall comply with manufacturer's installation instructions and code.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install supports, filters and gages in accordance with manufacturer's instructions.

3.2 START-UP AND TEMPORARY USE

- A. Clean and vacuum air handling units and plenums to the satisfaction of the Architect/Engineer prior to starting air handling systems.
- B. Install or deliver replacement filter units as directed by the Architect/Engineer.

END OF SECTION

SECTION 23 60 00 - CENTRAL COOLING EQUIPMENT

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies rooftop units.
- B. Definitions:
 - 1. Energy Efficiency Ratio (EER): A ratio calculated by dividing the cooling capacity in Watts (Btuh) by the power input in watts at any given set of rating conditions, expressed in Watts (Btuh) per watt.
 - 2. Unitary (ARI): Consists of one or more factory-made assemblies which normally include an evaporator or cooling coil, a compressor and condenser combination, and may include a heating function.

1.2 RELATED WORK

- A. Section 23 05 00: COMMON WORK RESULTS FOR HVAC.
- B. Section 23 40 00: HVAC AIR CLEANING DEVICES.
- C. Section 23 05 93: TESTING, ADJUSTING, AND BALANCING FOR HVAC.

1.3 QUALITY ASSURANCE

- A. Refer to Section, COMMON WORK RESULTS FOR HVAC.
- B. Safety Standards: ASHRAE Standard 15, design, manufacture and installation of mechanical refrigeration equipment.

1.4 SUBMITTALS

- A. Submit in accordance with Division 01.
- B. Manufacturer's Literature and Data:
 - 1. Unitary air conditioners:
 - a. Rooftop units.
- C. Submit proof of specified ARI Certification.
- D. Performance Rating: Submit catalog selection data showing equipment ratings and compliance with required sensible-to-heat-ratio, energy efficiency ratio (EER), and coefficient of performance(COP).

1.5 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. Air-Conditioning and Refrigeration Institute (ARI) Standards:
 - 210/240-89..... Unitary Air-conditioning and Air Source Heat Pump Equipment
 - 270-84.....Sound Rating of Outdoor Unitary Equipment
 - 360-86.....Commercial and Industrial Unitary Air-Conditioning Equipment

- 520-90..... Positive Displacement Refrigerant Compressors, Compressor Units and Condensing Units
ARI-DCAACP..... Directory of Applied Air Conditioning Products
- C. Air Movement and Control Association(AMCA):
210-85..... Laboratory Methods of Testing Fans for Rating
410-90..... Recommended Safety Practices for Air Moving Devices
- D. American National Standards Institute(ANSI):
S12.31-90.....Precision Methods for the Determination of Sound Power Levels of Broad-Band Noise Sources in Reverberation Rooms
- E. American Society of Heating, Refrigerating, and Air-Conditioning Engineers Inc. (ASHRAE), Inc. Publications:
1988 Equipment Handbook
1987 Systems Handbook
- F. American Society of Testing and Materials (ASTM):
B117-90.....Standard Method of Salt Spray(Fog) Testing
- G. National Electrical Manufacturer's Association(NEMA):
MG-1-93..... Motors and Generators
ICS-1-R90.....Industrial Controls and Systems
- H. National Fire Protection Association (NFPA) Publications:
90A-1996.....Standard for the Installation of Air-conditioning and Ventilating Systems

PART 2 - PRODUCTS

2.1 UNITARY AIR CONDITIONERS

- A. Applicable ARI Standards:
1. Capacity 39.6 kW (135,000 Btu/h) and greater: ARI 360.
 2. Capacity Below 39.6 kW (135,000 Btu/h): ARI 210. Units shall be listed in the ARI Directory of Certified Unitary Air-Conditioners.
- B. Performance Rating: Cooling capacity of unit shall meet the sensible heat requirements and total heat requirements shown in the contract documents. In selecting unit size, make true allowance for "sensible to total heat ratio" to satisfy required sensible cooling capacity.
- C. Machinery Guards: Provide guards as shown in AMCA 410 for belts, chains, couplings, pulleys, sheaves, shafts, gears and other moving parts regardless of height above the floor. Drive guards may be excluded where motors and drives are inside factory fabricated casings.
- D. Corrosion Prevention: Unless specified otherwise, equipment fabricated from ferrous metals that do not have a zinc coating or a duplex coating of zinc and paint shall be treated for prevention of rust with a factory coating or paint system that will withstand 125 hours in a salt-spray fog test, except that equipment located outdoors shall be tested for 500 hours. the salt-spray fog test shall be in accordance with ASTM B117 using a 20 percent sodium chloride solution. Immediately after completion of the test, the coating shall show no signs of blistering, wrinkling or cracking, no loss of adhesion, and the specimen shall show no signs of rust creepage beyond 3 mm (1/8-inch) on either side of the scratch mark.

- E.** Rooftop Unit: Air-conditioner shall be a factory packaged cooling combination heating and cooling unit as indicated and shall be suitable for mounting on roof of building with sloped roof curb. The package shall consist of one or more refrigerant compressors with electric motors, cooling coils, condensers, fans, filters, heating natural gas section, control wiring and piping, all factory assembled in a weatherproof enclosure mounted on a structural steel base ready for field connection to utilities and ducts. The package unit shall be sufficiently rigid and arranged to permit handling by a crane boom or by helicopter. **Provide the unit with vibration isolation roof curb, and flashing and transition plenums with flexible collars.**
1. Unit Enclosure: Construct enclosure with removable access panels completely weatherized for outside installation, and properly reinforced and braced. Provide panels and access door for inspection and access to all internal parts. Surface of steel parts shall be factory corrosion protected by a painting or coating system specified. Provide enclosure with adequate reinforced points of supports for setting of the unit. Joints shall be air and watertight.
 2. Provide packaged rooftop unit with standard manufacturer controls or approved equal, diffuser section, outside air dampers and exhaust to equalize resistance through cooling and heating passages and control to maintain acceptable carbon dioxide (CO₂) levels (750 ppm or less in return air supply path or individual room CO₂ sensors as shown on the drawings) using CO₂ sensor(s).
- F.** Insulation: Apply in sufficient thickness and density to prevent condensate from forming on the unit casing from air entrance at coils to air outlet of unit. Insulation shall meet the requirements of NFPA 90A and be protected against deterioration and delamination from air currents. Insulate condensate drain pan with water impervious insulation of sufficient thickness to prevent condensate formation on the exterior at ambient conditions encountered.
- G.** Evaporator Fan: Forward curved type or backward inclined centrifugal type specifically designed and suitable for the operating pressure conforming to AMCA 210. For units less than five tons, direct drive with at least three speed taps may be used. Units shall have either greaseable or permanently lubricated ball or roller bearings. Statically balance fan assemblies in the fan housing and final assembly. Fan motors shall conform to NEMA MG-1. Motor starters shall conform to NEMA ICS-1.
- H.** Compressors: Provide hermetic type conforming to ARI 520, provided with all the minimum standard equipment and accessories listed therein. Compressors shall be mounted with vibration isolation springs or approved equal. Compressor speed for compressors above 70.4 kW (20 tons) shall not exceed 1750 rpm. Provide compressors with cylinder unloading for automatic capacity reduction of at least 50 percent for units over 35.2 kW (10 tons). Compressors shall start unloaded to minimum step of unloading. If standard with the manufacturer, two or more compressors, but not more than four, may be provided in lieu of a single compressor with cylinder unloading in which case capacity reduction shall be provided by sequence operation of the compressor or combination of the two methods. Provide each compressor with independent refrigerant circuit. Where compressors are paralleled, provide not less than two independent refrigerant circuits. Provide each compressor with devices to protect the compressor from short-cycling when shut-down by safety controls. Provide a pump-down cycle of the non-recycling start type for each compressor 35.2 kW (10 tons) and over. Provide compressors with vibration isolators. Compressor motor shall be suitable for electric power characteristics as indicated. Motor shall conform to NEMA MG-1. Motor starters shall conform to NEMA ICS-1.
- I.** Filter Boxes: Provide filter boxes with either hinged access doors or removable panels. Filters shall be as specified in Section, HVAC AIR CLEANING DEVICES.

- J. Controls:
1. Rooftop unit shall be complete with Carrier manufacturer's or equal PIC and VVT controls. Mount all other controls including motor starters and safety controls inside the enclosure. All wiring inside enclosure shall be accomplished at the factory. Provide convenience electrical 120 volt outlet at the unit.
 2. Condenser Controls: Provide head pressure control to insure condensing temperature for proper system operation at all ambient temperatures down to -18 degrees C (0 degrees F).
 3. Condenser Start-Up Control: Provide condenser with a start-up control package which permits start-up of compressor at ambient temperature of -18 degrees C (0 degrees F). Package shall temporarily bypass system low pressure stat to permit start-up whenever minimum ambient temperature is below design evaporator coil suction temperature.
- K. Refrigerant Circuits: Dehydrate entire refrigerant circuit, purge, and charge with refrigerant and oil at factory. Factory oil charge shall be the full amount required for operation. Factory charge for refrigerant shall be full amount required for operation, if within limits permitted by Interstate Commerce Commission, otherwise furnish a holding charge of the type refrigerant to be used.

PART 3 – EXECUTION

3.1 INSTALLATION

- A. Handle and install units and accessories in accordance with the manufacturer's printed instructions.

3.2 TESTS

- A. Perform tests and make reports in accordance with Sections, COMMON WORK RESULTS FOR HVAC and TESTING, ADJUSTING, AND BALANCING FOR HVAC.

END OF SECTION

SECTION 23 81 46 - WATER-SOURCE UNITARY HEAT PUMPS

PART 1 – GENERAL

1.1 DESCRIPTION

- A. This Section specifies the following configurations of electrically operated Water Source Unitary Heat Pumps"
 - 1. Water source unitary heat pump.
 - 2. Concealed water source heat pumps larger than 21 kW (6 tons).
 - 3. Vertical stack water source heat pumps.

- B. Definitions:
 - 1. Energy Efficiency Ratio (EER): The ratio of net cooling capacity in Btu/h to total rate of electricity input in watts under designated operating conditions.
 - 2. Coefficient of Performance (COP) - Cooling: The ratio of the rate of heat removed to the rate of energy input in consistent units, for a complete refrigerating system or some specific portion of that system under designated operating conditions.
 - 3. Coefficient of Performance (COP) - Heating: The ratio of the rate of heat delivered to the rate of energy input in consistent units for a complete heat pump system, including the compressor and, if applicable, auxiliary heat under designated operating conditions.
 - 4. Unitary Heat Pump: One or more factory made assemblies that normally include an indoor conditioning coil, compressor(s) and an outdoor refrigerant-to-air coil or refrigerant-to-water heat exchanger. These units provide both heating and cooling functions.

1.2 RELATED WORK

- A. Section 01 00 00 – General Requirements: For pre-test requirements.
- B. Section 23 05 00 – Common Work Results for HVAC: General mechanical requirements and items, which are common to more than one section of Division 23.
- C. Section 23 21 13 – Hydronic Piping
- D. Section 23 30 00 – HVAC Air Distribution.
- E. Section 23 05 93 – Testing, Adjusting, and Balancing for HVAC: Requirements for testing, adjusting and balancing of HVAC system.

1.3 QUALITY ASSURANCE:

- A. Refer to specification Section 23 05 00, COMMON WORK RESULTS FOR HVAC
- B. Comply with ASHRAE Standard 15, Safety Code for Mechanical Refrigeration.
- C. Comply with ASHRAE 90.1-2004.

1.4 SUBMITTALS

- A. Submit in accordance with specification Division 01.

- B. Manufacturer's Literature and Data.
 - 1. Water Source Unitary Heat Pumps:
 - a. Vertical unit type
- C. Certification: Submit, simultaneously with shop drawings, a proof of certification that this product has been certified by ARI.
- D. Performance Rating: Submit catalog selection data showing equipment ratings and compliance with required cooling and heating capacities EER and COP values as applicable.

1.5 APPLICABLE PUBLICATIONS:

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. Federal Specification (Fed. Spec.):
A-A-50502-90 Air-conditioner (UNITARY HEAT PUMP), AIR TO AIR (3000 TO 300,000 BTUH)
- C. Air-Conditioning and Refrigeration Institute (ARI) Standards:
ARI-DCPP Directory of Certified Product Performance - Applied Directory of Certified Products
210/240-06 Performance Rating of Unitary Air-Conditioning and Air-Source Heat Pump Equipment
270-95 Sound Rating of Outdoor Unitary Equipment
310/380-04 Standard for Packaged Terminal Air-Conditioners and Heat Pumps (CSA-C744-04)
320-98 Water-Source Heat Pumps
330-98 Ground Source Closed-Loop Heat Pumps
340/360-04 Commercial and Industrial Unitary Air-Conditioning and Heat Pump Equipment
- D. Air Movement and Control Association (AMCA):
210-99 Laboratory Methods of Testing Fans for Aerodynamic Performance Rating (ANSI)
410-96 Recommended Safety Practices for Users and Installers of Industrial and Commercial Fans
- E. American National Standards Institute (ANSI):
S12.51-02 Acoustics - Determination of Sound Power Levels of Noise Sources Using Sound Pressure - Precision Method for Reverberation Rooms (same as ISO 3741:1999)
- F. American Society of Heating, Refrigerating and Air-Conditioning Engineers Inc (ASHRAE):
2004 Handbook HVAC Systems and Equipment
- G. American Society of Testing and Materials (ASTM):
B117-03 Standard Practice for Operating Salt Spray (Fog) Apparatus
- H. National Electrical Manufacturer's Association (NEMA):
MG 1-06 Motors and Generators (ANSI)
ICS 1-00 (R2005) Industrial Controls and Systems: General Requirements
- I. National Fire Protection Association (NFPA):

90A-02 Standard for the Installation of Air-Conditioning and Ventilating Systems

- J. Underwriters Laboratory (UL):
1995-05 Heating and Cooling Equipment

PART 2- PRODUCTS

2.1 GENERAL REQUIREMENTS FOR WATER SOURCE HEAT PUMPS

- A. System Characteristics of a Closed-Loop System: The system consists of multiple units connected to a 2-pipe, closed-loop hydronic system with continuous water circulation. The temperature of the water loop shall be maintained at approximately 18-35 degrees C (65-95 degrees F) by means of addition of heat and heat rejection when needed.
- B. Applicable ARI Standards: Units shall be listed in the corresponding ARI Directory of certified Products shown in paragraph APPLICABLE PUBLICATIONS.

2.2 WATER SOURCE UNITARY HEAT PUMP (WSHP)

- A. Description: Packaged water-source heat pump with temperature controls; and shall be factory assembled, tested, and rated according to ARI-ISO-13256-1. Unit shall vertical type, with ducted air delivery. Comply with ARI 320.
- B. Cabinet: Manufacturer's standard galvanized steel for ducted models and galvanized steel with baked enamel finish. Unit shall have access panels and flanged duct connections. Cabinet shall be factory insulated with fiber glass duct liner, minimum 13 mm (1/2-inch) thick and complying with UL 181. Units shall have knockouts for electrical, piping, and condensate drain connections.
- C. Fan: Direct driven, centrifugal, with permanently lubricated multi-speed motor resiliently mounted in fan inlet
- D. Compressor: Hermetic, scroll compressor installed on vibration isolators; with a slide-out chassis and housed in an acoustically treated enclosure. Unit shall have factory-installed safeties, anti-recycle timer, high-pressure cutout, low-pressure cutout or loss-of-charge switch, internal thermal-overload protection, and freeze stat to stop compressor if water-loop temperature in refrigerant-to-water heat exchanger falls below 2 deg C (35 deg F). Condensate overflow switch shall stop compressor with high condensate level in condensate drain pan. Compressor lockout circuit shall be capable of being reset at either remote thermostat or circuit breaker.
- E. Refrigerant Piping Materials: ASTM B 743 copper tube with wrought-copper fittings and brazed joints.
- F. Pipe Insulation: Refrigerant minimum 10-mm (3/8-inch) thick, flexible elastomeric insulation on piping exposed to airflow through the unit. Maximum 25/50 flame-spread/smoke-development indexes according to ASTM E 84.
- G. Refrigerant Metering Device: Thermal expansion valve to allow specified operation with entering-water temperatures from minus 4 to plus 52 deg C (25 to 125 deg F).
- H. Condensate Drainage: Plastic or stainless-steel drain pan with condensate drain piping projecting through unit cabinet and complying with ASHRAE 62.1-2004.
- I. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2004.

- J. Sound Attenuation Package: Minimum 1-mm (0.06-inch) thick compressor enclosure and front panel. Minimum 2-mm (0.12-inch) thick foam gasket around the compressor and perimeter of end panel, sound attenuating blanket over compressor and hot-gas muffler//.
- K. General Motor Requirements: Motor shall be multispeed, permanently lubricated, ECM.
- L. Water-to-Refrigerant Heat Exchanger:
 - 1. Coaxial heat exchangers with copper water tube with enhanced heat-transfer surfaces inside a steel shell; both shell and tube shall be leak tested to 3102 kPa (450 psig) on refrigerant side and 2758 kPa (400 psig) on water side. Heat exchanger shall be factory mounted in unit on resilient rubber vibration isolators.
 - 2. Domestic Water Heat Exchanger: Refrigerant-to-domestic water heat exchanger shall be double-wall-vented type with factory-mounted pump and controls. Pump shall be energized when domestic-water temperature in heat exchanger is more than 63 deg C (145 deg F) and temperature in water heater is less than 52 deg C (125 deg F).
- M. Water Regulating Valves: Limit water flow through refrigerant-to-water heat exchanger, and control head pressure on compressor during cooling and heating. Valves shall close when heat-pump compressor is not running.
- N. Motorized Water Valve: Stop water flow through the unit when compressor is off.
- O. Refrigerant-to-Air Coils: Copper tubes with aluminum fins, leak tested to 3102 kPa (450 psig).
- P. Refrigerant Circuit Components: Sealed refrigerant circuit charged with R-410A refrigerant
 - 1. Filter-Dryer: Factory installed to clean and dehydrate the refrigerant circuit.
 - 2. Charging Connections: Service fittings on suction and liquid for charging and testing.
 - 3. Reversing Valve: Pilot-operated sliding-type valve designed to be fail-safe in heating position with replaceable magnetic coil.
 - 4. Refrigerant Metering: Extended temperature range device or a bi-directional thermal expansion valve.
- P. Electric Heating Coil: Helix-wound, nickel-chromium wire-heating elements in ceramic insulators mounted on steel supports. Energize on call for heating when entering-water-loop temperature is less than minus 5 deg C (40 deg F).
- R. Hot-Gas Reheat: Reheat valve shall be a pilot-operated, sliding-type valve with replaceable magnetic coil to divert refrigerant hot gas to reheat coil when remote humidistat calls for dehumidification.
- S. Hot-Gas Bypass: Include constant pressure expansion valve, solenoid valve, and controls to maintain continuous refrigeration system operation at 10 percent of full load on lead compressor.
- T. Filters: Disposable, pleated type, 25 mm (1 inch)// thick and with a minimum of 90 percent arrestance according to ASHRAE 52.1 and a MERV rating of 7 according to ASHRAE 52.2.
- U. Comply with control requirements as specified below.

- V. Controls:
1. Basic Unit Controls:
 - a. Low- and high-voltage protection.
 - b. Overcurrent protection for compressor and fan motor.
 - c. Random time delay, three to ten seconds, start on power up.
 - d. Time delay override for servicing.
 - e. Control voltage transformer.
 2. Thermostat: Wall-mounted thermostat heat-cool-off switch, fan on-auto switch, automatic changeover, temperature set point, Deg F indication.
 3. Wall-Mounted Humidistat: Exposed humidity set point, and wall-mounted humidity sensor. Unoccupied period override pushbutton LED shall indicate fault condition at heat pump data entry and access port input data and shall include room humidity set points for occupied and unoccupied periods. Output data include room humidity, supply-air temperature, entering-water temperature, operating mode, and status.
 4. Terminal Controller:
 - a. Scheduled operation for occupied and unoccupied periods on 7-day clock with minimum 4 programmable periods per day, two-hour unoccupied period override period Remote control panel to contain programmable timer and LED for fault condition.
 - b. Compressor-disable relay shall stop compressor operation for demand limiting or switch to unoccupied operation.
 - c. Unit shall automatic restart after five minutes if fault clears and lockout after three attempts to restart following fault.
 - d. Indicate fault for service technician Return-air temperature high-limit (firestat).
 - e. Stop unit on high temperature.
 - f. Backup for volatile memory.
 - g. Differential pressure switch shall indicate fan status.
 - h. Fan failure alarm.
 - i. Differential pressure switch shall indicate filter status.
 - j. Dirty filter alarm.
- W. Electrical Connection: Control box with single electrical connection factory installed and tested.

2.3 VERTICAL STACK WATER SOURCE HEAT PUMPS

- A. Description: Packaged water-source heat pump with temperature controls; factory assembled, tested, and rated according to ARI-ISO-13256-1.
- B. Cabinet and Chassis: Manufacturer's standard galvanized-steel casing, with return-air opening. Unit shall have access panel, and knockouts for electrical and piping connections. Cabinet shall be factory insulated with glass-fiber duct liner, 13 mm (1/2 inch) thick and complying with UL 181. Unit shall have a plastic or stainless-steel drain pan with condensate drain piping projecting to unit exterior and complying with ASHRAE 62.1-2004. Discharge grille shall be double deflection with adjustable discharge air pattern. Discharge- and return-air grille color shall be as selected by Architect from manufacturer's standard colors.
- C. Fans: Direct driven, centrifugal, with permanently lubricated multi-speed motor resiliently mounted in fan inlet

- D. Compressor: Hermetic, scroll compressor installed on vibration isolators; with a slide-out chassis and housed in an acoustically treated enclosure. Unit shall have factory-installed safeties, anti-recycle timer, high-pressure cutout, low-pressure cutout or loss-of-charge switch, internal thermal-overload protection, and freeze stat to stop compressor if water-loop temperature in refrigerant-to-water heat exchanger falls below 35 deg F (2 deg C). Condensate overflow switch shall stop compressor with high condensate level in condensate drain pan. Compressor lockout circuit shall be capable of being reset at either remote thermostat or circuit breaker.
- E. Risers: ASTM B 88M, Type B (ASTM B 88, Type L) copper pipe with hose and ball valve for system flushing.
- F. Refrigerant Piping Materials: ASTM B 743 copper tube with wrought-copper fittings and brazed joints.
- G. Pipe Insulation: Refrigerant minimum 10-mm (3/8-inch) thick, flexible elastomeric insulation on piping exposed to airflow through the unit. Maximum 25/50 flame-spread/smoke-development indexes according to ASTM E 84.
- H. Refrigerant Metering Device: Thermal expansion valve to allow specified operation with entering-water temperatures from minus 18 to plus 38 deg C (65 to 100 deg F).
- I. Condensate Drainage: Plastic or stainless-steel drain pan with condensate drain piping projecting through unit cabinet and complying with ASHRAE 62.1-2004.
- J. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2004.
- K. Sound Attenuation Package: Minimum 1-mm (0.06-inch) thick compressor enclosure and front panel. Minimum 2 mm (0.12 inch) thick foam gasket around the compressor and perimeter of end panel, sound attenuating blanket over compressor and hot-gas muffler.
- L. Water-to-Refrigerant Heat Exchanger:
 - 1. Coaxial heat exchangers with copper water tube with enhanced heat-transfer surfaces inside a steel shell; both shell and tube shall be leak tested to 3102 kPa (450 psig) on refrigerant side and 2758 kPa (400 psig) on water side. Heat exchanger shall be factory mounted in unit on resilient rubber vibration isolators.
- M. Refrigerant Circuit Components: Sealed refrigerant circuit charged with R-22 refrigerant.
 - 1. Filter-Dryer: Factory installed to clean and dehydrate the refrigerant circuit.
 - 2. Charging Connections: Service fittings on suction and liquid for charging and testing.
 - 3. Reversing Valve: Pilot-operated sliding-type valve designed to be fail-safe in heating position with replaceable magnetic coil.
 - 4. Refrigerant Metering: Extended temperature range device or a bi-directional thermal expansion valve.
- O. Electric Heating Coil: Helix-wound, nickel-chromium wire-heating elements in ceramic insulators mounted on steel supports. Energize on call for heating when entering-water-loop temperature is less than 4 deg C (25 deg F).
- P. Hot-Gas Reheat: Reheat valve shall be a pilot-operated, sliding-type valve with replaceable magnetic coil to divert refrigerant hot gas to reheat coil when remote humidistat calls for dehumidification.

