ROCKFORD BOARD OF EDUCATION
INVITATION FOR BID ON SUPPLIES, MATERIALS, EQUIPMENT OR SERVICES FOR SCHOOL DISTRICT NO. 205 ROCKFORD, ILLINOIS

IFB No. **16-49 Washington Academy Renovations**

DATE: **March 24, 2016**

OFFERS WILL BE RECEIVED UNTIL: **3:00 P.M. (CDST) on Tuesday, April 19, 2016**

RE: **IFB No. 16-49 Washington Academy Renovations**. The purpose of this Invitation for Bid (IFB) is to solicit bids for the renovations at Washington Academy, 1421 West Street, Rockford, IL 61102.

IFB Opening: **Tuesday, April 19, 2016 at 3:00 p.m., Rockford Board of Education, 6th floor Conference Room, 501 Seventh St., Rockford, IL 61104.**

If you plan to hand deliver your IFB submission on the due date, please note that you must check in on the 3rd floor prior to coming to the 6th floor. Please allow time for this as late submissions will not be accepted.

Copies of the bidding documents are available from Onvia DemandStar, by email from the Purchasing Department, BHFX Digital Imaging and Printing, DG Digital Printing, YCS Printing, Inc., or by download from the District's Purchasing Bids-RFPs webpage at www.rps205.com.

A MANDATORY PRE-BID MEETING WILL BE CONDUCTED ON, TUESDAY, APRIL 5, 2016 AT 3:00 P.M. (CDST), AT WASHINGTON ACADEMY, 1421 WEST STREET, ROCKFORD, IL 61102 BY OWNER'S REPRESENTATIVE. MEET IN THE LIBRARY.

Refer all questions relative to the business aspect, Instructions to Bidders, Special Conditions, and questions concerning the technical aspect of the documents to the Purchasing Process Manager by email at tamara.pugh@rps205.com.

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RLJ
RPS Washington Academy

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INVITATION TO BID

Project	Washington Academy Renovations
Location	Washington Academy 1421 West Street Rockford, Illinois 61102
Owner	Rockford Public School District 205 501 Seventh Street Rockford, Illinois 61104
Architect	Richard L. Johnson Associates, Inc 4703 Charles Street Rockford, Illinois 61108 815-398-1231 Fax 815-398-1280
Bid Scope	Project includes the renovations at Washington Academy, 1421 West Street, Rockford, Illinois 61102
Bid Due Date	3:00 P.M. (CDST), Tuesday, April 19, 2016
Pre-Bid Meeting	Mandatory Meeting: 3:00 PM (CDST), Tuesday, April 5, 2016; at Washington Academy, 1421 West Street, Rockford, IL 61102.
Addendums	Last RFI accepted; 4:30 P.M. (CDST), April 14, 2016 Last addendum issued; 4:30 P.M. (CDST) April 15, 2016
Other Key Dates	Tuesday, April 26, 2016; RPS Board Meeting Wednesday, April 27, 2016; Award / Notice to Proceed
Bid Security	5% of Base Bid.

INVITATION TO BID

Obtain Bid Documents By	Emailing the District's Purchasing Department, by downloading from the on District's Purchasing Bids-RFPs webpage at www.rps205.com, or by contacting the following: Onvia Demandstar BHFX Digital Imaging and Printing 1404 21st Street Rockford, IL 61108 P. (815) 397-8800 F. (815) 397-8844 rockford@bhfx.net DG Digital Printing 214 N. Rockton Avenue Rockford, IL 61103 P. (815) 961-0000 F. (815) 961-0004 http://www.dgdplanroom.com/ YCS Printing, Inc. 305 E. Riverside Blvd. Loves Park, IL 61111 P. (815) 636-2058 F. (815) 636-2059 print@ycsprinting.com
Performance Bond and Labor And Material Payment Bond	Furnish in the amount of 100% of the Contract after award.
Rights Reserved by Owner	The Owner reserves the right to waive any irregularities and/or reject any or all bids when, in the opinion of the Owner, such action will serve the best interests of the Owner.
Withdrawal of Bids	No bid may be withdrawn for a period of 60 days after the opening of bids without written consent of the Owner.

STATEMENT OF NO INTEREST - BID

NOTE: If you are unable to submit a bid for this work, please complete and return this form immediately.