- Q. Hot-Gas Bypass: Include constant pressure expansion valve, solenoid valve, and controls to maintain continuous refrigeration system operation at 10 percent of full load on lead compressor.
- R. Filters: Disposable, pleated type, 25 mm (1 inch) thick and with a minimum of 90 percent arrestance according to ASHRAE 52.1 and a MERV of 7 according to ASHRAE 52.2.
- S. Controls:
 - 1. Basic Unit Controls:
 - a. Low- and high-voltage protection.
 - b. Overcurrent protection for compressor and fan motor.
 - c. Random time delay, three to ten seconds, start on power up.
 - d. Time delay override for servicing.
 - e. Control voltage transformer.
 - 2. Thermostat: Wall-mounted thermostat heat-cool-off switch, fan on-auto switch, automatic changeover, exposed temperature set point, Deg F indication.
 - 3. Wall-Mounted Humidistat: Exposed humidity set point, and wall-mounted humidity sensor. Unoccupied period override pushbutton LED shall indicate fault condition at heat pump data entry and access port input data and shall include room humidity set points for occupied and unoccupied periods. Output data include room humidity, supply-air temperature, entering-water temperature, operating mode, and status.
 - 4. Terminal Controller: Scheduled operation for occupied and unoccupied periods on 7 -day clock with minimum 4 programmable periods per day, two unoccupied period override period.
- U. Electrical Connection: Control box with single electrical connection factory installed and tested.

PART 3- EXECUTION

3.1 INSTALLATION

- A. Floor-Mounted Units: Support on neoprene pads with minimum 3.17-mm (0.125-inch) static deflection. Secure units to anchor bolts installed in concrete bases.
- B. Suspended Units: Suspend from structure with threaded steel rods and minimum 6.35-mm (0.25-inch) static deflection rubber-in-shear, vibration isolators.
- C. Install wall-mounting thermostats, humidistats, and switch controls in electrical outlet boxes at heights to match lighting controls or as required.

3.2 CONNECTIONS

- A. Connect supply and return hydronic piping to heat pump with hose kits.
- B. Connect heat-pump condensate drain pan to indirect waste connection with condensate trap of adequate depth to seal against the pressure of fan. Install cleanouts in piping at changes of direction.
- C. Connect supply- and return-air ducts to water-source heat pumps with flexible duct connectors. Comply with requirements in Section 23 310 00, HVAC Air Distribution.
- D. Install electrical devices furnished by manufacturer but not specified to be factory mounted.

- E. Install piping adjacent to machine to allow service and maintenance.

3.4 FIELD QUALITY CONTROL

- A. Perform the following field tests and inspections and prepare test reports:
 1. After installing water-source heat pumps and after electrical circuitry has been energized, test units for compliance with requirements.
 2. Inspect for and remove shipping bolts, blocks, and tie-down straps.
 3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
 4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- B. Remove and replace malfunctioning units and retest as specified above.

3.5 INSTRUCTIONS

- A. Provide services of manufacturer's technical representative for four hours to instruct VA personnel in operation and maintenance of heat pumps.

END OF SECTION

SECTION 26 05 00 – BASIC METHODS AND REQUIREMENTS (ELECTRICAL)

PART 1. GENERAL

1.1. DESCRIPTION

- A. Furnish all labor, materials, services and skilled supervision necessary for the construction, erection, installation, connection, testing, and adjustments needed to install electrical wiring, raceways, devices, fixtures, system components, equipment and accessories necessary to provide a complete, safe, operational electrical installation in accordance with the intent of the specifications and drawings. The word furnish is defined to mean provide and install the related item
- B. Each system shall be installed in a manner which will fully comply with all applicable requirements of NFPA, ADA, IBC, Local Standards, Industry Standards, manufacturer's recommendations, and project drawings and specifications.
- C. Electrical service entrance equipment (arrangements for temporary and permanent connections to the power company's system) shall conform to the power company's requirements. Coordinate fuses, circuit breakers and relays with the power company's system, and obtain power company approval.
- D. Wiring ampacities specified or shown on the drawings are based on copper conductors with 75 degree C insulation, with the conduit and raceways accordingly sized. With the exception of service entrance conductors, aluminum conductors are prohibited unless specifically identified on the drawings. For service entrance conductors, aluminum conductors of equal or greater ampacity may be used (with corresponding adjustments to quantities and conduit requirements) in configurations acceptable to the utility company.
- E. Make final connections to equipment supplied by others. Controls and starters related to mechanical equipment shall be supplied by the mechanical contractor. Controls and starters for owner furnished equipment shall be supplied by others. Electrical contractor shall make electrical connections to equipment from point of electrical circuit shown on drawings for equipment. Electrical contractor shall make connections to owner furnished equipment serviced by either hard wiring or service cord drops. Electrical contractor shall provide means of disconnection of equipment from electrical circuit if starter or controller supplied with equipment does not meet NEC requirements for disconnect.
- F. Procure and pay for all permits and certificates necessary to construct and place in operation all work to be done under this DIVISION. Pay for all legally imposed charges made by the local authorities for full inspection and approval services of the bureaus administering applicable codes and regulations. This shall include the cost and back charge of installing any portion of the work where performed by county or municipal utility departments, and utility companies.

1.2. MINIMUM REQUIREMENTS

- A. References to the National Electrical Code (NEC), Underwriters Laboratories, Inc. (UL), and National Fire Protection Association (NFPA) are a minimum installation requirement standard. Applicable reference documents shall be those in effect as of the date of the contract award.
- B. The installation shall conform to the latest requirements of all applicable federal, state, and local codes, laws and regulations governing standards of design, construction, workmanship, materials, types of equipment, and methods of installation in effect for the project location at the time of the contract award. These include, but are not limited to:

The International National Building Code, NFPA 70 (NEC), NFPA 101, NFPA 72, and ADA requirements unless more stringent requirements are indicated herein or shown.

- C. Drawings and other specification sections shall govern in those instances where requirements are greater than those specified in NEC

1.3. MATERIAL STANDARDS

- A. All components of the installation shall be new. All electrical apparatus furnished under this DIVISION shall be approved by the UL and shall be so labeled or listed where such is applicable. Where custom-built equipment is specified and the UL label or listing is not applicable to the completed product, all components used in the construction of such equipment shall be labeled or listed by UL where applicable. The label or listing of the Underwriters Laboratories, Inc., shall be accepted as evidence that the materials or equipment conform to the applicable standards of that agency. In lieu of this label or listing, a statement from a nationally recognized, adequately equipped testing agency indicating that the items have been tested in accordance with required procedures and that the materials and equipment comply with all contract requirements will be accepted. For other than equipment and materials specified to conform to UL publications, a manufacturer's statement indicating complete compliance with the applicable Federal Specification, or standard of the American Society for Testing and Materials, National Electrical Manufacturers Association, or other commercial standard, is acceptable. Materials and equipment shall be approved based on the manufacturer's published data.

1.4. DEFINITIONS

- A. Listed; equipment or device of a kind mentioned which:
 - 1. Is published by a nationally recognized laboratory which makes periodic inspection of production of such equipment.
 - 2. States that such equipment meets nationally recognized standards or has been tested and found safe for use in a specified manner
- B. Labeled; equipment or device is when
 - 1. It embodies a valid label, symbol, or other identifying mark of a nationally recognized testing laboratory such as Underwriters Laboratories, Inc.
 - 2. The laboratory makes periodic inspections of the production of such equipment.
 - 3. The labeling indicates compliance with nationally recognized standards or tests to determine safe use in a specified manner.
- C. Certified; equipment or product is which:
 - 1. Has been tested and found by a nationally recognized testing laboratory to meet nationally recognized standards or to be safe for use in a specified manner.
 - 2. Production of equipment or product is periodically inspected by a nationally recognized testing laboratory.
 - 3. Bears a label, tag, or other record of certification.
- D. Nationally recognized testing laboratory; which is approved, in accordance with OSHA regulations, by the Secretary of Labor.

1.5. QUALIFICATIONS (PRODUCTS AND SERVICES)

- A. Manufacturers Qualifications: The manufacturer shall regularly and presently produce, as one of the manufacturer's principal products, the equipment and material specified for this project, and shall have manufactured the item for at least three years.
 - B. Product Qualification
 - 1. Manufacturer's product shall have been in satisfactory operation, on three installations of similar size and type as this project, for approximately three years
 - 2. The Owner reserves the right to require the Contractor to submit a list of installations where the products have been in operation before approval.
 - C. Service Qualifications: There shall be a permanent service organization maintained or trained by the manufacturer which will render satisfactory service to this installation within four hours of receipt of notification that service is needed. Submit name and address of service organizations.
 - D. The contractor, by accepting this work, represents that he is qualified to successfully accomplish the work without additional direction by the design engineer. The design engineer is not responsible for means, method, techniques, or procedures used by the contractor during construction.
- 1.6. MANUFACTURED PRODUCTS
- A. Materials and equipment furnished shall be of current production by manufacturers regularly engaged in the manufacture of such items, for which replacement parts should be available.
 - B. When more than one unit of the same class of equipment is required, such units shall be the product of a single manufacturer.
 - C. Equipment Assemblies and Components:
 - 1. Components of an assembled unit need not be products of the same manufacturer.
 - 2. Manufacturers of equipment assemblies, which include components made by others, shall assume complete responsibility for the final assembled unit.
 - 3. Components shall be compatible with each other and with the total assembly for the intended service.
 - 4. Constituent parts which are similar shall be the product of a single manufacturer.
 - D. Factory wiring shall be identified on the equipment being furnished and on all wiring diagrams.
- 1.7. VARIATIONS
- A. Where variations from the contract requirements are requested, the connecting work and related components shall included. The requested variation shall include, but not be limited to additions or changes to branch circuits, circuit protective devices, conduits, wire, feeders, controls, panels and installation methods. The impact and cost of the requested variation shall be included in the request for variation
- 1.8. EQUIPMENT PROTECTION
- A. Equipment and material shall be protected during shipment and storage against physical damage, dirt, moisture, cold and rain.

- B. During installation, enclosures, equipment, controls, controllers, circuit protective devices, and other like items, shall be protected against entry of foreign matter; and be vacuum cleaned both inside and outside before testing, operating and painting.
- C. Damaged equipment shall be placed in first class operating condition or be returned to the source of supply for repair or replacement
- D. Painted surfaces shall be protected with factory installed removable heavy protective paper, sheet vinyl, or equivalent covering.
- E. Damaged paint on equipment and materials shall be refinished with the same quality of paint and workmanship as used by the manufacturer so that repaired areas are not obvious.

1.9. WORK PERFORMANCE

- A. The drawings indicate the extent and the general location and arrangement of equipment, conduit, and wiring. The Contractor shall become familiar with all details of the work and verify all dimensions in the field so that outlets, components, disconnects, raceways and equipment shall be properly located and readily accessible.
 - 1. Final locations of all equipment requiring electrical connections shall be confirmed with the installing trade prior to rough in or installation of associated disconnects, wiring, raceways, etc. Contractor shall be responsible for any re-work require resulting from failure to coordinate. Conflicts shall be reported to the Engineer prior to execution of work.
 - 2. Over-current protective device ratings for all equipment requiring electrical connections shall be confirmed with the installing trade prior to ordering protective devices and rough in of circuit conductors, raceways, disconnects, and associated devices. Contractor shall be responsible for any re-work require resulting from failure to coordinate. Conflicts shall be reported to the Engineer prior to execution of work.
 - 3. Lighting fixtures, outlets, and other equipment and materials shall be located to avoid interference with mechanical or structural features; otherwise, lighting fixtures shall be symmetrically located according to the room arrangement where uniform illumination is required, or asymmetrically located to suit conditions fixed by design and shown.
 - 4. Raceways, junction and outlet boxes, and lighting fixtures shall not be supported from sheet metal roof decks.
 - 5. The Electrical Contractor shall coordinate the electrical work with HVAC and electrical drawings and provide all power related wiring even if it is not shown on electrical drawings. If any conflicts occur necessitating departures from the drawings, details of and reasons for departures shall be submitted and approved prior to implementing any change.
- B. The drawings are diagrammatic only, intending to show general runs and locations of circuits, equipment, fixtures, and devices; and do not necessarily show all required offsets, routing, details, fire-stopping, and mounting requirements. The electrical contractor is responsible for determining the optimal routing of circuits and field investigations required to complete the installation in a professional workmanship manner.
 - 1. The Contractor shall refer to architectural drawings for additional dimensions and mounting locations.

2. The Contractor shall coordinate with cabinet installers for locations of outlets and devices integral to or immediately adjacent to casework, counter, or cabinet installations.
 3. The exact location and mounting height of all lighting fixtures shall be coordinated with architectural reflected ceiling plans, architectural details, mechanical and plumbing plans prior to installation of fixtures.
 4. All door swings shall be verified on site prior to rough-in of light switches.
 5. All work shall be accurately laid out with reference to the drawings and in cooperation with other trades to avoid conflicts and to obtain a neat and workable installation which will afford maximum accessibility for operation, maintenance and headroom.
 6. Coordinate installation of electrical equipment, conduit, wiring, and devices with other trades to avoid interference. The contractor shall coordinate with the mechanical contractor for final locations and connection requirements of mechanical equipment.
- C. The drawings are not intended to be rigid in specific details. Where they are in conflict with requirements of other drawings, or with any applicable code or with recommendations of the manufacturers of any equipment actually furnished, installed or connected under this DIVISION, make such adjustments as may be required to insure that all such equipment installed and connected is in conformance with such codes or recommendations, for safe, proper, and efficient operation of the equipment. In the event of conflict between various parts of the contract documents, including but not limited to drawings and general provisions, the more stringent (more costly) of the conditions shall apply for bidding purposes. The contractor shall request clarification for all conflicts prior to construction. Failure to request clarification shall not relieve the contractor of the requirement to provide the more costly implementation. If any conflicts occur necessitating departures from the drawings, details of and reasons for departures shall be submitted and approved prior to implementing any change.
- D. New work shall be installed and connected to existing work neatly and carefully. Disturbed or damaged work shall be replaced or repaired to its prior condition.
- E. All cutting and patching incidental to and required for the proper installation of the work of this DIVISION shall be performed under this DIVISION. All work of this DIVISION shall be fully coordinated with the work of other trades and with all phases of construction in order to minimize the amount of cutting and patching. Coordinate with the Contractor to assure all requirements relating to cutting and patching are satisfied.
- F. Work done by others on the premises, including the buildings, grounds and appurtenances, shall be protected from damage which might be done or caused by work performed under this DIVISION. Provide protective materials and coverings where necessary, to guard building surfaces and building contents from damages due to the operations of this work. Any and all such damages which occur shall be repaired by approved methods so as to restore the damaged areas to their original condition. The Contractor shall be held responsible for and shall pay for all damage to other work caused by his work or workmen. Repairing of such damage shall be done by workmen skilled in the trade required for the repair and shall be performed according to the directions of the Architect.
- G. Clear away all debris and surplus materials resulting from the performance of this work leaving the job and equipment furnished under this DIVISION in a clean, first-class condition. All materials excess to the needs of this project shall be removed from the premises and disposed of. After all debris is removed, the building shall be left broom clean.

- H. Coordinate location of equipment and conduit with other trades to minimize interferences.
- I. Where conduits, wireways, and other electrical raceways pass through fire rated partitions, floors, or ceilings, provide UL listed fire stop assemblies of equal fire rating. Completely fill and seal clearances between raceways with approved fire stopping material.

1.10. EQUIPMENT INSTALLATION AND REQUIREMENTS

- A. Equipment location shall be as close as practical to locations shown on the drawings.
- B. Working spaces shall not be less than specified in the NEC for all voltages specified.

1.11. EQUIPMENT IDENTIFICATION

- A. In addition to the requirements of the NEC, install an identification sign which will clearly indicate information required for use and maintenance of items such as panelboards, cabinets, motor controllers (starters), safety switches, separately enclosed circuit breakers, individual breakers and controllers in switchgear and motor control assemblies, control devices and other significant equipment.
- B. Major items of electrical equipment and major components shall be permanently marked with an identification name to identify the equipment by type or function, specific unit number, and circuit designator as indicated. Designation of motors shall coincide with their designation in the motor control center or panel. Unless otherwise specified, all identification nameplates shall be made of laminated plastic with black outer layers and a white core. Plates shall be fastened with screws, except motors which shall be attached with metal fasteners.
- C. The Engineer's approval shall be obtained for all equipment and material before delivery to the job site.
- D. All submittals shall include adequate descriptive literature, catalog cuts, shop drawings and other data necessary for the Owner to ascertain that the proposed equipment and materials comply with specification requirements. Catalog cuts submitted for approval shall be legible and clearly identify equipment being submitted.
- E. Submittals for individual systems and equipment assemblies which consist of more than one item or component shall be made for the system or assembly as a whole. Partial submittals will not be considered for approval.
- F. The submittals shall include the following
 1. Information that confirms compliance with contract requirements. Include the manufacturer's name, model or catalog numbers, catalog information, technical data sheets, shop drawings, pictures, nameplate data and test reports as required.
 2. Elementary and interconnection wiring diagrams for communication and signal systems, control system and equipment assemblies. All terminal points and wiring shall be identified on wiring diagrams.
 3. Parts list which shall include those replacement parts recommended by the equipment manufacturer, quantity of parts, current price and availability of each part.

1.12. TESTS

- A. After the wiring system installation is completed the Contractor shall conduct an operating test for approval. The equipment shall be demonstrated to operate in accordance with the requirements of the project. The Contractor shall furnish all instruments and personnel required for the tests, and the owner will furnish the necessary electric power. No part of the electrical distribution system shall be energized prior to the resistance testing of that system's ground rods.
- B. The Contractor shall perform all tests required for final acceptance testing by the jurisdiction having authority or other tests directed by the Architect.

1.13. WARRANTY

- A. The contractor shall warrant the complete electrical installation at the time of completion for a period of one year. During the warranty period the contractor shall replace or repair any components or work which develop defects beyond normal wear and tear. The electrical contractor shall be responsible for, and shall incur financial responsibility for any damages caused by or resulting from defects in his work.

END OF SECTION

SECTION 26 05 21 - CABLES, LOW VOLTAGE (600 VOLTS AND BELOW)

PART 1. GENERAL

1.1. DESCRIPTION

- A. This section includes the furnishing, installation, and connection of the low voltage power and lighting wiring.

1.2. RELATED WORK

- A. General electrical requirements that are common to more than one section in Division 26.

1.3. APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. Except where a specific date is given, the issue in effect (including amendments, addenda, revisions, supplements, and errata) on the date of Invitation for Bids shall be applicable. The publications are referenced in the text by designation only.
- B. National Fire Protection Association (NFPA):
 - 70 National Electrical Code (NEC)
- C. Underwriters Laboratories, Inc. (UL):
 - 44 Rubber Insulated Wire and Cables
 - 83 Thermoplastic insulated Wires
 - 486A Wire Connectors and Soldering Lugs for Use with copper
 - 486B Splicing Wire Connectors
 - 486D Insulated Wire Connectors for Use with Underground Conductors
 - 493 Thermoplastic Insulated Underground Feeder and Branch Circuit Cables

PART 2. PRODUCTS

2.1 CABLE AND WIRE (POWER AND LIGHTING)

- A. Cable and Wire: except as hereinafter specified.
- B. Single Conductor:
 - 1. Annealed copper.
 - 2. Stranded for sizes No. 8 and larger. Solid for sizes No. 10 and smaller.
 - 3. Minimum size No. 12, except where larger gauge sizes are shown.
- C. Non-metallic Cable
 - 1. Type NM-B. PVC jacket with nylon covered THHN insulation.
 - 2. UL 719 Conductors per ASTM B-3
- D. Type MC Cable: UL Standard 83, UL Standard 1063, UL Standard 1569
- E. Insulation:
 - 1. THW, XHHW, or dual rated THHN THWN, UL 44, 83 and 493.
 - 2. Direct burial: UF or USE.
 - 3. Isolated power system wiring: Type XHHW with a dielectric constant of 3.5 or less.

F. Color code:

1. Secondary service, feeder, and branch circuit conductors, be color coded as follows:

| | 208/120 volt | Phase | 480/277 volt |
|-------|--------------|--------|--------------|
| Black | A | Brown | |
| Red | B | Orange | |
| Blue | C | Yellow | |
| White | Neutral | Gray * | |

* or white with colored (other than green) tracer.

2. Use solid color compound or solid color coating for No. 12 and No. 10 branch circuit conductors and neutral sizes.
3. Phase conductors No. 8 and larger color code using one of the following:
 - a. Solid color compound or solid color coating.
 - b. Stripes, bands, or hash marks of color specified above.
 - c. Colored as specified using 3/4 inch wide tape. Apply tape in half overlapping turns for a minimum of three inches for terminal points, and in junction boxes, pull boxes, troughs, manholes, and handholes. Apply the last two laps of tape with no tension to prevent possible unwinding. Where cable markings are covered by tape, apply tags to cable stating size and insulation type.
4. For modifications and additions to existing wiring systems, color coding shall conform to the existing wiring system.
5. Color code for isolated power system wiring, in accordance with the NEC.

2.2 SPLICES AND JOINTS

- A. In accordance with UL 486 A, B, D and NEC.

- B. Branch circuits (No. 10 and smaller):

1. Connectors: Solderless, screw on, reusable pressure cable type, 600 volt, 105 degree C with integral insulation, approved for copper and aluminum conductors.
2. The integral insulator shall have a skirt to completely cover the stripped wires.
3. The number, size, and combination of conductors, as listed on the manufacturers packaging shall be strictly complied with.

- C. Feeder Circuits:

1. Connectors shall be indent, hex screw, or bolt clamp type of high conductivity and corrosion resistant material.
2. Field installed compression connectors for cable sizes 250 MCM and larger shall have not less than two clamping elements or compression indents per wire.
3. Insulate splices and joints with materials approved for the particular use, location, voltage, and temperature. Insulate with not less than that of the conductor level that is being joined.
4. Plastic electrical insulating tape: Fed Spec. HH I 595 shall apply, flame retardant, cold and weather resistant.