The Purchasing Department of the Rockford School District wishes to keep its vendors list file current. If for any reason you cannot supply the commodity/service noted on the attached solicitation, this form must be completed and returned to remain on the particular vendor list for future projects of this type.

We, the undersigned, have declined to submit a proposal on:

Bid No. & Name: Bid 16-49 Washington Academy Renovations

We are unable to submit a proposal for this work due to the following:

_____Too busy at this time _____Unable to meet specifications

_____Bond requirement _____Not engaged in this type work

_____Insurance requirement _____Site location too distant

_____Length of time required to obtain payment

_____Project is _____too large _____too small

_____Remove us from your bidder's list for this commodity/service

_____Other (specify below)

_____Do you wish to be considered in the future for similar projects? _____ Yes ____No

REMARKS:

_____

_____

_____

Signature: _____ Name & Title: _____

Firm: _____Phone: _____

Fax: _____ E-mail: _____

Address:_____
(Street Address) (City) (State) (Zip-Code)

Date:_____

Return to: Executive Director of Budgeting and Purchasing
Rockford Public School District
501 7th Street
Rockford, IL 61104

LATE BIDS CANNOT BE ACCEPTED!

SEALED BID PROPOSAL

BID NO.: **16-49**

OPENING DATE: **April 19, 2016**

OPENING TIME: **3:00 PM (CDST)**

DESCRIPTION: **Washington Academy Renovations**

ATTN: PURCHASING DEPT.

DATED MATERIAL-DELIVER IMMEDIATELY

PLEASE CUT OUT AND AFFIX THIS BID LABEL TO THE OUTERMOST ENVELOPE OF YOUR PROPOSAL TO HELP ENSURE PROPER DELIVERY!

LATE OFFERS CANNOT BE ACCEPTED!

AIA® Document A701™ – 1997

Instructions to Bidders

for the following PROJECT:
(Name and location or address)
MFP Bid docs boilerplate

THE OWNER:
(Name, legal status and address)
Board of Education
Rockford School District No. 205
Winnebago and Boone Counties, Illinois
501 Seventh Street
Rockford, Illinois 61104

THE ARCHITECT:

ADDITIONS AND DELETIONS:
The author of this document has added information needed for its completion. The author may also have revised the text of the original AIA standard form. An *Additions and Deletions Report* that notes added information as well as revisions to the standard form text is available from the author and should be reviewed. A vertical line in the left margin of this document indicates where the author has added necessary information and where the author has added to or deleted from the original AIA text.

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

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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 A201as revised by Owner, 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 and all required information required by Owner in the Bidding Documents has been furnished by Bidder..

§ 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.

§ 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.

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§ 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 submit inquiries to the Director of Purchasing for Owner, 501 Seventh Street, Rockford, Illinois 61104.

§ 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 and Program Manager 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.

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§ 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

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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

This bid is form a project for the Rockford Public Schools. All bids advertised, submitted, and selected for award by Owner and other matters relating to the bidding process shall adhere to the provisions of Illinois law, in particular the provisions of the School Code, including without limitation, the provisions of 105 ILCS 5/10-20.21.

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 nonresponsive, 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 responsible 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

(Paragraphs deleted)

SUBMITTALS

(Paragraphs deleted)

§ 6.2.1 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.

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

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§ 6.3.3 Prior to the execution of the Contract, the Architect will notify the Bidder in writing if either the Owner, Program Manager 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. The Owner may accept the substitute person or entity 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

The Agreement for the Work will be written on AIA Document A101-2007 as revised by Owner and be accompanied by General Conditions on AIA Document A201-2007, as revised by Owner and further revised by Supplementary Conditions issued by Owner all as included in the Bidding Documents.

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SUPPLEMENTARY INSTRUCTIONS TO BIDDERS

1. SPECIAL NOTICE TO BIDDERS:

   A. Proposals shall be submitted in duplicate on the forms provided. The sample proposal form bound into these Specifications is for reference only and shall not be detached. Proposals shall be enclosed in a sealed envelope, with name of the project clearly identified, and bearing the words "SEALED BID ENCLOSED".