2.3 CONTROL WIRING

- A. Unless otherwise specified in other sections of these specifications, size control wiring as specified for power and lighting wiring, except the minimum size shall be not less than No. 14.

- B. Size wire large enough so that the voltage drop under inrush conditions does not adversely affect operation of the controls.

2.4 COMMUNICATION AND SIGNAL WIRING

- A. Shall conform to the recommendations of the manufacturers of the communication and signal systems; however, not less than what is shown.
- B. Wiring shown is for typical systems. Provide wiring as required for the systems being furnished. Category 5E cable required as a minimum for where data cabling is shown.
- C. Multi conductor cables shall have the conductors color coded.

2.5 WIRE LUBRICATING COMPOUND

- A. Suitable for the wire insulation and conduit it is used with, and shall not harden or become adhesive.
- B. Shall not be used on wire for isolated type electrical power systems.

2.6 FIREPROOFING TAPE

- A. The tape shall consist of a flexible, conformable fabric of organic composition coated one side with flame retardant elastomer.
- B. The tape shall be self extinguishing and shall not support combustion. It shall be arcproof and fireproof.
- C. The tape shall not deteriorate when subjected to water, gases, salt water, sewage, or fungus and be resistant to sunlight and ultraviolet light.
- D. The finished application shall withstand a 200 ampere arc for not less than 30 seconds.
- E. Securing tape: Glass cloth electrical tape not less than 0.18 mm (7 mils) thick, and 19 mm (3/4 inch) wide.

PART 3. EXECUTION

3.1. INSTALLATION, GENERAL

- A. Install in accordance with the NEC, and as specified.
- B. Install wiring in raceway systems as shown. MC cable and NM cable shall be permitted where shown on the panel schedules as MC or NM.
- C. Splice cables and wires only in outlet boxes, junction boxes, pull boxes, manholes, or handholes.
- D. Install cable supports for all vertical feeders in accordance with the NEC. Provide split wedge type which firmly clamps each individual cable and tightens due to cable weight.
- E. For panelboards, cabinets, wireways, switches, and equipment assemblies, neatly form and train conductors.
- F. Seal cable and wire entering a building from underground between the wire and conduit, where the cable exits the conduit, with a nonhardening approved compound.

- G. Provide fireproofing with UL listed materials where conductors or raceways penetrate fire rated assemblies.
- H. Wire Pulling:
 - 1. Provide installation equipment that will prevent the cutting or abrasion of insulation during pulling of cables.
 - 2. Use ropes for pulling feeders made of nonmetallic material.
 - 3. Attach pulling lines for feeders by means of either woven basket grips or pulling eyes attached directly to the conductors, as approved by the Engineer.
 - 4. Pull in together multiple cables in a single conduit.

3.2. SPLICE INSTALLATION

- A. Splices and terminations shall be mechanically and electrically secure.
- B. Where the Engineer determines that unsatisfactory splices or terminations have been installed, remove the devices and install approved devices at no additional cost to the Owner.

3.3. CONTROL, COMMUNICATION AND SIGNAL WIRING INSTALLATION

- A. Unless otherwise specified in other sections of these specifications, install wiring and connect to perform the functions shown and specified in other sections of these specifications.
- B. Except where otherwise required, install a separate power supply circuit for each system so that malfunctions in any system will not affect other systems.
- C. Where power supply circuits are not shown for systems, connect them to the nearest panelboards of suitable voltages, which are intended to supply such systems and have suitable spare circuit breakers or space for installation.
- D. Install a red warning indicator on the handle of the branch circuit breaker for the power supply circuit for each system to prevent accidental de energizing fire alarm system components.
- E. System voltages shall not exceed 120 volts and shall be lower voltages where shown on the drawings or required by the NEC.

3.4. CONTROL, COMMUNICATION AND SIGNAL SYSTEM IDENTIFICATION

- A. Install a permanent wire marker on each wire at each termination.
- B. Identifying numbers and letters on the wire markers shall correspond to those on the wiring diagrams used for installing the systems.
- C. Wire markers shall retain their markings after cleaning.
- D. In each manhole and handhole, install embossed brass tags to identify the system served and function.

3.5. FEEDER IDENTIFICATION

- A. In each interior, pullbox and junction box, install metal tags on each circuit cables and wires to clearly designate their circuit identification and voltage.
- B. In manholes and handholes, provide tags of the embossed brass type, and also show the cable type and voltage rating. Attach the tags to the cables with slip free plastic cable lacing units.

3.6. DIRECT BURIAL CABLE INSTALLATION

- A. Tops of the cables:
 - 1. Below the finished grade: Minimum 600 mm (24 inches) unless greater depth is shown.
 - 2. Below road and other pavement surfaces: In conduit as specified, minimum 30 inches unless greater depth is shown.
 - 3. Do not install under railroad tracks.
- B. Under road and paved surfaces, install the cables in bituminous coated galvanized steel rigid conduits, not less than two inch trade size with bushings at each end of each conduit run.
- C. Work with extreme care near existing ducts, conduits, cables and other utilities to prevent any damage.
- D. Cut the trenches neatly and uniformly:
 - 1. Place a three inch layer of sand in the trenches before installing the cables.
 - 2. Place a three inch layer of sand over the installed cables.
 - 3. Install continuous horizontal, warning tape three inches above the installed cables before backfilling.
- E. Provide horizontal slack in the cables for contraction during cold weather.
- F. Install the cables in continuous lengths. Splices within cable runs will not be accepted.
- G. Connections and terminations shall be submersible type designed for the cables being installed.

3.7. FIELD TESTING

- A. Feeders and branch circuits shall have their insulation tested after installation and before connection to utilization devices such as fixtures, motors, or appliances.
- B. Test conductors phase to phase and phase to ground.

END OF SECTION

SECTION 26 05 26 – GROUNDING

PART 1. GENERAL

1.1 DESCRIPTION

- A. This section specifies general grounding and bonding requirements of electrical installations.

1.2 RELATED WORK

- A. General electrical requirements that are common to more than one section in DIVISION 16: Section 16050, BASIC METHODS AND REQUIREMENTS (ELECTRICAL).

1.3 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. National Fire Protection Association (NFPA):
70.....National Electrical Code (NEC)
- C. Underwriters Laboratories, Inc. (UL):
83Thermoplastic Insulated Wires and Cables
44.....Rubber Insulated Wires and Cables
467.....Grounding and Bonding Equipment

PART 2. PRODUCTS

2.1. GROUNDING WIRES

- A. General Purpose: UL and NEC approved types, copper, with TW, THW, XHHW or dual rated THHN THWN insulation color identified green.
- B. Size wire not less than what is shown and not less than required by the NEC.

2.2. GROUND RODS

- A. Copperclad steel, 3/4 inch diameter by 8 feet long.

PART 3. EXECUTION

3.1. INSTALLATION, GENERALLY

- A. Ground in accordance with the NEC as shown, and as hereinafter specified.
- B. System Grounding:
 - 1. Secondary service neutrals ground at the supply side of the secondary disconnecting means and at the related transformers.
 - 2. Separately derived systems (transformers downstream from the service entrance) ground the secondary neutral.
 - 3. Isolation transformers and isolated power systems shall not be system grounded.
- C. Equipment Grounding:

1. Metallic structures, enclosures, raceways, junction boxes, outlet boxes, cabinets, machine frames, and other conductive items in close proximity with electrical circuits shall be grounded for personnel safety and to provide a low impedance path for possible ground fault currents.

3.2. PRIMARY EQUIPMENT AND CIRCUITS

- A. Switchgear: Provide a bare grounding electrode conductor from the switchgear ground bus to a grounding electrode system, metal underground water pipe or driven ground rods for the grounding electrode.
- B. Duct Banks and Manholes:
 1. Provide a bare equipment grounding conductor in each duct bank containing medium or high voltage cables. Connect the grounding conductors to the switchgear ground bus, to all manhole hardware, to the cable shielding of medium or high voltage cable splices and terminations, and equipment enclosures.
 2. Provide a grounding conductor having at least 50 percent ampacity of the largest phase conductor in the duct bank.
 3. Connect the equipment grounding conductor to the ground rod.
- C. Pad Mounted Transformers:
 1. Provide a driven ground rod and connect with a grounding electrode conductor to the grounding facilities at the transformer.
 2. Ground the secondary neutral.
 3. Connect lightning arrester grounds to the pad ground per NEC.
- D. Lightning Arresters: Connect lightning arrester grounds to the equipment ground bus, or ground rods as applicable.
- E. Outdoor Fences: Connect outdoor fences around electrical equipment to the grounding electrode system.
- F. Metallic Conduit: Metallic conduits which terminate without mechanical connection to a housing of electrical equipment by means of locknut and bushings or adapters, provided with grounding bushings. Connect bushings with a bare grounding conductor to the equipment ground bus.

3.3. SECONDARY EQUIPMENT AND CIRCUITS

- A. Main Bonding Jumper: Connect the secondary service neutral to the ground bus in the service equipment.
- B. Water Pipe and Supplemental Electrode:
 1. Provide a ground conductor connection between the service equipment ground bus and the metallic water pipe system. Jumper insulating joints in the water pipe.
 2. Provide a supplemental ground electrode and bond to the water pipe ground, or connect to the service equipment ground bus.

- C. Service Disconnect (Separate Individual Enclosure): Provide a ground bar bolted to the enclosure with lugs for connecting the various grounding conductors.
- D. Switchgear, Switchboards, and Unit Substations:
1. Connect the various feeder green grounding conductors to the ground bus in the enclosure with suitable pressure connectors.
 2. Connect the grounding electrode conductor to the ground bus.
 3. Connect the neutral to the ground bus (main bonding jumper).
 4. Connect metallic conduits, which terminate without mechanical connection to the housing, by grounding bushings and ground wire to the ground bus.
- E. Transformers:
1. Exterior: Exterior transformers supplying interior service equipment shall also have the neutral grounded at the transformer secondary. Provide a grounding electrode at the transformer.
 2. Separately derived systems (transformers downstream from service equipment): Ground the secondary neutral at the transformer. Provide a grounding electrode conductor from the transformer to the nearest cold water pipe.
- F. Conduit Systems:
1. Ground all metallic conduit systems.
 2. Non-metallic conduit systems shall contain a grounding conductor.
 3. Conduit provided for mechanical protection containing only a grounding conductor, bond to that conductor at the entrance and exit from the conduit.
- G. Feeders and Branch Circuits: Install green grounding conductors with feeders and branch circuits as indicated in panel schedules.
- H. Boxes, Cabinets, Enclosures, and Panelboards:
1. Bond the grounding wires to each pullbox, junction box, outlet box, cabinets, and other enclosures through which the ground wires pass.
 2. Provide ground bars in panelboards, bolted to the housing, with sufficient lugs for terminating the ground wires.
- I. Motors and Starters:
1. Provide lugs in motor terminal box and starter housing for ground wire termination.
 2. Make ground wire connections to ground bus in motor control centers.
- J. Receptacles are not approved for grounding through their mounting screws. Ground with a ground wire from green ground terminal on the receptacle to the outlet box ground screw.
- K. Ground lighting fixtures to the grounding conductor of the wiring system. Fixtures connected with flexible conduit shall have a green ground wire included with the power wires from the fixture through the flexible conduit to the first outlet box.
- L. Fixed electrical appliances and equipment shall have a ground lug installed for termination of the green ground conductor.

3.4. CONDUCTIVE PIPING

- A. Bond all conductive piping systems in the building to the electrical system ground. Bonding connections shall be made as close as practical to the water pipe ground or service equipment ground bus.

3.5. GROUND RESISTANCE

- A. Services at power company interface points shall comply with the power company ground resistance requirements.
- B. Make necessary modifications to the ground electrodes for compliance that are needed without additional cost to the Owner, including the provisions of a multi rod system.

3.6. GROUND ROD INSTALLATION

- A. Drive each rod vertically in the earth for not less than ten feet in depth.
- B. Where permanently concealed ground connections are required, make the connections by the exothermic process to form solid metal joints. Make accessible ground connections with mechanical pressure type ground connectors.
- C. Where rock prevents the driving of vertical ground rods, install grounding electrodes in horizontal trenches to achieve the specified resistance.

END OF SECTION

SECTION 26 05 33 - RACEWAY SYSTEMS

PART 1. GENERAL

1.1 DESCRIPTION

- A. This section includes the furnishing, installation, and connection of conduit, fittings, and boxes to form complete, coordinated, grounded raceway systems. Raceways are required for all wiring unless shown or specified otherwise, such as by type MC or NM in panel schedules.
- B. Definitions: The term conduit, as used in this specification, shall mean any or all of the types raceway types specified.

1.2 RELATED WORK

- A. General electrical requirement and items that are common to more than one section of DIVISION 26: Section 26 05 11, BASIC METHODS AND REQUIREMENTS (ELECTRICAL).
- B. Requirements for personnel safety and to provide a low impedance path for possible ground fault currents: Section 26 05 26: GROUNDING.

1.3 APPLICABLE PUBLICATIONS

- A. The publication listed below form a part of this specification to the extent referenced. Except where a specific data is given, the issue in effect (including amendments, addenda, revisions, supplements, and errata) on the date of Invitation for Bids shall be applicable. The publications are referenced in the text by the basic designation only.
- C. National Fire Protection Association (NFPA):
 - 70.....National Electrical Code (NEC)
- D. Underwriters Laboratories, Inc. (UL):
 - 1..... Flexible Metal Electrical Conduit
 - 5..... Surface Metal Electrical Raceway and Fittings
 - 6 Rigid Metal Conduit
 - 50..... Electrical Cabinets and Boxes
 - 467..... Electrical Grounding and Bonding Equipment
 - 514A..... Metallic Outlet Boxes
 - 514B.....Fittings for Conduit and Outlet Boxes
 - 651.....Schedule 40 and 80 Rigid PVC Conduit
 - 651A.....Type EB and A Rigid PVC Conduit
 - 797.....Electrical Metallic Tubing
 - 1242.....Intermediate Metal Conduit
- E. National Electrical Manufacturers Association (NEMA)
 - TC 13..... Electrical Nonmetallic Tubing (ENT)

PART 2. PRODUCTS

2.1 MATERIAL

- A. Conduit Size: In accordance with the NEC, but not less than 3/4 inch unless otherwise shown. Where permitted by the NEC, 1/2 inch flexible conduit may be used for tap connections to recessed lighting fixtures.

B. Conduit:

1. Rigid steel: UL 6.
2. Rigid intermediate steel conduit (IMC): UL 1242.
3. Electrical metallic tubing (EMT): U.L. 797. Maximum size 5 inch. Permitted only with cable rated 600 volts or less.
4. Flexible steel conduit (commercial Greenfield): UL 1.
5. Liquid tight flexible metal conduit: Flexible galvanized steel tubing covered with extruded liquid tight jacket of polyvinyl chloride (PVC). Provide conduit with a continuous copper bonding conductor wound spirally between the convolutions.
6. Direct burial plastic conduit: UL 651, and UL 651A, heavy wall PVC or high density PE.
7. Surface metal raceway: UL 5.

C. Conduit Fittings:

1. Rigid steel and IMC conduit fittings:
 - a. Standard threaded couplings, locknuts, bushings, and elbows: Steel or malleable iron are acceptable. Integral retractable type IMC couplings are acceptable also.
 - b. Locknuts: Bonding type with sharp edges for digging into the metal wall of an enclosure.
 - c. Bushings: Metallic insulating type, consisting of an insulating insert molded or locked into the metallic body of the fitting. Bushings made entirely of metal or nonmetallic material are not permitted.
 - d. Erickson (union type) and set screw type couplings: Approved for use in concrete are permitted for use to complete a conduit run where conduit is installed in concrete. Use set screws of case hardened steel with hex head and cup point to firmly seat in conduit wall for positive ground. Tightening of set screws with pliers is prohibited.
 - e. Sealing fittings: Threaded cast iron type. Use continuous drain type sealing fittings to prevent passage of water vapor. In concealed work, install fittings in flush steel boxes with blank coverplates having the same finishes as that of other electrical plates in the room.
2. Rigid aluminum conduit fittings:
 - a. Standard threaded couplings, locknuts, bushings, and elbows: Malleable iron, steel or aluminum alloy materials. Zinc or cadmium plate iron or steel fittings. Aluminum fittings containing more than 0.4 percent copper are prohibited.
 - b. Locknuts and bushings: As specified for rigid steel and IMC conduit.
 - c. Set screw fittings: Not permitted for use with aluminum conduit.
3. Electrical metallic tubing fittings:
 - a. Material of steel or malleable iron is acceptable.
 - b. Couplings and connectors: Concrete tight and rain tight, with connectors having insulated throats. Use gland and ring compression type couplings and connectors for conduit sizes 2 inches and smaller. Use set screw type couplings with four set screws each for conduit sizes over 2 inches. Use set screws of case hardened steel with hex head and cup point to firmly seat in wall of conduit for positive grounding.
 - c. Indent type connectors or couplings are prohibited.
 - d. Die cast or pressure cast zinc alloy fittings or fittings made of "pot metal" are prohibited.
4. Flexible steel conduit (Greenfield) fittings:
 - a. UL 5, except only steel or malleable iron material is acceptable.
 - b. Clamp type, with insulated throat.

5. Liquid tight flexible metal conduit fittings:
 - a. Steel or malleable iron material is acceptable.
 - b. Type incorporating a threaded grounding cone, a steel or plastic compression ring, and gland for tightening. Connectors shall have insulated throats.
 - c. Direct burial plastic conduit fittings: As recommended by the conduit manufacturer.
 6. Surface metal raceway fittings: As recommended by the raceway manufacturer.
 7. Expansion and deflection couplings:
 - a. UL 467 and UL 514.
 - b. Accommodate, 0.75 inch deflection, expansion, or contraction in any direction, and allow 30 degree angular deflections.
 - c. Include internal flexible metal braid sized to guarantee conduit ground continuity and fault currents in accordance with UL 467, and the NEC code tables for ground conductors.
 - d. Jacket: Flexible, corrosion resistant, watertight, moisture and heat resistant molded rubber material with stainless steel jacket clamps.
- D. Conduit Supports:
1. Parts and hardware: Zinc coat or provide equivalent corrosion protection.
 2. Individual Conduit Hangers: Designed for the purpose, having a pre assembled closure bolt and nut, and provisions for receiving a hanger rod.
 3. Multiple conduit (trapeze) hangers: Not less than 1 1/2 by 1 1/2 inch, 12 gage steel, cold formed, lipped channels; with not less than 3/8 inch diameter steel hanger rods.
 4. Solid Masonry and Concrete Anchors: Self drilling expansion shields, or machine bolt expansion.
- E. Outlet, Junction, and Pull Boxes:
1. UL 50, UL 514A
 2. Cast metal where required by the NEC or shown, and equipped with rustproof boxes.
 3. Sheet metal boxes: Galvanized steel, except where otherwise shown.
- F. Wireways: Equip with hinged covers, except where removable covers are shown.

PART 3. EXECUTION

3.1. PENETRATIONS

- A. Cutting or Holes:
1. Locate holes in advance where they are proposed in the structural sections such as ribs or beams. Obtain the approval of the Engineer prior to drilling through structural sections.
 2. Cut holes through concrete and masonry in new and existing structures with a diamond core drill or concrete saw. Pneumatic hammer, impact electric, hand or manual hammer type drills are not allowed, except where permitted by the Engineer as required by limited working space.
- B. Fire Stop: Where conduits, wireways, and other electrical raceways pass through fire partitions, fire walls, smoke partitions, or floors, install a fire stop that provides an effective barrier against the spread of fire, smoke and gases with rock wool fiber or

silicone foam sealant only. Completely fill and seal clearances between raceways and openings with the fire stop material.

- C. Waterproofing: At floor, exterior wall, and roof conduit penetrations, completely seal clearances around the conduit and make watertight.

3.2. CONDUIT SYSTEMS INSTALLATION, GENERAL

- A. Installation: In accordance with UL, NEC, as shown, and as hereinafter specified.
- B. Essential (Emergency) raceway systems: Install entirely independent of other raceway systems, except where specifically "excepted" by NEC Article 517.
- C. Install conduit as follows:
 1. In complete runs before pulling in cables or wires.
 2. Flattened, dented, or deformed conduit is not permitted. Remove and replace the damaged conduits with new undamaged material.
 3. Assure conduit installation does not encroach into the ceiling height head room, walkways, or doorways.
 4. Cut square with a hacksaw, ream, remove burrs, and draw up tight.
 5. Mechanically and electrically continuous.
 6. Independently support conduit. Do not use other supports i.e., (suspended ceilings, suspended ceiling supporting members, lighting fixtures, mechanical piping, or mechanical ducts).
 7. Support within one foot of changes of direction, and within one foot of each enclosure to which connected.
 8. Close ends of empty conduit with plugs or caps at the rough in stage to prevent entry of debris, until wires are pulled in.
 9. Conduit installations under fume and vent hoods are prohibited.
 10. Secure conduits to cabinets, junction boxes, pull boxes and outlet boxes with bonding type locknuts. For rigid and IMC conduit installations, provide a locknut on the inside of the enclosure, made up wrench tight. Do not make conduit connections to junction box covers.
- D. Conduit Bends:
 1. Make bends with standard conduit bending machines.
 2. Conduit hickey may be used for slight offsets, and for straightening stubbed out conduits.
 3. Bending of conduits with a pipe tee or vise is prohibited.
- E. Layout and Homeruns:
 1. Install conduit with wiring for homeruns grouped as shown.
 2. Deviations: Make only where necessary to avoid interferences and only after drawings showing the proposed deviations have been submitted to and have been approved by the Resident Engineer.

3.3. CONCEALED WORK INSTALLATION

- A. In Concrete:
 1. Conduit: Rigid steel, IMC or EMT; except do not install EMT in concrete slabs that are in contact with soil, gravel or vapor barriers.
 2. Align and run conduit in direct lines.

3. Install conduit through concrete beams only when the following occurs:
 - a. Where shown on the structural drawings.
 - b. As approved by the Engineer prior to construction, and after submittal of drawing showing location, size, and position of each penetration.
4. Installation of conduit in concrete that is less than 3 inches thick is prohibited.
 - a. Conduit outside diameter larger than 1/3 of the slab thickness is prohibited.
 - b. Space between conduits in slabs: Approximately six conduit diameters apart, except one conduit diameter at conduit crossings.
 - c. Install conduits approximately in the center of the slab so that there will be a minimum of 3/4 inch of concrete around the conduits.
5. Make couplings and connections watertight. Use thread compounds that are UL approved conductive type to insure low resistance ground continuity through the conduits. Tightening set screws with pliers is prohibited.

B. Above Furred or Suspended Ceilings and in Walls:

1. Conduit for conductors above 600 volts:
 - a. Rigid steel or rigid aluminum. Do not use aluminum in wet locations.
 - b. Aluminum conduit mixed indiscriminately with other types in the same system is prohibited.
2. Conduit for conductors 600 volts and below:
 - a. Rigid steel, IMC, rigid aluminum, or EMT. Types mixed indiscriminately in the same system is prohibited.
 - b. Do not use aluminum in wet locations.
3. Align and run conduit parallel or perpendicular to the building lines.
4. Connect recessed lighting fixtures to conduit runs with maximum six feet of flexible metal conduit extending from a junction box to the fixture.
5. Tightening set screws with pliers is prohibited.