   B. Proposals shall be based upon the drawing and specifications and each bidder shall acknowledge the receipt and inclusion of any further instruction or addenda which may be issued prior to receipt of proposal.

   C. Bids shall be opened publicly by the Owner, immediately after bid closing time at the office of the Board of Education, 501 Seventh Street, Rockford, Illinois.

2. METHOD OF BIDDING

   Bids will be received for a single contract.

3. SIGNING BIDS:

   A. Bids which are signed for a partnership shall be signed by all partners or by an Attorney-In-Fact. If signed by an Attorney-In-Fact, there shall be attached to the bid, a Power of Attorney evidencing such authority.

   B. Bids which are signed for a corporation shall have the correct corporation name thereon and the signature of the president or other authorized officer of the corporation.

   C. Proposals shall be made on the form provided and shall not be altered in any way.

4. QUALIFICATIONS:

   Statement as to whether the bidder has adequate equipment to do the work properly and expeditiously.

SUPPLEMENTARY INSTRUCTIONS TO BIDDERS

5. AWARD (SEE ARTICLE 5.3)

The Contract shall be deemed as having been awarded when formal written notice shall have been duly served by an officer or agent of the Owner duly authorized to give such notice.

6. TAXES:

The bidder shall not include any Illinois Retailers Occupation or use taxes on tangible property purchased in the State of Illinois in his bid. Exemption Certificates for these taxes will be furnished by the Board of Education to the Contractor when requested by him/her in writing. See Section 17 regarding sales of tangible property into the State of Illinois.

7. FORM OF CONTRACT:

The Owner-Contractor agreement shall be the Standard Form of Agreement between Owner and Contractor, AIA Document A101-2007 as revised by Owner, (form included in bidding documents), including the General Conditions AIA A201-2007 as revised by Owner (form included in Invitation for Bid), the Addendum included in the Invitation for Bid, the Invitation for Bid, all amendments and addenda to the Invitation for Bid issued by the Owner, and the successful bidders bid.

8. ACCEPTANCE OR REJECTION OF BIDS:

The Owner reserves the right to reject any or all bids and to waive informalities in order to accept the bid that in his judgment will be best for the interest of the School District. Any bidder may withdraw his bid either personally or by telephone written request at any time prior to the scheduled closing time for receipt of bids.

9. QUESTION ON BIDDING DOCUMENT:

Refer all questions relative to the business aspect, Instructions to Bidders, Special Conditions, and questions concerning the technical aspect of the documents to the Executive Director of Budget and Purchasing by email at stacie.scott@rps205.com.

10. BID DEPOSIT:

Each bidder shall provide a Bid Bond, a Certified Check or Bank Draft in the amount of 5% of the bid total. Bid deposits will be returned to unsuccessful bidders within (30) days after award. Bid deposits will be returned to successful bidder as soon as Contract is accepted for the work outlined in this proposal.

SUPPLEMENTARY INSTRUCTIONS TO BIDDERS

11. EXAMINATION OF SITE:

Bidder shall examine the sites of the work prior to bidding. He shall satisfy himself/herself as to existing conditions, local facilities and governing factors under which he will be obliged to operate in performing his part of the work, or that may in any manner affect the work under this contract. No allowance shall be subsequently made in this connection in behalf of the Bidder for any error or negligence on his/her part due to this failure to fully examine the sites or the work prior to bidding.

12. PREVAILING WAGE:

This Bid requires that the successful Contractor comply with all statues, both Federal and State, governing payment of wages to employees. The Contractor certifies that by submitting his bid that he will pay the prevailing rate of wage in this area, for the particular type of labor, in accordance with State of Illinois Codes and the Illinois department of Labor. The Contractor and each Subcontractor shall keep an accurate record to show names and occupation of all workmen employed by them in connection with this contract. The actual hourly wage paid to each shall be recorded. These records shall be open for inspection during all working hours to the Owner's agent and the agent of the Illinois Dept. of Labor. In accordance with the amendment of the Illinois Prevailing Wage Act effective 1-1-90, as amended, the following clause shall be apart of this contract. *"If during the course of this contract the Department of Labor revises the prevailing rate hourly wages to be paid under this contract for any trade or occupation, Owner will notify contractor and each Subcontractor of the change in the prevailing rate of hourly wages. Contractor shall have the sole responsibility and duty to ensure that the revised prevailing rate of hourly wage is paid by Contractor and all Subcontractors to each worker to whom a revised rate is applicable. Revisions to the prevailing wage as set forth above shall not result in an increase in the contract sum."*

13. DOCUMENTS TO BE RETURNED:

Forwarded with this bidding document is one complete set of specifications and bidding forms. The bidding forms are included within the bidding document, *Two copies of the bidding forms are to be returned as your Bidding Document, along with the Bid Deposit, signatures, and other required information*. A self-addressed label, properly identified, is provided for your use.