3.4. EXPOSED WORK INSTALLATION

A. Conduit for conductors above 600 volts:

1. Rigid steel or rigid aluminum. Do not use aluminum in wet locations.
2. Aluminum mixed indiscriminately with other types in the same system is prohibited.

B. Conduit for Conductors 600 volts and below:

1. Rigid steel, IMC, rigid aluminum, or EMT. Types mixed indiscriminately in the system is prohibited.
2. Do not use aluminum in wet locations.

C. Align and run conduit parallel or perpendicular to the building lines.

D. Install horizontal runs close to the ceiling or beams and secure with conduit straps.

E. Support horizontal or vertical runs at not over eight foot intervals.

F. Surface metal raceways: Use only where shown.

G. Painting:

1. Exposed conduit on painted surfaces shall be painted to match surface color.

2. Paint all conduits containing cables rated over 600 volts safety orange. Refer to Section, painting specifications for preparation, paint type, and exact color. In addition, paint legends, using two inch high black numerals and letters, showing the cable voltage rating. Provide legends where conduits pass through walls and floors and at maximum 20 foot intervals in between.

3.5. DIRECT BURIAL INSTALLATION

- A. Exterior routing of Lighting Systems and Other Branch circuits (600 Volt and Less, and 5 feet from the buildings):
 1. Conduit: Thick wall PVC or high density PE, unless otherwise shown.
 2. Mark conduit at uniform intervals to show the kind of material, direct burial type, and the UL approval label.
 3. Install conduit fittings and terminations as recommended by the conduit manufacturer.
 4. Tops of conduits shall be as follows unless otherwise shown:
 - a. Not less than 24 inches below finished grade.
 - b. Not less than 30 inches below road and other paved surfaces.
 5. Work with extreme care near existing ducts, conduits, cables, and other utilities to avoid damaging them.
 6. Excavation for conduit bedding and back filling of trenches:
 - a. Cut the trenches neatly and uniformly.
 - b. Do not kink the conduits.
 7. Seal conduits, including spare conduits, at building entrances and at outdoor terminations for equipment with a suitable compound that prevents the entrance of moisture and gases.
 8. Where metal conduit is shown, install threaded heavy wall rigid steel galvanized conduit or type A20 rigid steel galvanized conduit coated with .5 mm (20 mil) bonded PVC, or rigid steel or IMC, PVC coated or standard coated with bituminous asphaltic compound.

3.6. HAZARDOUS LOCATIONS

- A. Use rigid steel conduit only, notwithstanding requirements otherwise specified in this or other sections of these specifications.
- B. Install UL approved sealing fittings, that prevent passage of explosive vapors, in hazardous areas equipped with explosive proof lighting fixtures, switches, and receptacles, as required by the NEC.

3.7. WET OR DAMP LOCATIONS

- A. Unless otherwise shown, use conduits of rigid steel or IMC.
- B. Provide sealing fittings, to prevent passage of water vapor, where conduits pass from warm to cold locations, i.e., (refrigerated spaces, constant temperature rooms, air conditioned spaces building exterior walls, roofs) or similar spaces.
- C. Unless otherwise shown, use rigid steel or IMC conduit within five feet of the exterior and below concrete building slabs in contact with soil, gravel, or vapor barriers. Cover conduit on the outside with a factory coating of .5 mm (20 mil) bonded PVC or field coat with asphaltum before installation. After installation, completely coat damaged areas of coating.

3.8. MOTORS AND VIBRATING EQUIPMENT

- A. Use flexible metal conduit for connections to motors and other electrical equipment subject to movement, vibration, misalignment, cramped quarters, or noise transmission. Provide liquid tight flexible metal conduit for installation in exterior locations, moisture or humidity laden atmosphere, corrosive atmosphere, water or spray wash down operations, inside (air stream) of HVAC units, and locations subject to seepage or dripping of oil, grease or water. Provide a green ground wire with flexible metal conduit.

3.9. EXPANSION JOINTS

- A. Conduits 3 inches and larger, that are secured to the building structure on opposite sides of a building expansion joint, require expansion and deflection couplings. Install the couplings in accordance with the manufacturer's recommendations.
- B. Provide conduits smaller than 3 inches with junction boxes on both sides of the expansion joint. Connect conduits to junction boxes with sufficient slack of flexible conduit to produce 5 inch vertical drop midway between the end. Flexible conduit shall have a copper green ground bonding jumper installed. In lieu of this flexible conduit, expansion and deflection couplings as specified above for 15 inches and larger conduits are acceptable.
- C. Install expansion and deflection couplings where shown.

3.10. CONDUIT SUPPORTS, INSTALLATION

- A. Safe working load shall not exceed 1/4 of proof test load of fastening devices.
- B. Use pipe straps or individual conduit hangers for supporting individual conduits.
- C. Support multiple conduit runs with trapeze hangers. Use trapeze hangers that are designed to support a load equal to or greater than the sum of the weights of the conduits, wires, hanger itself, and 90 kg (200 pounds). Attach each conduit with U bolts or other approved fasteners.
- D. Support conduit independently of junction boxes, pull boxes, fixtures, suspended ceiling T bars, angle supports, and similar items.
- E. Fasteners and Supports in Solid Masonry and Concrete:
 - 1. New Construction: Use steel or malleable iron concrete inserts set in place prior to placing the concrete.
 - 2. Existing Construction:
 - a. Steel expansion anchors not less than 1/4 inch bolt size and not less than 1 1/8 inch embedment.
 - b. Power set fasteners not less than 1/4 inch diameter with depth of penetration not less than 3 inches.
 - c. Use vibration and shock resistant anchors and fasteners for attaching to concrete ceilings.
- F. Hollow Masonry: Toggle bolts are permitted. Bolts supported only by plaster are not acceptable.
- G. Metal Structures: Use machine screw fasteners or other devices specifically designed and approved for the application.

- H. Attachment by wood plugs, rawl plug, plastic, lead or soft metal anchors, or wood blocking and bolts supported only by plaster is prohibited.
- I. Chain, wire, or perforated strap shall not be used to support or fasten conduit.
- J. Spring steel type supports or fasteners are prohibited for all uses except: Horizontal and vertical supports/fasteners within walls.
- K. Vertical Supports: Vertical conduit runs shall have riser clamps and supports in accordance with the NEC and as shown. Provide supports for cable and wire with fittings that include internal wedges and retaining collars.

3.11. BOX INSTALLATION

- A. Boxes for Concealed Conduits:
 - 1. Mount flush.
 - 2. Provide raised covers for boxes to suit the wall or ceiling, construction and finish.
- B. In addition to boxes shown, install additional boxes where needed to prevent damage to cables and wires during pulling in operations.
- C. Remove only knockouts as required and plug unused openings. Use threaded plugs for cast metal boxes and snap in metal covers for sheet metal boxes.
- D. Outlet boxes in the same wall mounted back to back are prohibited.
- E. Minimum size of outlet boxes for ground fault interrupter (GFI) receptacles is 4 inches square by 2 1/8 inches deep, with device covers for the wall material and thickness involved.
- F. Stencil or install phenolic nameplates on covers of boxes identified on riser diagrams.

3.12. TELEPHONE CONDUIT

- A. Install the telephone raceway system as shown on drawings.
- B. Minimum conduit size of 3/4 inch, but not less than the size shown on the drawings.
- C. All conduit ends shall be equipped with insulated bushings.
- D. All four inch conduits within buildings shall include pull boxes after every two 90 degree bends. Size per the NEC.
- E. Vertical conduits/sleeves through closets floors shall terminate not less than 3 inches below the floor and not less than 3 inches below the ceiling of the floor below.
- F. Terminate conduit runs to/from a telephone backboard in a closet or interstitial space at the top or bottom of the backboard. Conduits shall enter telephone closets next to the wall and be flush with the backboard.
- G. Where drilling is necessary for vertical conduits, locate holes so as not to affect structural sections such as ribs or beams.

- H. All empty conduits located in telephone closets or on telephone backboards shall be sealed with a standard non hardening duct seal compound to prevent the entrance of moisture and gases and to meet fire resistance requirements.
- I. Conduit runs shall contain no more than four quarter turns (90 degree bends) between pull boxes/backboards. Minimum radius of telephone conduit bends shall be as follows (special long radius):
- | Sizes of Conduit
Trade Size | Radius of Conduit Bends
Inches |
|--------------------------------|-----------------------------------|
| 3/4 | 6 |
| 1 | 9 |
| 1 1/4 | 14 |
| 1 1/2 | 17 |
| 2 | 21 |
| 2 1/2 | 25 |
| 3 | 30 |
| 3 1/2 | 36 |
| 4 | 45 |
- J. Furnish and install 3/4 inch thick fire retardant plywood on the wall of telephone closets where indicated. Size plywood eight feet high by the width of the closet. Mount the plywood with the bottom edge one foot above the finished floor.
- K. Furnish and install pull wire in all empty conduits. (Sleeves through floor are exceptions)

END OF SECTION

SECTION 26 24 16 – PANELBOARDS

PART 1. GENERAL

1.1. DESCRIPTION

- A. This section includes the furnishing, installation and connection of panelboards.

1.2. RELATED WORK

- A. Section 26 05 00, BASIC METHODS AND REQUIREMENTS (ELECTRICAL).
- B. Section 26 05 26, GROUNDING.

1.3. SUBMITTALS.

- A. Sufficient information, clearly presented, shall be included to determine compliance with drawings and specifications.

1.4. APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by basic designation only.
- B. Underwriters Laboratories, Inc. (UL):
 - 50 Cabinet and Boxes, Electrical
 - 67 Panelboards
 - 489 Molded Case Circuit Breakers and Circuit Breaker Enclosures
- C. National Fire Protection Association (NFPA):
 - 70 National Electrical Code (NEC)
- D. National Electrical Manufacturers Association (NEMA):
 - PB 1 Panelboards
 - AB 1 Molded Case Circuit Breakers

PART 2. PRODUCTS

2.4. PANELBOARDS

- A. Panelboards shall be in accordance with UL, NEMA, NEC, and as shown on the drawings.
- B. Provide standard manufactured products. All components of panelboards shall be the product and assembly of the same manufacturer. All similar units of all panelboards to be of the same manufacturer.
- C. All panels shall be dead front safety type. Arrange sections for easy removal without disturbing other sections.
- D. All panelboards shall be completely factory assembled with molded case circuit breakers.
- E. Panels shall have main breaker or main lugs, bus size, voltage, and phase as shown on the drawings. Panels may be top or bottom feed. Panels shall be flush when installed on finished wall surfaces. Panels shall be surface mount when installed in unfinished rooms.

- F. Panelboards shall have the following features:
1. Non-reduced size copper or aluminum bus bars, and connection straps bolted together and rigidly supported on molded insulators. Bus bar taps for panels with single pole branches shall be arranged for sequence phasing of branch circuit devices.
 2. Full size neutral bar, mounted on insulated supports.
 3. Ground bar with sufficient terminals for all grounding wires.
 4. Buses braced for the available short circuit current as indicated on the drawings. If no ratings are shown on the drawings the ratings shall be not less than 10,000 amperes symmetrical for 120/128 volt and 120/240 volt panelboards, and 14,000 amperes symmetrical for 277/480 volt panelboards.
 5. All breakers and phase bus connections shall be arranged so that it will be possible to substitute a 2 pole breaker for two single pole breakers, and a 3 pole breaker for three single pole breakers, when trip is 30 amps or less and frame size is 100 amperes or less, without having to drill and tap the main bus bars at bus straps.
 6. Design interior so that protective devices can be replaced without removing adjacent units, main bus connectors, and without drilling or tapping. Panel phase bus connections to protective devices shall not be riveted to the panel bus and shall be field removable by means of a screw driver.
 7. Where designated on panel schedule as "space" or "spare", include all necessary bussing, device support and connections. Provide blank cover for each space.
 8. In two section panelboards, the main bus in each section shall be full size. The first section shall be furnished with subfeed lugs on the line side with cable connections to the second section. Panelboard sections with tapped bus or crossover bus shall not be accepted.

2.5. CABINETS AND TRIMS

A. Cabinets:

1. Provide galvanized steel cabinets to house panelboards. Cabinets for distribution panels may be factory primed and suitably treated with a corrosion resisting paint finish meeting UL standard for outdoor applications.
2. Cabinet enclosure shall not have ventilating openings.
3. Back and sides shall be of one piece formed steel. Cabinets for distribution panels may be of formed sheet steel with end and side panels welded, riveted, or bolted as required.
4. Provide minimum of four interior mounted studs and necessary hardware for "in" and "out" adjustment of panel interior.
5. Cabinets for two section panelboards shall have both sections bolted together, arranged side by side, and shall be the same height. Flush mounted cabinets should be 1 1/2 inches apart and coupled by conduit nipple.
6. Gutter size in panel boxes, on all sides, shall be in accordance with the NEC. Cabinets containing through feeders shall have the gutters space increased by the amount required for auxiliary gutters in the NEC.

B. Trims:

1. Fabricate trim of sheet steel consisting of frame with door attached by concealed hinges. Provide flush or surface trim as shown on the drawings.
2. Provide hinged trim compliant with door-in-door specifications. Trim screw removal shall allow the trim to swing away from the panelboard interior.
3. Flush trims shall overlap the box by at least 3/4 inch all around.
4. Surface trim shall have the same width and height as the box.

5. Flush or surface trims shall not have ventilating openings.
6. Secure trims to back boxes by indicating trim clamps or screws.
7. Provide separate trims for each section of multiple section panelboards. Trims and doors of sections shall be of the same height.

C. Doors:

1. Provide doors with flush type latch and manufacturer's standard lock. Doors over 48 inches in height shall have a vault handle and a three point catch, arranged to fasten door at top, bottom, and center.
2. In making switching devices accessible, doors shall not uncover any live parts.
3. Provide concealed, butt hinges welded to the doors and trims.
4. For magnetic contactors incorporated in panelboards, provide separate doors for the contactors.
5. Provide keyed alike system for all panelboards. In existing buildings where new panels are installed, provide keyed alike locks as directed by Resident Engineer.
6. Provide a directory card, metal holder, and transparent cover. Permanently mount holders on inside of doors.

D. Painting:

1. Thoroughly clean and paint trims and doors at the factory with primer and manufacturer's standard finish.

2.6. MOLDED CASE CIRCUIT BREAKERS FOR PANELBOARDS

- A. Breakers shall be UL listed and labeled, in accordance with the NEC, as shown on the drawings, and as specified.
- B. Circuit breakers in panelboards shall be bolt on type on phase bus bar or branch circuit bar. Loadcenter circuit breakers may be plug on type.
1. Molded case circuit breakers for lighting and appliance branch circuit panelboards shall have minimum interrupting rating as indicated but not less than:
 - a. 120/208 Volt Panelboard: 22,000 amperes symmetrical.
 - b. 120/240 Volt Panelboard: 10,000 amperes symmetrical.
 - c. 277/480 Volt Panelboard: 14,000 amperes symmetrical.
- C. Molded case circuit breakers shall have automatic, trip free, non adjustable, inverse time, and instantaneous magnetic trips for 100 ampere frame or less. Magnetic trip shall be adjustable from 3X to 10X for breakers with 600 ampere frames and higher. Factory setting shall be HI, unless otherwise noted.
- D. Breaker features shall be as follows:
1. A rugged, integral housing of molded insulating material.
 2. Silver alloy contacts.
 3. Arc quenchers and phase barriers for each pole.
 4. Quick make, quick break, operating mechanisms.
 5. A trip element for each pole, thermal magnetic type with long time delay and instantaneous characteristics, a common trip bar for all poles and a single operator.
 6. Electrically and mechanically trip free.
 7. An operating handle which indicates ON, TRIPPED, and OFF positions.

8. Line connections shall be bolted for 480 volt panels, bolted or plug-on for 208 volt panels.
9. Interrupting rating shall not be less than the maximum short circuit current available at the line terminals as indicated on the drawings.
10. An overload on one pole of a multipole breaker shall automatically cause all the poles of the breaker to open.
11. For circuit breakers being added to existing panelboards, coordinate the breaker type with existing panelboards. Modify the panel directory.

2.7. SEPARATELY ENCLOSED MOLDED CASE CIRCUIT BREAKERS

- A. Where separately enclosed molded case circuit breakers are shown on the drawings, provide circuit breakers in accordance with the applicable requirements of those specified for panelboards.
- B. Enclosures are to be of the NEMA types shown on the drawings. Where the types are not shown, they are to be the NEMA type most suitable for the environmental conditions where the breakers are being installed.

PART 3. EXECUTION

3.4. INSTALLATION

- A. Installation shall be in accordance with NEC, as shown on the drawings, and as specified.
- B. Locate panelboards so that the present and future conduits can be conveniently connected. Coordinate the sizes of cabinets with designated closet space.
- C. Install a typewritten directory of circuits in each panelboard after wiring is complete. Schedule shall be typed on the panel directory cards. Include the room numbers and items served on the cards. Descriptions shall be in conformance with NFPA 70 requirements.
- D. Mount the panelboard so that maximum height of circuit breaker above finished floor shall not exceed 78 inches. For panelboards which are too high, mount panelboard so that the bottom of the cabinets will not be less than 6 inches above the finished floor.
- E. For panelboards located in areas accessible to the public, paint the exposed surfaces of the trims, doors, and boxes with finishes to match surrounding surfaces after the panelboards have been installed.
- F. Circuit numbers indicated on the drawings are shown for the purpose of clarifying the grouping of outlets. The actual number assigned to the circuit in the panelboard shall suit the bussing and branch circuiting to the panel.

END OF SECTION

SECTION 26 27 26 - WIRING DEVICES

PART 1. GENERAL

1.1. DESCRIPTION

- A. This section includes the furnishing, installation, and connection of wiring devices.

1.2. RELATED WORK

- A. Section 26 05 00, BASIC METHODS AND REQUIREMENTS (ELECTRICAL).
- B. Section 26 05 33, CONDUIT SYSTEMS.
- C. Section 26 05 21, CABLES, LOW VOLTAGE (600 VOLTS AND BELOW).
- D. Section 26 05 26, GROUNDING.

1.3. APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The issue in effect listed below (including amendments, addenda, revisions, supplements, and errata) on the date of Invitation for Bids shall be applicable. The publications are referenced in the text by designation only.
- B. National Fire Protection Association (NFPA):
 - 70 National Electrical Code (NEC)
- C. National Electrical Manufacturers Association (NEMA):
 - WD1 General Requirements for Wiring Devices
 - WD6 Wiring Devices – Dimensional Requirements
- D. Underwriter's Laboratories, Inc. (UL):
 - 5 Safety; Surface Metal Raceways and Fittings
 - 20 Safety; General-Use Snap Switches
 - 231 Safety; Power Outlets
 - 467 Safety; Grounding and Bonding Equipment
 - 498 Safety; Attachment Plugs and Receptacles
 - 943 Safety; Ground Fault Circuit Interrupters

PART 2. PRODUCTS

2.3. RECEPTACLES

- A. General: All receptacles shall be specification grade and conform to NEMA WD1.
 - 1. Mounting straps shall be plated steel, with beak-off plaster ears and shall include a self-grounding feature. Terminal screws shall be brass, brass plated or a copper alloy metal.
 - 2. Receptacles shall have provisions for back wiring with separate metal clamp type terminals (four min.) and side wiring from four captively held binding screws.
- B. Standard duplex receptacles shall be single phase, 15 Ampere, 120 volts, 2 pole, 3 wire, and conform to the NEMA 5 20R configuration. The duplex type shall have break off feature for two circuit operation. The ungrounded pole of each receptacle shall be

provided with a separate terminal. Other outlet configurations shall be as shown on the drawings.

1. Bodies shall be DARK BROWN as selected by the architect unless noted otherwise on the drawings.
 2. Switched duplex receptacles shall be wired so that only the top receptacle is switched. The remaining receptacle shall be un-switched.
 3. Ground Fault Interrupter Duplex Receptacles: Shall be an integral unit suitable for mounting in a standard outlet box.
 - a. Ground fault interrupter, shall be specification grade and consist of a differential current transformer, solid state sensing circuitry and a circuit interrupter switch. It shall be rated for operation on a 60 Hz, 120 volt, 20 ampere branch circuit. Device shall have nominal sensitivity to ground leakage current of five milliamperes and shall function to interrupt the current supply for any value of ground leakage current above five milliamperes on the load side of the device. Device shall have a minimum nominal tripping time of 1/30th of a second. Devices shall meet UL 943.
 4. Arc Fault Interrupter Receptacles shall be UL listed and installed per requirements of local enforcement of NFPA 70.
 5. Isolated Ground Type Duplex Receptacles:
 - a. Bodies shall be orange in color.
 - b. Shall be specification grade and UL listed as "Isolated Ground".
- C. Receptacles 20, 30 and 50 Ampere, 250 Volt: Devices shall meet UL 231.
- D. Weatherproof Receptacles: Shall consist of a duplex receptacle, mounted in box with a gasketed, weatherproof, cast metal cover plate and cap over each receptacle opening. The cap shall be permanently attached to the cover plate by a spring hinged flap. The weatherproof integrity shall not be affected when heavy duty specification or hospital grade attachment plug caps are inserted. Cover plates on outlet boxes mounted flush in the wall shall be gasketed to the wall in a watertight manner.
- 2.4. TOGGLE SWITCHES and dimmers
- A. Toggle switches shall be totally enclosed tumbler type with bodies of phenolic compound.
 - B. Toggle handles shall be the color selected by the architect unless shown otherwise on the drawings.
 1. Switches shall be DARK BROWN
 2. Switches installed in hazardous areas shall be explosion proof type in accordance with the NEC and as shown on the drawings.
 3. Shall be single unit toggle, butt contact, quiet AC type, heavy duty general-purpose use with an integral self-grounding mounting strap with break-off plaster ears and provisions for back wiring with separate metal wiring clamps and side wiring with captively held binding screws.
 4. Ratings:
 - a. 120 volt circuits: 20 amperes at 120-277 volts AC.
 - b. 277 volt circuits: 20 amperes at 120-277 volts AC.
 5. The switches shall be mounted on the striker plate side of doors, unless otherwise shown.
 6. Incorporate barriers between switches with multigang outlet boxes where required by the NEC.
 7. All toggle switches shall be of the same manufacturer.

- C. Dimmers: Incandescent lamp loads. Wall mounted incandescent dimmers shall be specification grade with capability of raising and lowering the lighting from completely off at extreme counter clockwise rotation, to full intensity. Dimmers shall include an "off" position. Dimmers shall maintain full load rating even when two or more units are installed adjacent to one another. All wall mounted dimmers shall be of the same manufacturer.
- D. Dimmers: Fluorescent lamp loads. Wall mounted fluorescent lamp dimmers shall be specification grade with large control knob and shall be capable of raising and lowering the lighting from completely off at extreme counter clockwise rotation, to full intensity. Dimmers shall include an "off" position. Dimmers shall have low end intensity adjustment and maintain full load rating even when two or more units are installed adjacent to one another. All wall mounted dimmers shall be of the same manufacturer. Dimming ballast shall be provided for each F32 rapid start lamp or pair of lamps. Dimmers shall have adequate capacity for the load served and the environment in which installed.

2.5. WALL PLATES

- A. Wall plates for switches and receptacles in non-residential applications shall be OIL RUBBED BRONZE unless noted otherwise on the drawings. Oversize plates will not be acceptable. In Residential applications the color shall be as selected by the architect.
- B. Standard NEMA design, so that products of different manufacturers will be interchangeable. Dimensions for openings in wall plates shall be accordance with NEMA WD1 and compatible with devices.
- C. For receptacles or switches mounted adjacent to each other, wall plates shall be common for each group of receptacles or switches.
- D. Install blank wall plates on telephone outlets.

2.6. SURFACE MULTIPLE-OUTLET ASSEMBLIES (Wiremold)

- A. Assemblies shall conform to the requirements of NFPA 70 and UL 5.
- B. Shall have the following features:
 - 1. Enclosures: Unless otherwise shown on the drawings the following shall apply:
 - a. Thickness of steel shall be not less than 0.040 inch steel for base and cover. Nominal dimension shall be 1 1/2 by 2 3/4 inches with inside cross sectional area not less than 3.5 square inches unless specific size or manufacturer information is provided on drawings.
 - b. The enclosures shall be thoroughly cleaned, phosphatized and painted at the factory with primer and the manufacturer's standard baked enamel or lacquer finish.
 - 2. Receptacles shall be duplex, specification grade. See paragraph 'RECEPTACLES' in this section. Device cover plates shall be the manufacturer's standard corrosion resistant finish and shall not exceed the dimensions of the enclosure.
 - 3. Unless otherwise shown on drawings, spacing of the receptacles along the strip shall be 18 inches on centers.
 - 4. Wires within the assemblies shall be not less than #12 AWG copper, with 600 volt ratings.

5. Installation fittings shall be designed for the strips being installed including bends, offsets, device brackets, inside couplings, wire clips, and elbows.
6. Bond the strips to the conduit systems for their branch supply circuits.
7. Dual channel raceway shall be provided where communication wiring is also intended to be placed in the raceway. Communication outlets and/or devices as shown on the drawings shall be installed. Standard communication outlet shall be RJ-45 unless otherwise shown.

PART 3. EXECUTION

3.3. INSTALLATION

- A. Installation shall be in accordance with the NEC, and as shown as on the drawings.
- B. Ground terminal of each receptacle shall be bonded to the outlet box with an approved green bonding jumper.

END OF SECTION

SECTION 26 29 21 - DISCONNECTS (MOTOR AND CIRCUIT)

PART 1. GENERAL

1.1. DESCRIPTION

- A. This section specifies low voltage disconnect switches.

1.2. RELATED WORK

- A. Section 26 05 00, BASIC METHODS AND REQUIREMENTS (ELECTRICAL).
- B. Section 26 05 26, GROUNDING.

1.3. SUBMITTALS

- A. Include sufficient information, clearly presented, to determine compliance with drawings and specifications. Include information on electrical ratings, mounting, material, and enclosure types.

1.4. APPLICABLE PUBLICATIONS

- A. The publication listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. Underwriters Laboratories, Inc. (UL):
 - 98 Enclosed and Dead-Front Switches
 - 198C High Interrupting-Capacity Fuses, Current Limiting Type
 - 198E Class R Fuses
 - 977 Fused Power-Circuit Devices
- C. National Fire Protection Association (NFPA):
 - 70 National Electrical Code (NEC)
- D. National Electrical Manufacturers Association (NEMA):
 - KS 1 Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum)

PART 2. PRODUCTS

2.4. LOW VOLTAGE FUSIBLE SWITCHES RATED 600 AMPERES AND LESS

- A. Quick-make, quick-break type in accordance with UL98, NEMA KS 1 and NEC.
- B. Minimum duty rating, NEMA classification General Duty (GD) for 240 volts and NEMA classification Heavy Duty (HD) for 277/480 volts.
- C. Shall have the following features:
 - 1. Switch mechanism shall be the quick-make, quick-break type.
 - 2. Copper blades, visible in the OFF position.
 - 3. An arc chute for each pole.
 - 4. External operating handle shall indicate ON and OFF position and shall have lock open padlocking provisions.
 - 5. Mechanical interlock shall permit opening of the door only when the switch is in the OFF position, defeatable by a special tool to permit inspection.

6. Fuse mounting for the size and type of fuses specified. Furnish switches completely fused. Furnish a complete set of spare fuses for each switch being installed. Provide additional sets of spare fuses to constitute not less than two complete sets for the type, size, and rating of each set installed. Deliver the fuses to the Resident Engineer prior to the final inspection.
7. Solid neutral for each switch being installed in a circuit which includes a neutral conductor.
8. Ground Lugs: One for each ground conductor.
9. Enclosures:
 - a. Shall be the NEMA types shown on the drawings for the switches.
 - b. Where the types of switch enclosures are not shown, they shall be the NEMA types which are most suitable for the environmental conditions where the switches are being installed.

2.5. LOW VOLTAGE UNFUSED SWITCHES RATED 600 AMPERES AND LESS

- A. Shall be the same as Low Voltage Fusible Switches rated 600 amperes and less, except it shall not accept fuses.

2.6. LOW VOLTAGE FUSIBLE SWITCHES RATED OVER 600 AMPERES TO 1200 AMPERE

- A. Shall be the same as Low Voltage Fusible Switches rated 600 amperes and less except minimum duty rating NEMA classification Heavy Duty (HD). Switch shall be horsepower rated.

2.7. MOTOR RATED TOGGLE SWITCH

- A. Motor rated toggle switch shall be single pole, 115 volts and shall include overload protection and pilot light to indicate the "on" or "running" condition of motor.
- B. Enclosures shall be most suitable for the environmental conditions where the switches are being installed.

PART 3. EXECUTION

3.4. INSTALLATION

- A. Installation shall be in accordance with the NEC and as shown on the drawings.
- B. Contractor shall confirm location of equipment to be served by disconnect with equipment installer prior to installation of disconnect and associated wiring. Contractor shall confirm rating required by equipment to be served prior to installation of disconnect.

END OF SECTION

SECTION 26 51 00 - INTERIOR LIGHTING

PART 1. GENERAL

1.1. DESCRIPTION:

- A. This section specifies the furnishing, installation and connection of the interior lighting systems.

1.2. RELATED WORK

- A. Section 26 05 00, BASIC METHODS AND REQUIREMENTS (ELECTRICAL): General requirements that are common to more than one section of Division 26.
- B. Section 26 05 21, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS AND BELOW): Cables and wiring.
- C. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS: Requirements for personnel safety and to provide a low impedance path to ground for possible ground fault currents.
- D. Section 26 27 26, WIRING DEVICES: Wiring devices used for control of the lighting systems.

1.3. QUALITY ASSURANCE

- A. Refer to Paragraph, QUALIFICATIONS, in Section 26 05 11, BASIC METHODS AND REQUIREMENTS (ELECTRICAL).

1.4. SUBMITTALS

- A. In accordance with Section 26 05 11, BASIC METHODS AND REQUIREMENTS (ELECTRICAL), submit the following:
- B. Product Data: For each type of lighting fixture (luminaire) designated on the LIGHTING FIXTURE SCHEDULE, arranged in order of fixture designation, submit the following information.
 - 1. Material and construction details include information on housing, optics system and lens/diffuser.
 - 2. Physical dimensions and description.
 - 3. Wiring schematic and connection diagram.
 - 4. Installation details.
 - 5. Energy efficiency data.
 - 6. Photometric data based on laboratory tests complying with IESNA Lighting Measurements, testing and calculation guides.
 - 7. Lamp data including lumen output (initial and mean), color rendition index (CRI), rated life (hours) and color temperature (degrees Kelvin).
 - 8. Ballast data including ballast type, starting method, ambient temperature, ballast factor, sound rating, system watts and total harmonic distortion (THD).

1.5. APPLICABLE PUBLICATIONS

- A. Publications listed below (including amendments, addenda, revisions, supplements, and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by designation only.

- B. Institute of Electrical and Electronic Engineers (IEEE):
C62.41 Guide on the Surge Environment in Low Voltage (1000V and less) AC Power Circuits
- C. National Fire Protection Association (NFPA):
70 National Electrical Code (NEC)
101 Life Safety Code
- D. National Electrical Manufacturer's Association (NEMA):
C82.1 Ballasts for Fluorescent Lamps - Specifications
C82.2 Method of Measurement of Fluorescent Lamp Ballasts
C82.4 Ballasts for High-Intensity-Discharge and Low-Pressure Sodium Lamps
C82.11 High Frequency Fluorescent Lamp Ballasts
- E. Underwriters Laboratories, Inc. (UL):
496-96 Edison-Base Lampholders
542-99 Lampholders, Starters, and Starter Holders for Fluorescent Lamps
844-95 Electric Lighting Fixtures for Use in Hazardous (Classified) Locations
924-95 Emergency Lighting and Power Equipment
935-01 Fluorescent-Lamp Ballasts
1029 High-Intensity-Discharge Lamp Ballasts
1029A. Igniters and Related Auxiliaries for HID Lamp Ballasts
1598 Luminaires
1574. Standard for Track Lighting Systems
2108. Standard for Low-Voltage Lighting Systems
8750. Light Emitting Diode (LED) Light Sources for Use in Lighting Products
- F. Federal Communications Commission (FCC):
Code of Federal Regulations (CFR), Title 47, Part 18

PART 2. PRODUCTS

2.5. LIGHTING FIXTURES (LUMINAIRES)

- A. Shall be in accordance with NFPA 70 and UL 1598, as shown on drawings, and as specified.
- B. Sheet Metal:
 - 1. Shall be formed to prevent warping and sagging. Housing, trim and lens frame shall be true, straight (unless intentionally curved) and parallel to each other as designed.
 - 2. Wireways and fittings shall be free of burrs and sharp edges and shall accommodate internal and branch circuit wiring without damage to the wiring.
 - 3. When installed, any exposed fixture housing surface, trim frame, door frame and lens frame shall be free of light leaks; lens doors shall close in a light tight manner.
 - 4. Hinged door closure frames shall operate smoothly without binding when the fixture is in the installed position, latches shall function easily by finger action without the use of tools.
- C. Ballasts shall be serviceable while the fixture is in its normally installed position, and shall not be mounted to removable reflectors or wireway covers unless so specified.
- D. Lamp Sockets:

1. Fluorescent: Lampholder contacts shall be the biting edge type or phosphorous-bronze with silver flash contact surface type and shall conform to the applicable requirements of UL 542. Lamp holders for bi pin lamps shall be of the telescoping compression type, or of the single slot entry type requiring a one-quarter turn of the lamp after insertion.
 2. High Intensity Discharge (H.I.D.): Shall have porcelain enclosures.
- E. Recessed fixtures mounted in an insulated ceiling shall be listed for use in insulated ceilings.
- F. Mechanical Safety: Lighting fixture closures (lens doors, trim frame, hinged housings, etc.) shall be retained in a secure manner by captive screws, chains, captive hinges or fasteners such that they cannot be accidentally dislodged during normal operation or routine maintenance.
- G. Metal Finishes:
1. The manufacturer shall apply standard finish (unless otherwise specified) over a corrosion resistant primer, after cleaning to free the metal surfaces of rust, grease, dirt and other deposits. Edges of pre finished sheet metal exposed during forming, stamping or shearing processes shall be finished in a similar corrosion resistant manner to match the adjacent surface(s). Fixture finish shall be free of stains or evidence of rusting, blistering, or flaking, and shall be applied after fabrication.
 2. Interior light reflecting finishes shall be white with not less than 85 percent reflectances, except where otherwise shown on the drawing.
 3. Exterior finishes shall be as shown on the drawings.
- H. Lighting fixtures shall have a specific means for grounding metallic wireways and housings to an equipment grounding conductor.
- I. Light Transmitting Components for Fluorescent Fixtures:
1. Shall be 100 percent virgin acrylic.
 2. Flat lens panels shall have not less than 1/8 inch [3.2mm] of average thickness. The average thickness shall be determined by adding the maximum thickness to the minimum un-penetrated thickness and dividing the sum by 2.
 3. Unless otherwise specified, lenses, diffusers and louvers shall be retained firmly in a metal frame by clips or clamping ring in such a manner as to allow expansion and contraction of the lens without distortion or cracking.
- J. Lighting fixtures in hazardous areas shall be suitable for installation in Class and Group areas as defined in NFPA 70, and shall comply with UL 844.
- K. Compact fluorescent fixtures shall be manufactured specifically for compact fluorescent lamps with ballast integral to the fixture. Assemblies designed to retrofit incandescent fixtures are prohibited except when specifically indicated for renovation of existing fixtures (not the lamp) or so indicated on the fixture schedule. Fixtures shall be designed for lamps as specified.

2.6. BALLASTS

- A. Linear Fluorescent Lamp Ballasts: Multi-voltage (120 – 277V) electronic programmed-start or rapid-start type, complying with UL 935 and with ANSI C 82.11, designed for type

and quantity of lamps indicated. Ballast shall be designed for full light output unless dimmer or bi-level control is indicated; including the following features:

1. Lamp end-of-life detection and shutdown circuit (T5 lamps only).
 2. Automatic lamp starting after lamp replacement.
 3. Sound Rating: Class A.
 4. Total Harmonic Distortion Rating: 10 percent or less.
 5. Transient Voltage Protection: IEEE C62.41.1 and IEEE C62.41.2, Category A or better.
 6. Operating Frequency: 20 kHz or higher.
 7. Lamp Current Crest Factor: 1.7 or less.
 8. Ballast Factor: 0.87 or higher unless otherwise indicated.
 9. Power Factor: 0.98 or higher.
 10. Interference: Comply with 47 CFT 18, Ch.1, Subpart C, for limitations on electromagnetic and radio-frequency interference for non-consumer equipment.
 11. To facilitate multi level lamp switching, lamps within fixture shall be wired with the outermost lamp at both sides of the fixture on the same ballast, the next inward pair on another ballast and so on to the innermost lamp (or pair of lamps). Within a given room, each switch shall uniformly control the same corresponding lamp (or lamp pairs) in all fixture units that are being controlled.
 12. Where three lamp fixtures are indicated, unless switching arrangements dictate otherwise, utilize a common two lamp ballast to operate the center lamp in pairs of adjacent units that are mounted in a continuous row. The ballast fixture and slave lamp fixture shall be factory wired with leads or plug devices to facilitate this circuiting. Individually mounted fixtures and the odd fixture in a row shall utilize a single lamp ballast for operation of the center lamp.
 13. Dimming ballasts shall be as per above, except dimmable from 100% to 20% of rated lamp lumens.
- B. Compact Fluorescent Lamp Ballasts: Multi-voltage (120 – 277V), electronic-programmed rapid-start type, complying with UL 935 and with ANSI C 82.11, designed for type and quantity of lamps indicated. Ballast shall be designed for full light output unless dimmer or bi-level control is indicated; including the following features:
1. Lamp end-of-life detection and shutdown circuit.
 2. Automatic lamp starting after lamp replacement.
 3. Sound Rating: Class A.
 4. Total Harmonic Distortion Rating: 10 percent or less.
 5. Transient Voltage Protection: IEEE C62.41.1 and IEEE C62.41.2, Category A or better.
 6. Operating Frequency: 20 kHz or higher.
 7. Lamp Current Crest Factor: 1.7 or less.
 8. Ballast Factor: 0.95 or higher unless otherwise indicated.
 9. Power Factor: 0.98 or higher.
 10. Interference: Comply with 47 CFR 18, Ch. 1, Subpart C, for limitations on electromagnetic and radio-frequency interference for non-consumer equipment.
 11. Dimming ballasts shall be as per above, except dimmable from 100% to 20% of rated lamp lumens.
- C. Ballasts for high intensity discharge fixtures: Multi-tap voltage (120- 480v) electromagnetic ballast for high intensity discharge lamps. Comply with ANSI C82.4 and UL 1029. Include the following features unless otherwise indicated:
1. Ballast Circuit: Constant-wattage autotransformer or regulating high-power-factor type.

2. Minimum Starting Temperature: Minus 22 deg F (Minus 30 deg C) for single-lamp ballasts.
 3. Rated Ambient Operating Temperature: 104 deg F (40 deg C).
 4. Open-circuit operation that will not reduce average life.
 5. Low-Noise Ballasts: Manufacturers' standard epoxy-encapsulated models designed to minimize audible fixture noise.
- D. Electronic ballast for high intensity discharge metal-halide lamps shall include the following features unless otherwise indicated:
1. Minimum Starting Temperature: Minus 20 deg F (Minus 29 deg C) for single-lamp ballasts.
 2. Rated Ambient Operating Temperature: 130 deg F (54 deg C).
 3. Lamp end-of-life detection and shutdown circuit.
 4. Sound Rating: Class A.
 5. Total Harmonic Distortion Rating: 20 percent or less.
 6. Transient Voltage Protection: IEEE C62.41.1 and IEEE C62.41.2, Category A or better.
 7. Lamp Current Crest Factor: 1.5 or less.
 8. Power Factor: 0.90 or higher.
 9. Interference: Comply with 47 CFR 18, Ch. 1, Subpart C, for limitations on electromagnetic and radio-frequency interference for non-consumer equipment.
 10. Protection: Class P thermal cut.

2.7. FLUORESCENT EMERGENCY BALLAST

- A. Self-contained, modular, battery-inverter unit, factory mounted within lighting fixture body and compatible with ballast. Comply with UL 924.
1. Emergency Connection: Operate one fluorescent lamp continuously at an output of 1100 lumens each. Connect un-switched circuit to battery-inverter unit and switched circuit to fixture ballast.
 2. Test Push Button and Indicator Light: Visible and accessible without opening fixture or entering ceiling space.
 - a. Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
 - b. Indicator Light: LED indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
 3. Battery: Sealed, maintenance-free, nickel-cadmium type.
 4. Charger: Fully automatic, solid-state, constant-current type with sealed power transfer relay.
 5. Integral Self-Test: Automatically initiates test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and a flashing LED.

2.8. EMERGENCY LIGHTING UNIT

- A. Complete, self-contained unit with batteries, battery charger, one or more local or remote lamp heads with lamps, under-voltage relay, and test switch. Comply with UL 924.
1. Enclosure: Unless indicated otherwise on the fixture schedule, shall be impact-resistant thermoplastic, which will protect components from dust, moisture, and oxidizing fumes from the battery. Enclosure shall be suitable for the environmental conditions in which installed.
 2. Lamp Heads: Horizontally and vertically adjustable, mounted on the face of the unit, except where otherwise indicated.

3. Lamps: Shall be sealed-beam MR-16 halogen, rated not less than 12 watts at the specified DC voltage or LED as indicated on the fixture schedule.
4. Battery: Shall be maintenance-free lead-acid. Minimum normal life shall be 10 years.
5. Battery Charger: Dry-type full-wave rectifier with charging rates to maintain the battery in fully-charged condition during normal operation, and to automatically recharge the battery within 12 hours following a 1-1/2 hour continuous discharge.
6. Integral Self-Test: Automatically initiates test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and a flashing LED.

2.9. LAMPS

A. Linear and U-shaped T5 and T8 Fluorescent Lamps:

1. Rapid start fluorescent lamps shall comply with ANSI C78.1; and instant-start lamps shall comply with ANSI C78.3.
2. Chromacity of fluorescent lamps shall comply with ANSI C78.376.
3. Except as indicated below, lamps shall be low-mercury energy saving type, have a color temperature between 3500K and 4100K, a Color Rendering Index (CRI) of greater than 70, average rated life of 20,000 hours, and be suitable for use with dimming ballasts, unless otherwise indicated. Low mercury lamps shall have passed the EPA Toxicity Characteristic Leachate Procedure (TCLP) for mercury by using the lamp sample preparation procedure described in NEMA LL 1.

B. Compact Fluorescent Lamps:

1. T4, CRI 80 (minimum), color temperature 3500 K, and suitable for use with dimming ballasts, unless otherwise indicated.

C. Long Twin-Tube Fluorescent Lamps:

1. T5, CRI 80 (minimum), color temperature between 3500K and 4100K, 20,000 hours average rated life.

D. High Intensity Discharge Lamps:

1. High-Pressure Sodium Lamps: ANSI C78.42, CRI 21 (minimum), color temperature 1900K, and average rated life of 24,000 hours, minimum.
2. Pulse-Start, Metal-Halide Lamps: Minimum CRI 65, and color temperature 4000K.
3. Ceramic, Pulse-Start, Metal-Halide Lamps: CRI 80 (minimum), and color temperature 4000K.
4. Low-Pressure Sodium Lamps: ANSI 78.41, CRI 0, and color temperature 1800K.

2.10. EXIT LIGHT FIXTURES

A. Exit light fixtures shall meet applicable requirements of NFPA 101 and UL 924.

B. There shall be no radioactive material used in the fixtures.

C. Fixtures:

1. Maximum fixture wattage shall be 1 watt or less.

2. Inscription panels shall be cast or stamped aluminum a minimum of 0.090 inch [2.25mm] thick, stenciled with 6 inch [150mm] high letters, baked with red color stable plastic or fiberglass. Lamps shall be luminous Light Emitting Diodes (LED) mounted in center of letters on red color stable plastic or fiberglass. The LED shall be rated minimum 25 years life.
3. Double-Faced Fixtures: Provide double-faced fixtures where required or as shown on drawings.
4. Directional Arrows: Provide directional arrows as part of the inscription panel where required or as shown on drawings. Directional arrows shall be the "chevron-type" of similar size and width as the letters and meet the requirements of NFPA 101.
5. Voltages: Multi-voltage (120/277)

2.11. LED DOWNLIGHT FIXTURES

- A. Compliance: UL listed, Energy Star qualified.
- B. Performance
 1. Nominal Light Output: At least 650 lumens
 2. CRI: 92
 3. CCT: 3500
- C. Input Power: 120 volts, nominal 12 Watts, integrated power supply with power factor 0.95 or higher.
- D. Optical System: Uniform appearance, LED's shielded from direct view.
- E. Heat Rejection: Integrated thermal management system.
- F. Lifetime: design for 50,000 hrs. at minimum of 70% output.
- G. Housing: Recessed new construction.
- H. Trim: Smooth white.
- I. Warranty: 3 years.

PART 3. EXECUTION

3.5. INSTALLATION

- A. Installation shall be in accordance with the NEC, manufacturer's instructions and as shown on the drawings or specified.
- B. Align, mount and level the lighting fixtures uniformly.
- C. Lighting Fixture Supports:
 1. Shall provide support for all of the fixtures. Supports may be anchored to channels of the ceiling construction, to the structural slab or to structural members within a partition, or above a suspended ceiling.
 2. Shall maintain the fixture positions after cleaning and relamping.
 3. Shall support the lighting fixtures without causing the ceiling or partition to deflect.