It is required that the Bidder's signature appears on the following bidding forms:

A. Statement of No Interest (if applicable)
B. Bid-Rigging Certification
C. Minority and Women Owned Business Form
D. Certification Regarding Debarment Form
E. Certificate Regarding Lobbying Form
F. OFAC Compliance Form
G. Vendor Conflict of Interest Disclosure Form
H. Bid Offer Form

SUPPLEMENTARY INSTRUCTIONS TO BIDDERS

14. ILLINOIS FAIR EMPLOYMENT PRACTICES

The bidder's signature on the bid form of this Face Sheet will be construed as his/her acceptance of and willingness to comply with all provisions of the Acts of the General Assembly of the State of Illinois relating to wages of laborers, preferences and discrimination and intimidation of employees. This bid and the resulting Contract are specifically subject to the Equal Employment Opportunity requirements of the Illinois Fair Employment Practices Commission and the policies of the Rockford Board of Education. Bidder agrees to comply in all respect with Federal, State and local laws and ordinances pertaining to this bid and to the performance of the Contract in the event bidder is awarded the bid. Provisions of applicable acts are hereby incorporated by reference and become a part of this proposal and specifications.

15. EMPLOYMENT OF ILLINOIS WORKERS ON PUBLIC WORKS ACT

Pursuant to the Employment of Illinois Workers on Public Works Act, during any time of excessive unemployment (defined as any month immediately following 2 consecutive calendar months during which the level of unemployment in the State of Illinois has exceeded 5% as measured by the United States Bureau of Labor Statistics in its monthly publication of employment and unemployment figures) any person or entity charged with the duty, either by law or contract, of (1) constructing or building any public works, as defined in this Act, or (2) the clean-up and on-site disposal of hazardous waste for the State of Illinois or any political subdivision of the State, and that clean-up or on-site disposal is funded or financed in whole or in part with State funds or funds administered by the State of Illinois, then that person or entity shall employ at least 90% Illinois laborers on such project. Persons or entities entering into a contract with the Rockford Public Schools in which they are obligated to construct or build any public works (defined any fixed work construction or improvements funded in whole or part by the State of Illinois) agree to abide by the requirements of the Employment of Illinois Workers on Public Works Act.

16. TAX IDENTIFICATION NUMBER:

Under Federal Law and in accordance with instructions from the Department of Treasury and the Internal Revenue Service, our School District is required to have on file appropriated tax identification information concerning you or your firm. This information will be a Federal Employer's Identification Number, but in some instances of independent contractors, it might be a Social Security Number. This information is needed to determine on which vendors we must file a Form 1099.

SUPPLEMENTARY INSTRUCTIONS TO BIDDERS

BEFORE A BID CAN BE CONSIDERED BY THE SCHOOL DISTRICT, THE ABOVE REFERENCED TAX IDENTIFICATION NUMBER MUST BE ON THE BID FORM IN THE SIGNATURE SECTION. WE ALSO SPECIFICALLY REQUIRE THAT YOU IDENTIFY THE LEGAL ORGANIZATIONAL STATUS OF YOUR FIRM IN THE SIGNATURE SECTION AS TO WHETHER IT IS A CORPORATION, PARTNERSHIP, PROPRIETORSHIP, ETC., SHOULD YOU HAVE ANY QUESTIONS CONCERNING THIS TAX IDENTIFICATION NUMBER, PLEASE CONTACT US.