- D. Furnish and install the specified lamps for all lighting fixtures installed and all existing lighting fixtures reinstalled under this project.
- E. Coordinate between the electrical and ceiling trades to ascertain that approved lighting fixtures are furnished in the proper sizes and installed with the proper devices (hangers, clips, trim frames, flanges), to match the ceiling system being installed.
- F. Exercise electronic dimming ballasts over full range of dimming capability by operating the control devices(s). Observe for visually detectable flicker over full dimming range.
- G. Burn-in all lamps that require specific aging period to operate properly, prior to occupancy by the owner. Burn-in period to be 40 hours minimum, unless a lesser period is specifically recommended by lamp manufacturer. Burn-in fluorescent and compact fluorescent lamps intended to be dimmed, for at least 100 hours at full voltage. Replace any lamps and ballasts which fail during burn-in.
- H. At completion of project, relamp/reballast fixtures which have failed lamps/ballasts. Clean fixtures, lenses, diffusers and louvers that have accumulated dust/dirt/fingerprints during construction. Replace damaged lenses, diffusers and louvers with new.

END OF SECTION

SECTION 28 31 64 - FIRE ALARM LOCAL BUILDING SYSTEM

PART 1. GENERAL

1.1. DESCRIPTION

- A. This section of the specifications includes the detailed layout, furnishing, installation, connection and testing of the fire alarm equipment to form a complete coordinated system ready for operation. It shall include, but not be limited to, alarm initiating devices, alarm indicating devices, control panels, auxiliary control devices, annunciators, power supplies, and wiring as shown on the drawings, specified, and required for proper operation.
- B. The Fire Alarm system shall comply with requirements of NFPA 72 for local building systems except as modified and supplemented by this specification. The Fire Alarm system components and installation shall also comply with all local codes and requirements, including ADA requirements.
- C. The Fire Alarm system shall employ an addressable fire alarm system to notify occupants to evacuate. The system shall be microprocessor based. System operation shall identify the area of the endangered building from which the alarm was initiated. The alarm system shall be electrically supervised.
- D. The information shown on the drawings indicates the design and performance intent for the fire alarm system. Final design details, device locations, equipment selections, battery and low voltage circuit calculations, and installation details shall be developed by a NICET certified technician prior to installation. The contractor shall be responsible for making all needed adjustments and submittals required by the local authority having jurisdiction.

1.2. RELATED WORK

- A. Section 26 05 00, BASIC METHODS AND REQUIREMENTS (ELECTRICAL)
- B. Section 26 05 33, CONDUIT SYSTEMS
- C. Section 26 05 21, CABLES, LOW VOLTAGE (600 VOLTS AND BELOW)

1.3. SUBMITTALS

- A. Initial Submittal
 - 1. Submit sufficient information, clearly presented, to demonstrate compliance with the drawings, specifications, and code requirements.
 - 2. Include ratings, power requirements, dimensions, mounting, equipment, device arrangement, complete wiring diagrams (including floor plans), connection diagrams with terminal identification, material, and description of operation
 - 3. Manufacturer's descriptive data sheets clearly identifying each component shall be provided.
 - 4. Show annunciator layout, codes, riser diagram, and auxiliary functions.
 - 5. Complete backup calculations shall be provided in conformance with NFPA 72 for the FACP and all subsystems utilized for notification and fire department communications.
- B. At completion of project submit the following:

1. Complete operating and maintenance manuals including technical data sheets, wiring diagrams, and information for ordering replacement parts.
 - a. Wiring diagrams shall have their terminals identified to facilitate installation, operation and maintenance.
 - b. Wiring diagrams shall indicate internal wiring for each item of equipment and the interconnections between the items of equipment.
 - c. Provide a clear and concise description of operation which gives, in detail, the information required to properly operate the equipment and system.
2. Two weeks prior to final inspection, deliver four copies of the final updated operating and maintenance manual to the Engineer.
 - a. The manual shall be updated to include any information necessitated by shop drawing approval.
 - b. Complete "As installed" wiring and schematic diagrams shall be included which show all items of equipment and their interconnecting wiring.
 - c. Show all terminal identification.
 - d. Include information for testing, repair, trouble shooting, assembly, disassembly, and recommended maintenance intervals.
 - e. Furnish manuals in loose leaf binder or manufacturer's standard binder.

C. Certifications:

1. Provide certification from both the major equipment manufacturer and the detector manufacturer that the detectors being furnished are listed by UL as being compatible with the control equipment.

1.4. APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in text by the basic designation only.
- B. National Fire Protection Association (NFPA):
 - 70 National Electrical Code (NEC)
 - 72 National Fire Alarm Code
- C. Underwriters Laboratories, Inc. (UL):
 - 50 Safety Enclosures for Electrical Equipment
 - 268 Smoke Detectors for Fire Protective Signaling Systems;
 - 864 Control Units for Fire Protective Signaling Systems;

PART 2. PRODUCTS

2.4. EQUIPMENT AND MATERIAL, GENERAL

- A. All equipment and components shall be new, and the manufacturer's current model. The materials, appliances, equipment and devices shall be tested and listed by Underwriters Laboratories, Inc., or Factory Mutual Research Corporation. An authorized representative of the manufacturer of the major equipment such as control panel, annunciator, transmitters, and initiating devices, shall install and be responsible for satisfactory total system operation and its certification. All equipment shall include a warranty of one year from date of final inspection and acceptance by local authorities.

2.5. WIRING

- A. Wiring shall be in accordance with NEC, as shown on the drawings, and as recommended by the manufacturer of the fire alarm system. All wires shall be color coded. Number and size of conductors shall be as recommended by the fire alarm

system manufacturer but not less than 18 AWG. Wiring shall be FPLP unless noted otherwise.

- B. Wires in junction boxes and cabinets shall be permanently tagged and identified with metal or phenolic tags attached by nylon ties.
- C. Terminal Boxes, Junction Boxes and Cabinets:
 - 1. Shall be steel and in accordance with UL.
 - 2. Paint box and cover red and identify with letters of white paint stenciled as "Fire Alarm System"
 - 3. Junction boxes shall have a volume 40 percent greater than required by the NEC. Minimum sized wire shall be considered as 14 AWG for calculation purposes.

2.6. NOTIFICATION DEVICES (HORNS AND STROBES)

- A. The notification devices shall consist of combination electronic horn/strobes or stand-alone strobes as indicated on the drawings.
- B. The electronic horns shall be capable of an output of at least 85-dB sound pressure level at 10 ft. and shall be capable of producing a code 3 temporal pattern upon activation of the notification circuits (operating at a steady 24 volts DC). The horns shall be designed such that the code 3 temporal pattern is synchronized between all operating horns of the system.
- C. Strobe circuits shall be coordinated with audible circuits such that activation of an audible circuit results in activation of the companion strobe circuit. The strobe circuits shall be capable of being arranged such that they continue to operate in the event that the audible circuits have been silenced and remain operating until the FACP has been reset. Strobe circuits should also be coordinated with the audible circuits such that they are zoned in the same manner as the audible circuits.
- D. All stand-alone strobes as well as strobe devices of combination electronic horn/strobes shall be rated as indicated on the drawings or as required by NFPA 72. Both the audible circuits and the strobe circuits shall be designed for expandability. The maximum load per circuit shall not exceed 80 percent of circuit capacity. The installing contractor is responsible for assuring that the strobe circuit capacity contemplates the inherent momentary current surge of the strobe devices.
- E. Activation of any alarm initiating devices shall cause the following to occur:
 - 1. Indicators within the FACP shall activate an integral alphanumeric or LED display within the FACP as well as the remote LCD annunciator panel shall provide identification of the exact initiating device or zone in alarm.
 - 2. Refer to drawings for matrix of operations
 - 3. All notification devices of the system shall operate such that all occupants of the building are notified.
 - 4. Activation of individual duct detectors shall result in automatic shutdown of the respective air handling units. In general, duct-type smoke detectors shall not activate building notification devices unless specifically identified to do so.
 - 5. Refer to drawings for requirements for initiating devices associated with the elevator control system (if present).
- F. Refer to drawings for requirements for initiating devices associated with the fire protection sprinkler system (if present). As a minimum NFPA required monitoring shall be provided

for projects with sprinkler systems. Contractor shall coordinate detailed requirements with local fire marshal.

2.7. MANUAL STATIONS

- A. Shall be non-breakglass, non coded type.
- B. Station front shall be of cast or extruded metal. Stations shall be semi flush type, unless otherwise shown on the drawings. Stations shall be installed not more than 1200 mm (48 inches) from finished floor to center line of device.
- C. Stations shall be of the single action pull down type with suitable operating instructions provided on front in raised or depressed letters.
- D. Unless otherwise specified, all exposed metal parts shall be anodized, or given a prime coat and one or more finishing coats of red lacquer or red enamel to provide a smooth, hard, durable finish. Other approved equivalent finish with red lettering is acceptable.
- E. Operating handles shall be metal. On operation, the lever shall lock in alarm position and remain so until reset. A key or wrench shall be required to gain access for resetting, or conducting tests or drills. Gravity, mercury, or other switches which may be tripped by vibration or jarring are not acceptable. Unit shall be furnished with terminal blocks clearly marked to indicate connections.

2.8. INITIATING DEVICES (SMOKE AND HEAT DETECTORS)

- A. Smoke detectors shall be photoelectric system type, complying with applicable UL standards. Install in accordance with the manufacturer's recommendation and NFPA 72. All detectors shall have an insect screen. Detectors shall have an indicator to denote an alarm condition
- B. Photoelectric detectors shall be factory calibrated. The sensitivity of any photoelectric detector shall be factory set at 3.2 percent plus or minus 0.5 percent obscuration per foot. These detectors shall be mounted as required for detection of the particles of combustion at the installed location without causing nuisance activation.
- C. Duct detectors shall be listed and labeled for duct installation. See the mechanical drawings for locations of duct detectors. Detectors shall be provided with an approved duct housing mounted exterior to the duct, and shall have perforated sampling tubes extending across the full width of the duct (wall to wall). Duct detectors whose operation requires the heads to be mounted inside of ducts are not acceptable. Interlocking with fans shall be provided as specified in PART 3 under Article, TYPICAL OPERATION. Provide remote indicator and identification nameplates (smoke detector) for smoke detectors concealed from normal view. Duct smoke detectors shall be capable of remote resetting.
- D. Heat Detectors shall be installed where shown on the drawings. The thermal type sensor shall be a plug-in unit which mounts to a twist-lock base. The sensor shall be a combination rate of rise/fixed temperature sensor U.L. Listed/FM approved as a rate compensated heat detector. Each sensor shall be capable of operating at a selectable rate of rise operation of 15 or 20 degrees Fahrenheit per minute and shall be self-restorable. Each sensor is capable of fixed temperature operation selectable for either 117 or 135 degrees Fahrenheit, independent of the rate of rise setting. The 135-degree F. setting shall be used.

- E. Guaranteed simultaneous operation: Detector power supply shall be such that guaranteed simultaneous operation of all detectors shall result in alarm reporting and detector function of all detectors without losing any detector signal.
- F. Control and power panels necessary for operation of smoke detectors shall be provided as individual units, or integral with the fire alarm control panel. Detectors and associated panels must be compatible with the fire alarm control panel and suitable for use in supervised circuits. Detectors must be capable of functioning upon loss of normal AC system operating power and all necessary equipment and devices to permit such operation shall be provided. Malfunction of the circuitry to the detector or its control, or power units shall result in operation of the system trouble devices. Reset of detectors, after alarm, shall be from the fire alarm control panel.
- G. In addition to the items specified, provide all items necessary for satisfactory operation of the detector installation.

2.9. WATERFLOW SWITCHES (when building has sprinkler system)

- A. Each sprinkler system zone or riser shall be equipped with integral, mechanical, non coded, non accumulative retard type water flow switch. Each switch shall also have an SPDT auxiliary contact.
- B. Switches shall be conveniently adjustable from 0 to 60 seconds.
- C. Flow switches shall be provided and connected as part of this fire alarm system.

2.10. SPRINKLER AND STANDPIPE VALVE SUPERVISORY SWITCHES
(when building has sprinkler system)

- A. Each sprinkler system riser or zone control valve, and each standpipe system riser OS&Y control valve shall be equipped with a supervisory switch. Standpipe hose valves and test and drain valves shall not be equipped with switches.
- B. PIV (post indicator valve) or main gate valve shall be equipped with a supervisory switch.
- C. Mount switch so as not to interfere with the normal operation of the valve and adjust to operate within two revolutions toward the closed position of the valve control, or when the stem has moved no more than one fifth of the distance from its normal position.
- D. The mechanism shall be contained in a weatherproof die cast aluminum housing, which shall provide a 19 mm (3/4 inch) tapped conduit entrance and incorporate the necessary facilities for attachment to the valves.
- E. Switch housing to be finished in red baked enamel.
- F. The entire installed assembly shall be UL or Factory Mutual approved; tamperproof and arranged to cause a switch operation if the housing cover is removed, or if the unit is removed from its mounting.

2.11. ELECTROMAGNETIC DOOR HOLDERS

- A. Door holders shall be provided (if required) as shown the drawings, connected and coordinated into the fire alarm system as specified in this section.

- B. Operation shall be by 24 volt DC supplied from a battery located at the fire alarm control panel. Coordinate door holders as to voltage, ampere drain, and voltage drop with the battery, battery charger, wiring, and fire alarm system for the operation specified.
- C. A maximum of eight door holders shall be provided for each circuit with its own fuses, disconnect switch and pilot light.
- D. Associated relay control circuits shall be electrically supervised.
- E. Smoke detectors shall not be incorporated as an integral part of door holders, but are functionally associated as hereinafter specified.
- F. Provide master control switches with pilot light, for maintaining power to door holders during fire alarm tests. A switch shall be located at the fire alarm control panel.

2.12. ANNUNCIATOR PANELS

- A. Shall be installed in UL listed.
- B. Flush mount cabinets at location designated by local authority having jurisdiction.
- C. Components shall be arranged to facilitate convenient operation, testing, and maintenance from the front.
- D. Identification Devices Shall display English-language text of system point information including device type, zone, independent point alarm, trouble or supervisory status, as well as any custom banners programmed into the control panel.
- E. Display shall incorporate backlit LCD characters (minimum 20 characters x 4 lines).

2.13. FIRE ALARM CONTROL PANEL

- A. Function:
 - 1. Operate as a supervised, coded, positive noninterfering successive alarm system.
 - 2. Supervise all signal initiating circuits, alarm indicating circuits, alarm transmitter trip circuits, and sprinkler and standpipe valves.
 - 3. Detect the operation of any signal initiating device and the area of the alarm condition, and operate all alarm and designated auxiliary devices.
 - 4. Visually and audibly annunciate any trouble condition such as main power failure, ground or system wiring derangement, and sprinkler system and standpipe valve off normal position.
- B. Enclosure:
 - 1. The control panel shall be housed in a cabinet suitable for surface mounting. Cabinet and front shall be corrosion protected, given a rust resistant prime coat, and manufacturer's standard finish.
 - 2. Cabinet shall contain all necessary components, relays, terminals, indicating devices and displays to provide control for the system.
- C. Power Supply:
 - 1. The control panel shall derive its normal power from a 120 volt, 60 Hz supply. Standby power shall be provided by a DC battery as recommended by the

manufacturer. The normal power shall be transformed, rectified, coordinated, and interfaced with the standby battery and charger.

2. The door holder power shall be arranged so that momentary or sustained loss of main operating power shall not cause the release of any door. This may be accomplished by floating the door holders across the battery supply or by other approved means accomplishing the same function.
3. Power supply for smoke detectors shall be taken from the fire alarm control panel.
4. Provide protectors to protect the fire alarm equipment from damage due to lightning or voltage and current transients.

D. Circuit Arrangement:

1. Alarm initiating circuits shall be of the low voltage type and arranged for operation from normally open contact devices. Monitoring of addressable components may also be used.
2. Provide means whereby any initiating zone or annunciator circuit may be disconnected from the system. Removing any zone or annunciator circuit shall leave the remainder of the system in normal operating condition, and activate an individual trouble signal which shall remain activated until the circuit is restored to normal operating condition.
3. Arrange circuits so that if an open circuit occurs in an indicating device, it shall not prevent other signals on the same circuit from activating.
4. Each circuit shall be individually protected.

E. Circuit Supervision:

1. Each alarm initiating circuit, alarm indicating circuit, and local energy transmitter trip circuit, and sprinkler and standpipe valve circuit shall be supervised against the occurrence of a break or ground fault condition in the field wiring. These conditions shall cause a trouble signal to sound in the control panel until manually silenced by an off switch.
2. Sprinkler system valves, standpipe control valves, PIV, and main gate valves shall also be supervised for off normal position. Valve supervision shall indicate the fire alarm zone in which the valve is located. Supervisory switches may be series connected in the zone alarm initiating circuit after the last device on the circuit. Closing a valve shall sound a trouble signal in the control panel until silenced by an off switch. Valve operation shall not cause an alarm signal.
3. Each circuit shall have individual trouble indicators (amber) and alarm indicators (red).

F. Trouble signals:

1. Arrange the trouble circuit for ring back operation to prevent switch disarrangement during normal supervisory condition. Automatic reset arrangement is acceptable in lieu of ring back operation.
2. System trouble switch off and on indicators shall be visible through the control panel door.

G. Modules:

1. Module assemblies shall be of unit type construction and mounted on channels to permit easy removal and service by circuit function.
2. Modules shall contain system fault locators to enable maintenance personnel to pinpoint individual fault conditions.

3. Each module shall contain alarm indicators to indicate which zone or addressed device is in alarm.
 4. Modules shall have provisions for relaying incoming zone alarms to a display on a remote annunciator and perform auxiliary functions. Modules shall discriminate an incoming zone alarm as to category (manual alarm; smoke alarm; waterflow alarm) and indicate the signal at the remote annunciator as to location and category.
 5. Each initiative alarm circuit shall have its own control module.
- H. Printed Circuit Boards: Shall be of easily removable type and have sufficient capacity for the circuits controlled.
- I. Auxiliary Control Capability: The control panel shall perform auxiliary control functions on a common or selective basis as required. Auxiliary control capability includes such functions as HVAC shutdown and elevator recall. Coordinate requirements with HVAC and elevator installers.
- J. Function Switches: Provide the following switches in addition to any other switches required for the system.
1. Master Building Transmitter Switch: Shall prevent tripping of alarm transmitter when in off position. System trouble alarm shall be energized when switch is in off position.
 2. Alarm Off Switch: Shall disconnect power to alarm indicating device circuits. System trouble alarm shall be energized when switch is in off position.
 3. Trouble Off Switch: Shall silence the trouble signal whenever the system trouble circuit is energized.
 4. Reset Switch: Shall reset the system after an alarm, provided the initiating device has been reset. The system shall lock in until reset.
 5. Test Switches: A test switch or other approved convenient means shall be provided to test the indicator lamps.
 6. Drill Switch: Shall sound the alarm indicating devices without tripping the alarm transmitter.
 7. Master Door Release Switch: Shall prevent doors from releasing during fire alarm tests.
 8. A visual indicator shall show the off normal condition.
- K. Remote Transmissions:
1. Provide local energy trip circuits as required.
 2. The system shall be capable of operating a local energy fire alarm transmitter or telephone dialer for automatically transmitting fire information to the fire department.
 3. Transmitters shall be compatible with the systems and equipment they are connected to such as timing, operation and other required features.
- L. System Expansion: Design the control panel so that the system can be expanded in the future (to include the addition of twenty percent more circuits or zones) without disruption or replacement of the existing control panel.

2.14. BATTERY AND CHARGER

- A. Battery:
1. Shall be of nickel cadmium.

2. Battery shall have sufficient capacity to power the fire alarm system for not less than twenty four hours plus five minutes of alarm to an end voltage of 1.14 volts per cell, upon a normal AC power failure. System load shall include the power required by the electromagnetic door holders.
 3. Battery racks shall be steel with an alkali resistant finish.
- B. Battery Charger:
1. Shall be completely automatic, with constant potential charger maintaining the battery fully charged under all service conditions. Charger shall operate from a 120 volt, 60 hertz source.
 2. Shall be rated for fully charging a completely discharged battery within 48 hours while simultaneously supplying any loads connected to the battery.
 3. Shall have protection to prevent discharge through the charger.
 4. Shall have protection for overloads and short circuits on both AC and DC sides.
 5. A trouble condition shall actuate the fire alarm trouble signal.
 6. Charger shall have automatic AC line voltage regulation, automatic current limiting features, and adjustable voltage controls.

PART 3. EXECUTION

3.5. INSTALLATION

- A. Installation shall be in accordance with the NEC, NFPA 72, based upon the locations shown on the drawings, and as identified by the documents approved by the local authority having jurisdiction. Final system details, locations, and installation requirements shall be as developed by a NICET certified technician and as recommended by the component manufacturers.
- B. All work performed to comply with this specification shall be carried out by and/or managed by a competent firm regularly engaged in the installation and testing of fire alarm systems for commercial buildings. All subcontractors of the contractor including the chosen fire alarm equipment distributor shall also be competent firms which are regularly engaged in the design, installation, testing, and servicing of fire alarm systems for commercial buildings.
- C. Install smoke detector heads not more than two weeks prior to final inspection. Test the detectors in place.
- D. At the final inspection a factory trained representative of the manufacturer of the major equipment shall perform the tests in Article 3.3. Tests. The representative shall demonstrate that the system functions properly in every respect in the presence of an owner's representative.

3.6. TYPICAL OPERATION

- A. Normal System Operation: Refer to FACP Matrix on the drawings. Actuation of any manual station, smoke detector, heat detector, or water flow switch shall cause the following operations to occur, unless otherwise specified:
 1. Operate the audible signals in the building.
 2. Flash strobe lights. Lights shall continue to flash until reset at the fire alarm control panel.
 3. Activate the associated location and type indicators on the remote annunciator panel and the control panel.
 4. Release all magnetic door holders on the floor from which alarm was initiated.

5. Transmit a separate code alarm signal, via a telephone transmitter to the owner's designated monitoring service
 6. Smoke detectors in elevator lobbies shall, in addition to the above functions, cause the elevator cars in the related bank to return to an assigned floor (see elevator section of specifications and drawings for details and operation).
 7. Duct type smoke detectors and waterflow switches shall, in addition to A.1. through A.6. above, perform the functions specified in the mechanical specifications or shown on the mechanical drawings.
 8. Operation of any sprinkler and standpipe valve supervisory switch shall cause the system to go into trouble condition.
 - a. It shall not cause the system to go into alarm condition.
 - b. It shall not prevent any flow switch from actuating an alarm.
 9. Cooking Equipment Fire Extinguishing Connection shall, in addition to the above, perform the functions specified in the mechanical specifications or shown on the mechanical drawings, including fuel source cut-off.
- B. System Supervision: System supervision shall include the following conditions:
1. Loss of operating or standby power.
 2. A single ground or open circuit in alarm initiating circuits, alarm indicating circuits, and sprinkler and standpipe valve circuits. Each circuit shall have its own supervisory devices.
 3. Off normal position of sprinkler and standpipe valves.
 4. Battery and battery charger shall have supervision as specified elsewhere in this section.
- C. Trouble Signals:
1. Derangement of any of the above supervised conditions shall be visually and audibly annunciated at the fire alarm control panel. Each device, circuit, or zone shall have individual visual annunciation.
 2. Operation of the sprinkler and standpipe valves towards the closed position shall cause a trouble signal.
 3. Trouble signals shall be retransmitted to the remote monitoring service identified by the owner

3.7. TESTS

- A. Provide the service of a competent authorized engineer or technician authorized by the manufacturer of the fire alarm equipment to supervise and participate during all of the adjustments and tests for the system
- B. When the systems have been completed and prior to the scheduling of the final inspection, furnish testing equipment and perform the following tests. When any defects are detected, make repairs or install replacement components, and repeat the tests until such time that the complete fire alarm system meets all contract requirements.
1. Before energizing the cables and wires, check for correct connections and test for short circuits, ground faults, continuity, and insulation.
 2. Test the insulation on all installed cable and wiring by standard methods as recommended by the equipment manufacturer.
 3. Run water through all flow switches. Drain the water by hose to the nearest drain. Check to verify whether all codes are coming in clearly and correctly. Check time delay on water flow switches to assure that water surges do not trip transmitters. (Submit a report listing all water flow switch operations and their retard time in seconds.)

4. Open fire alarm station circuits to see if trouble signal actuates.
5. Open audible signal circuits to see if the trouble signal actuates.
6. Ground fire alarm station circuits and verify response of trouble signals.
7. Ground audible signal circuits and verify response of trouble signals.
8. Check code transmission of all fire alarm devices and verify proper operation of positive noninterfering succession requirements by operating two fire alarm stations simultaneously.
9. Check installation, supervision, operation and sensitivity of smoke detectors to ascertain that they will avoid false alarm signals and will function as specified. See Article, SMOKE DETECTORS.

3.8. FINAL INSPECTION

- A. At the final inspection a factory trained representative of the manufacturer of the major equipment shall perform the tests in Article 3.3 TESTS. In addition the representative shall demonstrate that the systems function properly in every respect. Perform all tests as required for approval by the local inspection authority.

3.9. INSTRUCTION

- A. Furnish the services of a competent instructor for instructing personnel in the operation and maintenance of the system.

END OF SECTION

SECTION 31 20 00 - EARTH MOVING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Preparing subgrades for slabs-on-grade, walks, and pavements.
 - 2. Drainage course for exterior concrete slabs-on-grade.
 - 3. Subbase course for concrete pavements.
 - 4. Excavating and backfilling for utility trenches.
- B. This section applies to exterior site earthwork only. No foundation work or any other work involving earth moving for the building or its interior is governed by this specification section.

1.2 DEFINITIONS

- A. Backfill: Soil material used to fill an excavation.
 - 1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
 - 2. Final Backfill: Backfill placed over initial backfill to fill a trench.
- B. Base Course: Aggregate layer placed between the subbase course and paving material.
- C. Bedding Course: Aggregate layer placed over the excavated subgrade in a trench before laying pipe.
- D. Drainage Course: Aggregate layer supporting the slab-on-grade that also minimizes upward capillary flow of pore water.
- E. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.
 - 1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Architect. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.
 - 2. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Architect. Unauthorized excavation, as well as remedial work directed by Architect, shall be without additional compensation.
- F. Fill: Soil materials used to raise existing grades.
- G. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.
- H. Subbase Course: Aggregate layer placed between the subgrade and base course for hot-mix asphalt pavement, or aggregate layer placed between the subgrade and a cement concrete pavement or a cement concrete or hot-mix asphalt walk.

- I. Subgrade: Uppermost surface of an excavation or the top surface of a fill or backfill immediately below subbase, drainage fill, drainage course, or topsoil materials.
- J. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

1.3 QUALITY ASSURANCE

- A. Preexcavation Conference: Conduct conference at Project site.

1.4 PROJECT CONDITIONS

- A. Utility Locator Service: Notify West Virginia Miss Utility (811) before beginning earth moving operations.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

- A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.
- B. Satisfactory Soils: Soil Classification Groups GW, GP, GM, SW, SP, and SM according to ASTM D 2487 Groups A-1, A-2-4, A-2-5, and A-3 according to AASHTO M 145, or a combination of these groups; free of rock or gravel larger than 3 inches in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.
- C. Unsatisfactory Soils: Soil Classification Groups GC, SC, CL, ML, OL, CH, MH, OH, and PT according to ASTM D 2487 Groups A-2-6, A-2-7, A-4, A-5, A-6, and A-7 according to AASHTO M 145, or a combination of these groups.
 - 1. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.
- D. Subbase Material: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch sieve and not more than 12 percent passing a No. 200 sieve.
- E. Base Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 95 percent passing a 1-1/2-inch sieve and not more than 8 percent passing a No. 200 sieve.
- F. Bedding Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; except with 100 percent passing a 1-inch sieve and not more than 8 percent passing a No. 200 sieve.
- G. Drainage Course: Narrowly graded mixture of washed crushed stone, or crushed or uncrushed gravel; ASTM D 448; coarse-aggregate grading Size 57; with 100 percent passing a 1-1/2-inch (37.5-mm) sieve and 0 to 5 percent passing a No. 8 sieve.

2.2 ACCESSORIES

- A. Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility; colored to comply with local practice or requirements of authorities having jurisdiction.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth moving operations.
- B. Protect and maintain erosion and sedimentation controls during earth moving operations.
- C. Protect subgrades and foundation soils from freezing temperatures and frost. Remove temporary protection before placing subsequent materials.

3.2 EXCAVATION, GENERAL

- A. Unclassified Excavation: Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for rock excavation or removal of obstructions.
 - 1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.

3.3 EXCAVATION FOR WALKS AND PAVEMENTS

- A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades.

3.4 EXCAVATION FOR UTILITY TRENCHES

- A. Excavate trenches to indicated gradients, lines, depths, and elevations.
- B. Excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches higher than top of pipe or conduit unless otherwise indicated.
 - 1. Clearance: 12 inches each side of pipe or conduit.
- C. Trench Bottoms: Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Shape subgrade to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. Remove projecting stones and sharp objects along trench subgrade.
 - 1. Excavate trenches 6 inches deeper than elevation required in rock or other unyielding bearing material, 4 inches deeper elsewhere, to allow for bedding course.

3.5 SUBGRADE INSPECTION

- A. Proof-roll subgrade to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades. Consult with Owner's Rep prior to proof rolling to decide the proper equipment to be used for the operation.

- B. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Owner's Rep, without additional compensation.

3.6 UNAUTHORIZED EXCAVATION

- A. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill, with 28-day compressive strength of 2500 psi, may be used when approved by Architect.
 - 1. Fill unauthorized excavations under other construction, pipe, or conduit as directed by Owner's Rep.

3.7 UTILITY TRENCH BACKFILL

- A. Place backfill on subgrades free of mud, frost, snow, or ice.
- B. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.
- C. Place and compact initial backfill of satisfactory soil, free of particles larger than 1 inch in any dimension, to a height of 12 inches over the pipe or conduit.
 - 1. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.
- D. Place and compact final backfill of satisfactory soil to final subgrade elevation.
- E. Install warning tape directly above utilities, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

3.8 SOIL MOISTURE CONTROL

- A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 2 percent of optimum moisture content.
 - 1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
 - 2. Remove and replace, or scarify and air dry, otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

3.9 COMPACTION OF SOIL BACKFILLS AND FILLS

- A. Place backfill and fill soil materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.
- B. Place backfill and fill soil materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.
- C. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D 698:

1. Under structures, building slabs, steps, and pavements, scarify and recompact top 12 inches of existing subgrade and each layer of backfill or fill soil material at 95 percent.
2. Under walkways, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 95 percent.
3. For utility trenches, compact each layer of initial and final backfill soil material at 95 percent.

3.10 GRADING

- A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.
- B. Site Rough Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:
 1. Walks: Plus or minus 1/2 inch.
 2. Pavements: Plus or minus 1/2 inch.
- C. Grading inside Building Lines: Finish subgrade to a tolerance of 1/2 inch when tested with a 10-foot straightedge.

3.11 SUBBASE AND BASE COURSES UNDER PAVEMENTS AND WALKS

- A. Place subbase course and base course on subgrades free of mud, frost, snow, or ice.
- B. On prepared subgrade, place subbase course and base course under pavements and walks as follows:
 1. Shape subbase course and base course to required crown elevations and cross-slope grades.
 2. Place subbase course and base course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.
 3. Compact subbase course and base course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D 698.

3.12 DRAINAGE COURSE UNDER EXTERIOR CONCRETE SLABS-ON-GRADE

- A. Place drainage course on subgrades free of mud, frost, snow, or ice.
- B. On prepared subgrade, place and compact drainage course under cast-in-place concrete slabs-on-grade as follows:
 1. Place drainage course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.
 2. Compact each layer of drainage course to required cross sections and thicknesses to not less than 95 percent of maximum dry unit weight according to ASTM D 698.

3.13 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified geotechnical engineering testing agency to perform tests and inspections.
- B. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earth moving only after test results for previously completed work comply with requirements.
- C. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil materials to depth required; recompact and retest until specified compaction is obtained.

3.14 PROTECTION

- A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.
- B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.
- C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.
 - 1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.15 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Remove surplus satisfactory soil and waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property.

END OF SECTION

SECTION 31 40 00 – SHORING AND UNDERPINNING

PART 1 - GENERAL

1.1 REFERENCE DOCUMENTS

- A. Reference written specification as described on Structural Sheet S.1 – General Notes.

PART 2 – PRODUCTS

- 2.1 Reference written specification as described on Structural Sheet S.1 – General Notes.

PART 3 – EXECUTION

- 3.1 Reference written specification as described on Structural Sheet S.1 – General Notes.

END OF SECTION

SECTION 31 12 16 – ASPHALT PAVING

PART 1 - GENERAL

1.1 REFERENCE DOCUMENTS

- A. For all specification information for asphalt paving, refer to West Virginia Department of Highways specifications.

PART 2 – PRODUCTS

PART 3 - EXECUTION

END OF SECTION

SECTION 32 14 00 - UNIT PAVING

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 unit pavers set in aggregate setting beds.
- 2. Dry-laid bluestone pavers
- 3. Wet-laid bluestone pavers

B. Related Sections:

- 1. Section 32 13 13 - Concrete Paving: For cast-in-place concrete curbs and sidewalks serving as edge restraints for unit pavers.
- 2. Section 03 30 00 - Cast-in-place Concrete: For any other requirements regarding the placement of concrete.
- 3. Section 31 20 00 - Earth Moving: For additional information on subgrade preparation for pavements.

1.3 ACTION SUBMITTALS

- A. Product Data: For materials other than water and aggregates.

B. LEED Submittals:

- 1. Product Certificates for Credit MR 5: For products and materials required to comply with requirements for regional materials, certificates indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating distance to Project, cost for each regional material, and fraction by weight that is considered regional.

- C. Sieve Analyses: For aggregate setting-bed materials, according to ASTM C 136.

- D. Samples for Initial Selection: For the following:

- 1. Each type of unit paver indicated.

- E. Samples for Verification:

- 1. Full-size units of each type of unit paver indicated.

1.4 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For each type of manufactured product, from manufacturer, and complying with the following:

- 1. Manufacturer's product brochure.
- 2. Manufacturer's certified analysis of standard products.

1.5 QUALITY ASSURANCE

- A. Source Limitations: Obtain each type of unit paver, joint material, and setting material from single source with resources to provide materials and products of consistent quality in appearance and physical properties.
- B. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 - 1. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.
- C. Preinstallation Conference: Conduct conference at Project site.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store pavers 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.
- B. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.
- C. Store liquids in tightly closed containers protected from freezing.

1.7 PROJECT CONDITIONS

- A. Cold-Weather Protection: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen subgrade or setting beds. Remove and replace unit paver work damaged by frost or freezing.

PART 2 - PRODUCTS

2.1 CONCRETE UNIT PAVERS

- A. Regional Materials: Provide concrete pavers that have been manufactured within 500 miles of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles of Project site.
- B. Concrete Unit Pavers: Light-traffic paving brick; ASTM C 902, Class SX, Type I, Application PX. Provide brick without frogs or cores in surfaces exposed to view in the completed Work.
 - 1. Manufacturers: To be specified by Owner's Rep.
 - 2. Thickness: To be specified by Owner's Rep.
 - 3. Face Size: To be specified by Owner's Rep.
 - 4. Color: To be specified by Owner's Rep.
- C. Efflorescence: Pavers shall be rated "not effloresced" when tested according to ASTM C 67.

2.2 BLUESTONE PAVERS

- A. Bluestone Pavers to be of a size and shade which has been approved by the Owner's Rep. Pavers will free of any fractures or spalls when they are placed. Follow installation instructions on the Contract Drawings for wet-laid and dry-laid pavers.

1. Manufacturers: Subject to compliance with requirements, please provide the following or equivalent approved by Owner's Rep:
 - a. Penn Direct Stone, All blue color range bluestone
Penn Direct Stone
11394 Foxvale Glen Court
Oakton, VA 22124
(703) 758-0210
2. Thickness: 2 inches.
3. Face Size: 18 by 36 inches.
4. Color: As selected by Owner's Rep.

2.3 CURBS AND EDGE RESTRAINTS

- A. Edge Restraints at Drainage Inlets: Inlets should be installed per manufacturer's specifications. For slot drain installation, refer to Contract Drawings for additional info.
- B. Edge Restraints at Other locations: Edge restraints at locations other than inlets will be provided by curbs, walls, and sidewalks. For details on concrete sidewalk construction, see Section 32 14 13 Concrete Paving.

2.4 AGGREGATES

- A. Graded Aggregate for Base: Sound, crushed stone or gravel complying with requirements in ASTM D 2490 for base course.
- B. Sand for Concrete Paver Leveling Course: Sound, sharp, washed, natural sand or crushed stone complying with gradation requirements in ASTM C 33 for fine aggregate.
- C. Stone Screenings for Dry-Laid Bluestone Paver Leveling Course: Sound stone screenings complying with ASTM D 448 for Size No. 10.
- D. Sand for Concrete Paver Joints: HP2 Polymeric Jointing Sand or equivalent approved by Owner's Rep.
Available from:
Techinseal
300, Liberte avenue
Candiac, Quebec, Canada
J5R 6X1
1-800-465-7325
- E. Stone dust for Dry-Laid Bluestone Paver Joints: Decomposed limestone screenings.
- F. Separation Geotextile: Woven geotextile fabric, manufactured for separation applications; made from polyolefins or polyesters, with elongation less than 50 percent; complying with AASHTO M 288 and the following, measured per test methods referenced:
 1. Survivability: Class 2, AASHTO M 288.
 2. Apparent Opening Size: No. 60 sieve, maximum; ASTM D 4751.
 3. Permittivity: 0.02 per second, minimum; ASTM D 4491.
 4. UV Stability: 50 percent after 500 hours' exposure, ASTM D 4355.
- G. Drainage Geotextile: Nonwoven needle-punched geotextile fabric, manufactured for subsurface drainage applications, made from polyolefins or polyesters; with elongation greater than 50 percent; complying with AASHTO M 288 and the following, measured per test methods referenced:

1. Survivability: Class 2, AASHTO M 288.
2. Apparent Opening Size: No. 40 sieve, maximum; ASTM D 4751.
3. Permittivity: 0.5 per second, minimum; ASTM D 4491.
4. UV Stability: 50 percent after 500 hours' exposure, ASTM D 4355.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Do not use unit pavers with chips, cracks, voids, discolorations, or other defects that might be visible or cause staining in finished work.
- B. Mix pavers from several pallets or cubes, as they are placed, to produce uniform blend of colors and textures.
- C. Cut unit pavers with motor-driven masonry saw equipment to provide clean, sharp, unchipped edges. Cut units to provide pattern indicated and to fit adjoining work neatly. Use full units without cutting where possible. Hammer cutting is not acceptable.
- D. Joint Pattern:
 1. Concrete Pavers: Herringbone, as indicated. Sailor course wherever indicated on Contract Drawings.
 2. Bluestone Pavers: Running bond, as indicated.
- E. Tolerances: Do not exceed 1/32-inch unit-to-unit offset from flush (lippage) nor 1/8 inch in 10 feet from level, or indicated slope, for finished surface of paving.
- F. Provide edge restraints as indicated. Install edge restraints before placing unit pavers.
 1. Install edge restraints as indicated in contract drawings.
 2. Install job-built concrete edge restraints to comply with requirements in Section 321413 "Concrete Paving."

3.2 CONCRETE PAVER AGGREGATE SETTING-BED APPLICATIONS

- A. Compact soil subgrade uniformly to at least 95 percent of ASTM D 698 laboratory density.
- B. Place separation geotextile over prepared subgrade, overlapping ends and edges at least 12 inches.
- C. Place aggregate base, compact by tamping with plate vibrator, and screed to depth indicated.
- D. Place drainage geotextile over compacted base course, overlapping ends and edges at least 12 inches.
- E. Place leveling course and screed to the thickness indicated on the Contract Drawings. Take care that moisture content remains constant and density is loose and uniform until pavers are set and compacted.
- F. Treat leveling course with herbicide to inhibit growth of grass and weeds.

- G. Set pavers “hand tight” with a minimum joint width of 1/16 inch and a maximum of 1/8 inch, being careful not to disturb leveling base. Use string lines to keep straight lines. Fill gaps between units that exceed ½ inch with pieces cut to fit from full-size unit pavers.
- H. Vibrate pavers into leveling course with a low-amplitude plate vibrator capable of a 3500- to 5000-lbf compaction force at 80 to 90 Hz. Use vibrator with neoprene mat on face of plate or other means as needed to prevent cracking and chipping of pavers. Perform at least three passes across paving with vibrator.
 - 1. Compact pavers when there is sufficient surface to accommodate operation of vibrator, leaving at least 36 inches of uncompacted pavers adjacent to temporary edges.
 - 2. Before ending each day's work, compact installed concrete pavers except for 36-inch width of uncompacted pavers adjacent to temporary edges (laying faces).
 - 3. As work progresses to perimeter of installation, compact installed pavers that are adjacent to permanent edges unless they are within 36 inches of laying face.
 - 4. Before ending each day's work and when rain interrupts work, cover pavers that have not been compacted and cover leveling course on which pavers have not been placed with nonstaining plastic sheets to protect them from rain.
- I. Spread dry polymeric sand and fill joints immediately after vibrating pavers into leveling course. Vibrate pavers and add sand until joints are completely filled, then remove excess sand. Leave a slight surplus of sand on the surface for joint filling.
- J. Do not allow traffic on installed pavers until sand has been vibrated into joints.
- K. Repeat joint-filling process 30 days later.

3.3 DRY-LAID BLUESTONE PAVER AGGREGATE SETTING-BED APPLICATIONS

- A. Compact soil subgrade uniformly to at least 95 percent of ASTM D 698 laboratory density.
- B. Place separation geotextile over prepared subgrade, overlapping ends and edges at least 12 inches.
- C. Place aggregate base, compact by tamping with plate vibrator, and screed to depth indicated.
- D. Place drainage geotextile over compacted base course, overlapping ends and edges at least 12 inches.
- E. Place leveling course of decomposed limestone screenings (stone dust) and screed to the thickness indicated on the Contract Drawings. Take care that moisture content remains constant and density is loose and uniform until pavers are set and compacted.
- F. Treat leveling course with herbicide to inhibit growth of grass and weeds.
- G. Set pavers with a maximum joint width of 3/8 inch and a minimum of 1/4 inch, being careful not to disturb leveling base. Use string lines to keep straight lines.
- H. Once pavers have been placed, hand tamp into place with rubber mallet. Ensure bluestone makes continuous contact with underlying leveling course and that tamping does not damage pavers.

- I. Immediately after pavers have been located and tamped into place, install decomposed granite in joints per manufacturer's specifications.
- J. Do not allow traffic on installed pavers until granite stone dust has been placed in joints.
- K. Repeat joint-filling process 30 days later.

3.4 WET-LAID BLUESTONE PAVER AGGREGATE SETTING-BED APPLICATIONS

- A. Compact soil subgrade uniformly to at least 95 percent of ASTM D 698 laboratory density.
- B. Place separation geotextile over prepared subgrade, overlapping ends and edges at least 12 inches.
- C. Place aggregate base, compact by tamping with plate vibrator, and screed to depth indicated.
- D. Install concrete slab as indicated in contract drawings. Concrete placement should follow guidelines laid out in Section 321413 "Concrete Pavement." Screed to proper elevation and float finish.
- E. Apply 3/4 inch latex mortar setting bed as indicated in drawings where bluestone pavers are to be placed and install pavers while mortar is plastic. Ensure pavers are level and within vertical tolerances with max 3/8 inch (min 1/4 inch) joints.
- F. Once bluestone pavers are placed, joints should be grouted and struck smooth. Grout joints with color to match stone dust within dry-laid bluestone paver joints. Grout should be approved by Owner's Rep prior to placement.
- G. Allow joints and setting bed to cure 7 days before allowing foot traffic.

3.5 REPAIRING

- A. Remove and replace unit pavers that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Provide new units to match adjoining units and install in same manner as original units, with same joint treatment and with no evidence of replacement.

END OF SECTION

SECTION 32 14 13 - CONCRETE PAVING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Concrete Pavement
- B. Related Requirements:
 - 1. Section 03 30 00 - Cast-in-Place Concrete: For further information on requirements for concrete placement.
 - 2. Section 31 20 00 - Earth Moving: For additional information on subgrade preparation for pavements.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. LEED Submittals:
 - 1. Product Data for Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating cost for each product having recycled content.
- C. Samples: For each exposed product and for each color and texture specified.
- D. Other Action Submittals:
 - 1. Design Mixtures: For each concrete paving mixture. Include alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

1.3 QUALITY ASSURANCE

- A. Ready-Mix-Concrete 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.
- B. ACI Publications: Comply with ACI 301 (ACI 301M) unless otherwise indicated.

PART 2 - PRODUCTS

2.1 STEEL REINFORCEMENT

- A. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
- B. Welded Wire Reinforcement: Plain or deformed steel, per ASTM A 1064/A 1064M, fabricated from steel wire into flat sheets.
- C. Deformed-Steel Welded Wire Reinforcement: ASTM A 497/A 497M, flat sheet.

- D. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420); deformed.
- E. Steel Wire: Plain or deformed, per ASTM A 1064/A 1064M.
- F. Dowel Bars: Smooth, round stainless steel, manufactured per ASTM A276-13a. Cut bars true to length with ends square and free of burrs.
- G. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars, welded wire reinforcement, and dowels in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice" from steel wire, plastic, or precast concrete of greater compressive strength than concrete specified.

2.2 CONCRETE MATERIALS

- A. Cementitious Material: Use the following cementitious materials, of same type, brand, and source throughout Project:
 - 1. Portland Cement: ASTM C 150, gray portland cement Type I.
 - a. Fly Ash: ASTM C 618, Class C or Class F.
 - b. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.
- B. Normal-Weight Aggregates: ASTM C 33, Class 4S, uniformly graded. Provide aggregates from a single source.
- C. Water: Potable and complying with ASTM C 94/C 94M.
- D. Air-Entraining Admixture: ASTM C 260.
- E. Chemical Admixtures: Admixtures certified by manufacturer to be compatible with other admixtures and to contain not more than 0.1 percent water-soluble chloride ions by mass of cementitious material.

2.3 CURING MATERIALS

- A. Absorptive Cover: AASHTO M 182, Class 3, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. (305 g/sq. m) dry.
- B. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
- C. Water: Potable.
- D. Evaporation Retarder: Waterborne, monomolecular, film forming, manufactured for application to fresh concrete.
- E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, dissipating.
- F. White, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 2, Class B, dissipating.