17. CONTRACTOR RESPONSIBILITY TO COLLECT AND REMIT ILLINOIS USE TAX

The bidders acknowledge and understand that any resulting contract for goods and services awarded to a bidder requires that as a contractor the person or entity and all affiliates of the person or entity will collect and remit Illinois Use Tax on all sales of tangible personal property into the State of Illinois in accordance with the provisions of the Illinois Use Tax Act (35 ILCS 105/1 et seq.) regardless of whether the person/entity or affiliate is a "retailer maintaining a place of business within this State" as defined by the Use Tax Act (35 ILCS 105/2). (Reference the School Code of Illinois; 105 ILCS 5/10-20.21(b))

18. PERFORMANCE BOND: Shall be submitted on AIA Document 312-2010, "Performance Bond" and "Labor & Material Payment Bond".

The successful bidder will be required to furnish a Performance Bond and a Labor & Materials Bond satisfactory to the Board of Education. The amount of said bond shall be equal to 100% of the contract award and the cost of any said bond shall be included in the Contractor's proposal.

19. PREQUALIFICATION OF MATERIALS:

Approval of other "or equal" materials shall be pre-qualified by the Architect's at least five (5) working days before the bid opening. Proposals may be offered on more than one manufacturer.

20. PREQUALIFICATION OF BIDDER:

A bidder may be required to furnish evidence satisfactory to the Owner that he/she and his/her proposed subcontractors have sufficient means and experience in the types of work call for to assure completion of the contract in a satisfactory manner. A new bidder may be required to properly execute AIA Document A305, "Contractor's Qualification Statement" before submitting his bid.

SUPPLEMENTARY INSTRUCTIONS TO BIDDERS

21. MINORITY AND FEMALE OWNED BUSINESSES

District #205 supports the policy of the State of Illinois to support Minority Owned Business Enterprise (MBE) and Female Owned Business Enterprise (FBE). The District seeks to identify and encourage the amount of minority and female involvement in each of the construction-related contracts issued by the District. A bidder will be required to submit the minority certification form enclosed with the bid documents. Additionally, in the event and to the extent State of Illinois funds in excess of $250,000.00 are awarded to and used by the District for capital construction costs and design services on a school construction project, and goals are established for MBE and FBE participation in such school construction project involving the use of State of Illinois funds, and to the extent such goals are not inconsistent with Federal guidelines the District will follow such goals unless waived. The successful bidder agrees to cooperate with the District to provide necessary information to meet state funding requirements and on participation by MBE and WBE and to assist in meeting goals through certification as a MBE or WBE or certification of subcontractors.

GENERAL TERMS AND CONDITIONS

"District" means Rockford School District No. 205, Winnebago and Boone Counties, Illinois.
"IFB" means an Invitation for Bid issued by the District at any time or times, identified by a unique bid number.
"Bidder" means a person or entity submitting a bid to the District in response to an IFB; including successful Bidders.

1. BID OPENING. Sealed bids will be received at the District Purchasing Department until the date and time specified at which time they shall be opened in public. No other bids will be considered after this date and time unless it is evidenced and determined that the bid was in the District's possession prior to the scheduled bid opening time and date. Late bids shall be rejected and shall remain unopened. The District does not prescribe the method by which bids are to be transmitted; therefore, it cannot be held responsible for any delay, regardless of the reason, in transmission of the bids. All bids delivered in person shall be deposited with the District Purchasing Department, 6th Floor, 501 Seventh Street, Rockford, IL, 61104.

2. BID PREPARATION. Bids must be submitted on this form and all information and certifications called for must be furnished. Bids submitted in any other manner, or which fail to furnish all information or certificates required, may be summarily rejected. Bids may be modified or withdrawn prior to the time specified for the opening of the bids. Bids shall be filled out legibly in ink or typewritten with all erasures, strikeovers and corrections initialed in ink by the person signing the bid. The bid shall include the legal name of the bidder, the complete mailing address, and be signed in ink by a person or persons legally authorized to bind the bidder to a contract. Name of person signing should be typed or printed below the signature.

3. BID ENVELOPES. Envelopes containing bids must be sealed and addressed to the District Purchasing Department. The name and address of the Bidder and the bid number must be shown on the envelope.

4. ERRORS IN BIDS. Bidders are cautioned to verify their bids before submission. Negligence on the part of the Bidder in preparing the bid confers no right for withdrawal or modification of the bid after it has been opened. In case of error in the extension of prices in the bid, the unit prices will govern.

5. RESERVED RIGHTS. The District reserves the right at any time and for any reason to cancel an IFB, accept or reject any or all bids or any portion thereof, or to accept an alternate offer. The District reserves the right to waive any minor informality defect in any IFB. Unless otherwise specified, the District will award a bid or reject bids within 60 days. The District may seek clarification from any Bidder at any time and failure to respond promptly is cause for rejection.

6. INCURRED COSTS. The District will not be liable for any costs incurred by Bidders in responding to an IFB.

7. AWARD. The District will evaluate bids and will award a contract to the lowest responsive and responsible bidder whose bid, conforming to the solicitation and specifications will be most advantageous to the District. Determination of the lowest responsible bidder conforming to the solicitation shall not be restricted to the price quotation alone, but will include such other factors (where applicable) as (a) adherence to all conditions and requirements of the technical specifications; (b) price; (c) qualifications of the bidder, including past performance, financial responsibility, general reputation, experience, service capabilities, and facilities; (d) delivery or completion date; (e) product appearance, workmanship, finish, taste, feel, overall quality, and results of product testing; (f) maintenance costs and warranty provisions; (g) repurchase or residual value; and (h) other such related items. The District is interested in obtaining the best overall value and reserves the right to make a selection based on its judgment of the bid that is best suited for the purpose intended. The District may (1) reject any or all bids, (2) accept other than the lowest bidder, and (3) waive informalities or minor irregularities in bids received. The District may accept any item or group of items of an offer, unless the bidder qualifies the bid by specific limitations. The District reserves the right to determine the lowest responsible bidder on the basis of an individual item, groups of items, or in any way determined to be in the best interests of the District. A written award or acceptance of a bid mailed or otherwise furnished to the successful Bidder within the time for acceptance specified in the bid shall result in a binding contract without further action by either party.

8. PRICING. The price quoted for each item is the full purchase price**, including delivery to destination**, and includes all transportation and handling charges, premiums on bonds, material or service costs, patent royalties and all other overhead charges of every kind and nature. Unless otherwise specified, prices shall remain firm for the contract period.

If at any time after a contract is awarded to the successful Bidder(s) makes a general price reduction in the comparable price of any material covered by the contract to customers generally, an equivalent price reduction based on similar quantities and/or considerations shall apply to the contract for the duration of the contract period (or until the price is further reduced). Such price reduction shall be effective at the same time and in the same manner as the reduction in the price to customers generally. For the purpose of this provision, a "general price reduction" shall mean any horizontal reduction in the price of an article or service offered (1) to successful Bidder's customers generally, or (2) in the successful Bidder's price schedule for the class of customers, i.e., wholesalers, jobbers, retailers, etc., which was used as the basis for bidding on this contract. An occasional sale at a lower price, or sale of distressed merchandise at a lower price, would not be considered a "general price reduction" under this provision. The successful Bidder shall invoice the District at such reduced prices indicating on the invoice that the reduction is pursuant to the "price reduction" provision of this contract. The successful Bidder, in addition, shall within ten (10) days of any general price reduction, notify the Executive Director of Budget and Purchasing of such reduction by letter. Failure to do so may result in termination of the contract.

9. DISCOUNTS. Prices quoted must be net after deducting all trade and quantity discounts.

10. SPECIFICATIONS. Reference to brand names and numbers is descriptive, but not restrictive, unless otherwise specified. Bids on equivalent items will be considered, provided the bidder clearly states exactly what is proposed to be furnished, including complete specifications. Unless the Bidder specified otherwise, it is understood the Bidder is offering a referenced brand item as specified or is bidding as specified when no brand is referenced, and does not propose to furnish an "equal." The District reserves the right to determine whether a substitute offer is equivalent to and meets the standard of quality and salient characteristics indicated by the brand name and number.

11. SAMPLES. Samples of items, when called for, must be furnished free of expense. Individual samples must be labeled with the Bidder's name, bid number, item reference, manufacturer's brand name and number. If samples are requested, they must be sent under separate cover and not included with bid. The District will not be responsible for any bid enclosed with sample boxes.

12. INTERPRETATION OR CORRECTION OF BIDDING DOCUMENTS. Bidders shall promptly notify the Rockford Public School District of any ambiguity, inconsistency or error which they may discover upon examination of the IFB documents. Interpretations, corrections and changes will be made by amendment. Each Bidder shall ascertain prior to submitting a bid that all amendments have been received and acknowledged in the offer.