2.4 RELATED MATERIALS

- A. Joint Fillers: ASTM D 1751, asphalt-saturated cellulosic fiber or ASTM D 1752, cork or self-expanding cork in preformed strips.

- B. Slip-Resistive Aggregate Finish: Factory-graded, packaged, rustproof, nonglazing, abrasive aggregate of fused aluminum-oxide granules or crushed emery aggregate containing not less than 50 percent aluminum oxide and not less than 20 percent ferric oxide; unaffected by freezing, moisture, and cleaning materials.

2.5 CONCRETE MIXTURES

- A. Prepare design mixtures, proportioned according to ACI 301, with the following properties:
 - 1. Compressive Strength (28 Days): 4000 psi.
 - 2. Maximum Water-Cementitious Materials Ratio at Point of Placement: 0.50.
 - 3. Slump Limit: 4 inches, plus or minus 1 inch.
 - 4. Air Content: 6 percent plus or minus 1.5 percent.
- B. Chemical Admixtures: Use admixtures according to manufacturer's written instructions.
- C. Color Pigment: Add color pigment to concrete mixture according to manufacturer's written instructions.

2.6 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M. Furnish batch certificates for each batch discharged and used in the Work.

PART 3 - EXECUTION

3.1 EXAMINATION AND PREPARATION

- A. Proof-roll prepared subbase surface below concrete paving to identify soft pockets and areas of excess yielding.
- B. Remove loose material from compacted subbase surface immediately before placing concrete.

3.2 EDGE FORMS AND SCREED CONSTRUCTION

- A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides to required lines, grades, and elevations. Install forms to allow continuous progress of work and so forms can remain in place at least 24 hours after concrete placement.
- B. Clean forms after each use and coat with form-release agent to ensure separation from concrete without damage.

3.3 STEEL REINFORCEMENT

- A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.

3.4 JOINTS

- A. General: Form construction, isolation, and contraction joints and tool edges true to line, with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline unless otherwise indicated.

- B. Construction Joints: Set construction joints at side and end terminations of paving and at locations where paving operations are stopped for more than one-half hour unless paving terminates at isolation joints.
- C. Isolation Joints: Form isolation joints of preformed joint-filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, other fixed objects, and where indicated.
- D. Contraction Joints: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of the concrete thickness.
- E. Edging: After initial floating, tool edges of paving, gutters, curbs, and joints in concrete with an edging tool to a 3/8-inch radius. Repeat tooling of edges after applying surface finishes. Eliminate edging-tool marks on concrete surfaces.

3.5 CONCRETE PLACEMENT

- A. Moisten subbase to provide a uniform dampened condition at time concrete is placed.
- B. Comply with ACI 301 requirements for measuring, mixing, transporting, placing, and consolidating concrete.
- C. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.
- D. Screed paving surface with a straightedge and strike off.
- E. Commence initial floating using bull floats or darbies to impart an open-textured and uniform surface plane before excess moisture or bleed water appears on the surface. Do not further disturb concrete surfaces before beginning finishing operations or spreading surface treatments.

3.6 FLOAT FINISHING

- A. General: Do not add water to concrete surfaces during finishing operations.
- B. Float Finish: Begin the second floating operation when bleed-water sheen has disappeared and concrete surface has stiffened sufficiently to permit operations. Float surface with power-driven floats or by hand floating if area is small or inaccessible to power units. Finish surfaces to true planes. Cut down high spots and fill low spots. Refloat surface immediately to uniform granular texture.
 - 1. Medium-to-Fine-Textured Broom Finish: Draw a soft-bristle broom across float-finished concrete surface perpendicular to line of traffic to provide a uniform, fine-line texture.

3.7 CONCRETE PROTECTION AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.
- B. Comply with ACI 306.1 for cold-weather protection.
- C. Evaporation Retarder: Apply evaporation retarder to 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.

- D. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.
- E. Curing Methods: Cure concrete by moisture curing, moisture-retaining-cover curing, curing compound, or a combination of these.

3.8 PAVING TOLERANCES

- A. Comply with tolerances in ACI 117 and as follows:
 - 1. Elevation: 3/4 inch.
 - 2. Thickness: Plus 3/8 inch, minus 1/4 inch.
 - 3. Surface: Gap below 10-foot-long, unlevelled straightedge not to exceed 1/2 inch.
 - 4. Joint Spacing: 3 inches.
 - 5. Contraction Joint Depth: Plus 1/4 inch, no minus.
 - 6. Joint Width: Plus 1/8 inch, no minus.

3.9 REPAIRS AND PROTECTION

- A. Remove and replace concrete paving that is broken, damaged, or defective or that does not comply with requirements in this Section. Remove work in complete sections from joint to joint unless otherwise approved by Owner's Rep.
- B. Protect concrete paving from damage. Exclude traffic from paving for at least 14 days after placement. When construction traffic is permitted, maintain paving as clean as possible by removing surface stains and spillage of materials as they occur.
- C. Maintain concrete paving free of stains, discoloration, dirt, and other foreign material. Sweep paving not more than two days before date scheduled for Substantial Completion inspections.

END OF SECTION

SECTION 32 31 13 - CHAIN LINK FENCE AND GATE

PART 1. GENERAL

1.1 RELATED DOCUMENTS

- A. DIVISION 01 - GENERAL REQUIREMENTS: Drawings, quality, product and performance requirements, general and supplemental conditions apply as applicable to the project and project documents.

1.2 SUMMARY

- A. This Section includes industrial/commercial chain link fence and gates specifications:
 - 1. Polymer coated steel chain link fabric
 - 2. Polymer coated galvanized steel framework and fittings
 - 3. Gates: swing
 - 4. Installation
- B. Related Sections:
 - 1. 01 33 23 - Shop Drawings, Product Data
 - 2. 01 43 13 - Manufacturers Qualifications

1.3 REFERENCES

- A. ASTM F552 Standard Terminology Relating to Chain Link Fencing
- B. ASTM F567 Standard Practice for Installation of Chain Link Fence
- C. ASTM F626 Specification for Fence Fittings
- D. ASTM F668 Specification for Polymer Coated Chain Link Fence Fabric
- E. ASTM F900 Specification for Industrial and Commercial Swing Gates
- F. ASTM F934 Specification for Standard Colors for Polymer-Coated Chain Link
- G. ASTM F1043 Specification for Strength and Protective Coatings of Steel Industrial Chain Link Fence Framework
- H. ASTM F1083 Specification for Pipe, Steel, Hot-Dipped Zinc-Coated (Galvanized) Welded, for Fence Structures

1.4 SUBMITTALS

- A. Shop drawings: Site plan showing layout of fence location with dimensions, location of gates and opening size, cleared area, elevation of fence, gates, footings and details of attachments. Comply with the provisions of Division 01.
- B. Material samples: When required, provide representative samples of chain link fabric, framework and fittings. (3) 12 inch square samples.

PART 2. PRODUCTS

2.1 MANUFACTURERS

- A. Framework, posts, rails, fabric, and fittings for chain link fence system:
1. **MERCHANTS METALS®**
Oldcastle Architectural®
www.merchantsmetals.com
Tech-Info@merchantsmetals.com
Phone: (888) 260-1600
Fax: (888) 261-3600
- B. Requests for substitutions will be considered in accordance with provisions of Division 01.

2.2 CHAIN LINK FABRIC

- A. Steel Chain Link Fabric: Height as indicated on drawings.
1. **COLOR BOND®** Polymer Coated Steel Fabric: ASTM F668, wire gauge specified is that of the metallic coated steel core wire.
 - a. Class 2b fused and adhered
 - b. Color – black in compliance with ASTM F934.
 2. Fabric: 1" mesh, 9 gauge core, zinc coated steel wire, chain link mesh sizes and gauges produced in one piece widths 3 feet to 12 feet.
 3. Fabric selvage:
 - a) Knuckle selvage for both top and bottom, K&K.

2.3 ROUND STEEL PIPE FENCE FRAMEWORK

- A. Round steel pipe and rail: Schedule 40 standard weight pipe, in accordance with ASTM F1083, 1.8 oz/ ft² hot dip galvanized zinc exterior and 1.8 oz/ft² hot dip galvanized zinc interior coating.

High Strength Grade: Minimum yield strength 50,000 psi (344 MPa)

1. Line post, 2.875 in. outside diameter, zinc coating, 5.79 lb/ft
 2. End, Corner, Pull post, 2.875 in. outside diameter, zinc coating, 5.79 lb/ft
 3. Top, brace, bottom and intermediate rails, 1.660 in. outside diameter, zinc coating, 2.27 lb/ft
- B. **COLORBOND®** Polymer Coated Pipe: Polymer coated pipe shall have a PVC coating fused and adhered to the exterior zinc coating of the galvanized pipe in accordance with ASTM F1043. The minimum thickness of the PVC coating shall be 10-mils. Color to match fabric black per ASTM F934.

2.4 TENSION WIRE

- A. **COLORBOND®** Polymer Coated Steel Tension Wire: 7 gauge core (0.177 in.) wire complying with ASTM F1664. Match coating class and color to that of the chain link fabric
1. Class 2b, fused and adhered

2.5 FITTINGS

- A. Tension and Brace Bands: Galvanized pressed steel complying with ASTM F626, minimum steel thickness of 12 gauge (0.105 in.), minimum width of 3/4 in. and minimum zinc coating of 1.20 oz/ft². Secure bands with 5/16 in. galvanized steel carriage bolts.
- B. Terminal Post Caps, Line Post Loop Tops, Rail and Brace Ends, Boulevard Clamps, Rail Sleeves: In compliance to ASTM F626, pressed steel galvanized after fabrication having a minimum zinc coating of 1.20 oz/ft².
- C. Truss Rod Assembly: In compliance with ASTM F626, 3/8 in. or 5/16" diameter steel truss rod with a pressed steel tightener, minimum zinc coating of 1.2 oz/ft², assembly capable of withstanding a tension of 2,000 lbs.
- D. Tension Bars: In compliance with ASTM F626. Galvanized steel one-piece length 2 in. less than the fabric height. Minimum zinc coating 1.2 oz. /ft². Bars for 1 in. mesh shall have a cross section of 1/4 in. by 3/8 in.
- E. **COLORBOND®** Polymer Coated Color Fittings: In compliance with ASTM F626, minimum coating thickness 0.006 in. fused and adhered to the zinc coated fittings. Match color to fence system.

2.6 TIE WIRE AND HOG RINGS

- A. Basic commercial / industrial applications - specify 9 gauge core aluminum alloy ties and hog rings per ASTM F626.
- B. Polymer coated **COLORBOND®**, match the coating, class and color to that of the chain link fabric

2.7 SWING GATES (See Door Hardware Schedule for additional hardware)

- A. Swing Gates: Galvanized steel pipe welded fabrication in compliance with ASTM F900. Gate frame members 1.900 in. outside dimension ASTM F1083 schedule 40 galvanized steel pipe. Frame members spaced no greater than 8 ft. apart vertically and horizontally. Welded joints protected by applying zinc-rich paint in accordance with ASTM Practice A780. Match gate fabric to that of the fence system. Gateposts per ASTM F1083 schedule 40 galvanized steel pipe. 2.875" outside diameter, 5.79 lb/ft. **COLORBOND®** Polymer coated gate frames and gateposts; match the coating type and color to that specified for the fence framework. Moveable parts such as hinges, latches and drop rods may be field coated using a liquid polymer touch up.

2.8 CONCRETE

- A. Concrete for post footings shall have a 28-day compressive strength of 2,500 psi. (17.2 MPa).

PART 3. EXECUTION

3.1 FRAMEWORK INSTALLATION

- A. Posts: Posts shall be set plumb in concrete footings in accordance with ASTM F567. Minimum footing depth, 24 in. plus an additional 3 in. depth for each 1 ft. increase in the fence height over 4 ft. Minimum footing diameter four times the largest cross section of the post up to a 4.00" dimension and three times the largest cross section of post greater than a 4.00" dimension. Top of concrete footing to be at grade crowned to shed water away from the post.

- B. Top rail: When specified, install 21 ft. lengths of rail continuous thru the line post or barb arm loop top. Splice rail using top rail sleeves minimum 6 in. long. Rail shall be secured to the terminal post by a brace band and rail end. Bottom rail or intermediate rail shall be field cut and secured to the line posts using boulevard clamps or brace band with rail end.
- C. Terminal posts: End, corner, pull and gate posts shall be braced and trussed for fence 6 ft. and higher and for fences 5 ft. in height not having a top rail. The horizontal brace rail and diagonal truss rod shall be installed in accordance with ASTM F567.
- D. Tension wire: Shall be installed 4 in. up from the bottom of the fabric. Fences without top rail shall have a tension wire installed 4 in. down from the top of the fabric. Tension wire to be stretched taut, independently and prior to the fabric, between the terminal posts and secured to the terminal post using a brace band. Secure the tension wire to each line post with a tie wire.

3.2 CHAIN LINK FABRIC INSTALLATION

- A. Chain Link Fabric: Install fabric to inside of the framework maintaining a ground clearance of no more than 2 inches. Attach fabric to the terminal post by threading the tension bar through the fabric; secure the tension bar to the terminal post with tension bands and 5/16 in. carriage bolts spaced no greater than 12 inches on center. Small mesh fabric less than 1 in., attach to terminal post by sandwiching the mesh between the post and a vertical 2 in. wide by 3/16 in. galvanized steel strap using carriage bolts, bolted thru the bar, mesh and post spaced 15 in. on center. Chain link fabric to be stretched taut free of sag. Fabric to be secured to the line post with tie wires spaced no greater than 12 inches on center and to horizontal rail spaced no greater than 18 inches on center. Aluminum alloy tie wire shall be installed following ASTM F567: Wrap the tie around the post or rail and attached to a fabric wire picket on each side of the post or rail by twisting the tie wire around the fabric wire picket two full turns, cut off excess wire and bend over to prevent injury. Preformed 9 gauge power-fastened wire ties shall be installed following ASTM F626: Wrap the tie a full 360° around the post or rail and fabric wire picket, using a variable speed drill, twist the two ends together three full turns, cut off any excess wire and bend over to prevent injury. Secure the fabric to the tension wire by crimping hogs rings around a fabric wire picket and tension wire.

3.3 GATE INSTALLATION

- A. Swing Gates: Installation of swing gates and gateposts in compliance with ASTM F 567. Direction of swing shall be outward. Gates shall be plumb in the closed position having a bottom clearance of 3 in., grade permitting. Hinge and latch offset opening space shall be no greater than 3 in. in the closed position. See Door Hardware Schedule for self closing spring hinges, and exit device kit.

3.4 NUTS AND BOLTS

- A. Bolts: Carriage bolts used for fittings shall be installed with the head on the secure side of the fence. All bolts shall be peened over to prevent removal of the nut.

3.5 ELECTRICAL GROUNDING

- A. Grounding: Grounding of the fence and gates is not the responsibility of the fence contractor and not included in the fencing scope of work for this contract. Grounding, when required, shall be specified and included in Contract Section 33 79 00 Site Grounding. A licensed electrical contractor shall install grounding when required.

3.6 CLEAN UP

- A. Clean Up: The area of the fence line shall be left neat and free of any debris caused by the installation of the fence.

END OF SECTION

SECTION 32 39 13 - BOLLARDS

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. Bollards.
- B. Related Requirements:
 - 1. Section 03 30 00 "Cast-in-Place Concrete" for further information on placement of concrete for footings.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples: For each exposed product and for each color and texture specified.
- C. Samples for Initial Selection: For units with factory-applied finishes.
- D. Samples for Verification: For each type of exposed finish, not less than 6-inch- long linear components and 4-inch- square sheet components.
 - 1. Include full-size samples of bollard.
- E. Product Schedule: For site furnishings. Use same designations indicated on contract drawings.

1.4 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For site furnishings.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For site furnishings to include in maintenance manuals.

PART 2 - PRODUCTS

2.1 BOLLARDS

- A. Products: Subject to compliance with requirements, provide each the following or equivalent products approved by Owner's Rep:
 - 1. Ironsmith, Metro cast gray iron bollard with lock tab for removable application (Model No. 9020RM)
 - 2. Ironsmith, Metro dedicated removable bollard receiver (Model No. 9020R)
- B. Bollard Construction:

1. Bollard material shall be cast gray iron from 100% recycled materials. All castings shall be manufactured true to pattern and component parts, and shall fit together in a satisfactory manner. The castings shall be of uniform pattern and quality, free from blowholes, hard spots, shrinkage, distortion, or other defects.
 2. Accessories: Locking mechanism for Bollards to be furnished by Owner.
 3. Installation Method: As indicated in contract drawings.
- C. Cast-Iron Finish: Polyester powder coated.
1. Color: RAL 9005 (Black).

2.2 CONCRETE

- A. General: Cast-in-place concrete according to ACI 318, ACI 350/350R, and the following:
1. Cement: ASTM C 150, Type II.
 2. Fine Aggregate: ASTM C 33, sand.
 3. Coarse Aggregate: ASTM C 33, crushed gravel.
 4. Water: Potable.
- B. Portland Cement Design Mix: 4000 psi minimum, with 0.45 maximum water/cementitious materials ratio.
- C. Reinforcing Fabric: ASTM A 1064/A 1064M, steel, welded wire fabric, plain.
- D. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 deformed steel
- E. For additional information on submittals, testing procedures, and other requirements for concrete footings, see Section 033000 "Cast-in-Place Concrete."

2.3 GENERAL FINISH REQUIREMENTS

- A. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.4 IRON FINISHES

- A. Baked-Enamel, Powder-Coat Finish: Manufacturer's standard, baked, polyester, powder-coat finish complying with finish manufacturer's written instructions for surface preparation, including pretreatment, application, baking, and minimum dry film thickness.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions, with Installer present, for compliance with requirements for correct and level finished grade, mounting surfaces, installation tolerances, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. Comply with manufacturer's written installation instructions unless more stringent requirements are indicated. Complete field assembly of site furnishings where required.
- B. Confirm all site amenity locations with Owner's Rep prior to installation.
- C. Install site furnishings level, plumb, true, and securely anchored at locations indicated on the contract drawings and after confirming locations with Owner's Rep.

3.3 PROTECTION

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

END OF SECTION

SECTION 33 40 00 - STORMWATER DRAINAGE AND CONVEYANCE

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. Stormwater Drainage Piping.
 - 2. Stormwater Inlet Structures.

1.3 INFORMATIONAL SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Trench drain, slot drain, and catch basin assemblies
- C. Coordination Drawings: Show pipe sizes, locations, and elevations. Show other piping in same trench and clearances from other existing/proposed utilities. Indicate interface and spatial relationship between manholes, piping, and proximate structures.
- D. Profile Drawings: Show system piping in elevation. Draw profiles at horizontal scale of not less than 1 inch equals 50 feet and vertical scale of not less than 1 inch equals 5 feet. Indicate manholes and piping. Show types, sizes, materials, and elevations of other utilities crossing system piping.
- E. Field quality-control reports.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Do not store plastic pipe and fittings in direct sunlight.
- B. Protect pipe, pipe fittings, and seals from dirt and damage.

1.5 PROJECT CONDITIONS

- A. Interruption of Existing Storm Drainage Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:
 - 1. Notify Owner's Rep no fewer than two days in advance of proposed interruption of service.
 - 2. Do not proceed with interruption of service without written permission from Owner's Rep.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: Fabricator of products.
- B. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

- C. Testing Agency Qualifications: Qualified according to ASTM C 1021 or ASTM C 1093 for testing indicated.

PART 2 - PRODUCTS

2.1 PVC PIPE AND FITTINGS

- A. PVC Cellular-Core Piping:
 - 1. PVC Cellular-Core Pipe and Fittings: ASTM F 891, Sewer and Drain Series, PS 50 minimum stiffness, PVC cellular-core pipe with plain ends for solvent-cemented joints.
 - 2. Fittings: ASTM D 3034, SDR 35, PVC socket-type fittings.

2.2 TRENCH DRAIN

- A. Provide the following trench drain structure or equivalent approved by Owner's Rep:
 - 1. ACO Klassic Drain K100S
ACO USA
North East Sales Office
P.O. Box 245
Chardon, OH 44024
- B. Install drain per manufacturer's written instructions. If all installation methods interfere with design in Contract Drawings, notify Owner's Rep so a proper solution can be determined.

2.3 SLOT DRAIN

- A. Provide the following slot drain structure or equivalent approved by Owner's Rep:
 - 1. ACO Brickslot Drain
ACO USA
North East Sales Office
P.O. Box 245
Chardon, OH 44024
- B. Install drain as outlined in contract drawings. Verify that installation method is in compliance with manufacturer's specifications. For any installation components not included in drawings, refer to manufacturer's written instructions.

2.4 CATCH BASIN

- A. Provide the following catch basin structure or equivalent approved by Owner's Rep:
 - 1. ACO K900 Series Catch Basin
ACO USA
North East Sales Office
P.O. Box 245
Chardon, OH 44024
- B. Install basin as indicated in contract drawings. Verify that installation method is in compliance with manufacturer's specifications. For any installation components not included in drawings, refer to manufacturer's written instructions.

2.5 AREA DRAIN

- A. Provide the following area drain or equivalent approved by Owner's Rep:
 - 1. Zurn Z560 12" Area Drain
Zurn Industries, LLC
1801 Pittsburgh Avenue
Erie, PA 16502
- B. Install drain as outlined in contract drawings. Verify that installation method is in compliance with manufacturer's specifications. For any installation components not included in drawings, refer to manufacturer's written instructions.

PART 3 - EXECUTION

3.1 EARTHWORK

- A. Excavation, trenching, and backfilling are specified in Section 312000 "Earth Moving."

3.2 PIPING INSTALLATION

- A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground storm drainage piping. Location and arrangement of piping layout take into account design considerations. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.
- B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements.
- C. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.
- D. When installing pipe under streets or other obstructions that cannot be disturbed, use pipe-jacking process of microtunneling.
- E. Install gravity-flow, nonpressure drainage piping according to the following:
 - 1. Install piping pitched down in direction of flow.
 - 2. Install piping with restrained joints at tee fittings and at changes in direction. Use corrosion-resistant rods, pipe or fitting manufacturer's proprietary restraint system, or cast-in-place concrete supports or anchors.
 - 3. Install piping with 48-inch minimum cover.
 - 4. Install PVC cellular-core piping according to ASTM D 2321 and ASTM F 1668.

3.3 PIPE JOINT CONSTRUCTION

- A. Join gravity-flow, nonpressure drainage piping according to the following:
 - 1. Join PVC cellular-core piping according to ASTM D 2321 and ASTM F 891 for solvent-cemented joints.

3.4 DRAIN INSTALLATION

- A. All drains should be installed per manufacturer's specifications unless otherwise noted.

3.5 CONNECTIONS

- A. Contractor is to verify horizontal location and invert of existing public stormwater conveyance system and connect into system. Connection should be made in compliance with any applicable local codes.

3.6 IDENTIFICATION

- A. Arrange for installation of green warning tape directly over piping and at outside edge of underground structures.
 - 1. Use detectable warning tape over nonferrous piping and over edges of underground structures.

3.7 CLEANING

- A. Clean interior of piping of dirt and superfluous materials. Flush with potable water.

END OF SECTION