13. INDEMNIFICATION. The Bidder shall indemnify and hold harmless the District, its agents, officials, and employees from and against all injuries, losses, claims, suits, costs and expenses which may accrue against the District as a consequence of granting the contract.

14. DEFAULT. If delivery of acceptable items or rendering of services is not completed by the time promised, the District reserves the right, without liability, in addition to its other rights and remedies, to terminate the contract by notice effective when received by Bidder, as to stated items not yet shipped or services not yet rendered and to purchase substitute items or services elsewhere and charge the Seller with any or all losses incurred. The District shall be entitled to recover its attorney fees and expenses in any successful action by the District to enforce this contract.

15. INSPECTION. Materials or equipment purchased are subject to inspection and approval at the District's destination. The District reserves the right to reject and refuse acceptance of items which are not in accordance with the IFB, instructions, specifications, drawings or data or Bidder's warranty (express or implied). Rejected materials or equipment shall be removed by, or at the expense of, the Bidder promptly after rejection and if not removed within 10-calendar days after notice, such shall be returned via collect shipping.

16. WARRANTY. Bidder warrants that all goods and services furnished hereunder will conform in all respects to the terms of this proposal, including any drawings, specification or standards incorporated herein, and that they will be free from latent and patent defects in materials, workmanship and title, and will be free from such defects in design to the best of the Bidder's knowledge. In addition, Bidder warrants that said goods and services are suitable for, and will perform in accordance with, the purposes for which they are purchased, fabricated, manufactured and designed or for such other purposes as are expressly specified in this solicitation. The District may return any nonconforming or defective items to the Bidder or require correction or replacement of the item at the time the defect is discovered, all at the Bidder's risk and expense. Acceptance shall not relieve the Bidder of its responsibility.

17. REGULATORY COMPLIANCE. Bidder represents and warrants that the goods or services furnished hereunder (including all labels, packages and container for said goods) comply with all applicable standards, rules and regulations in effect under the requirements of all Federal, State and local laws, rules and regulations as applicable, including the Occupational Safety and Health Act as amended, with respect to design, construction, manufacture or use for their intended purpose of said goods or services. Bidder shall furnish "Material Safety Data Sheets" in compliance with the Illinois Toxic Substances Disclosure to Employees Act, if applicable.

18. ROYALTIES AND PATENTS. Bidder shall pay all royalties and license fees. Bidder shall defend all suits or claims for infringement of any patent, copyright or trademark rights and shall hold the District harmless from loss on account thereof.

19. COMPLIANCE WITH LAWS AND REGULATIONS. Bidder represents and warrants that throughout the term of any contract arising from award of a bid and any extension thereof, Bidder and all products shall be and shall remain in compliance with all applicable federal, state, and local laws and regulations.

20. TERMINATION. (a) The District may terminate this contract in whole or in part, without liability, if deliveries are not made at the time and in the quantities specified, if the Bidder fails to perform any of the provisions of tis contract, or so fails to make progress as to endanger performance of this contract in accordance with its terms, and in either of these circumstances does not cure such failure within such period of time as the District may direct, if it is determined the successful Bidder knowingly falsified information provided to the District, if it is determined the successful Bidder offered substantial gifts or gratuities to a District official, employee, or agent whether in their official capacity or not, or in the event of a breach or failure of the Contractor to comply with any of the other terms or conditions herein. The District shall notify the contractor in writing of the specific nature of the breach and shall request that it be cured. If the Contractor does not cure the breach within thirty (30) days of such notice, the District may immediately terminate this contract. To terminate, the District shall give notice to the Contractor in writing, and to the extent specified therein, Contractor shall immediately terminate deliveries under the contract. Termination of the contract shall not preclude the District from pursuing any and all remedies available to it at law or at equity.
(b) Any termination by the District, whether for default or otherwise, shall be without prejudice to any claims for damages or other rights of the District against Contractor.
(c) The District shall have the right to audit all elements of any termination claim and Contractor shall make available to the District on request all books, records, and papers relating thereto.
(d) The Contractor shall be paid only for the performance of work up to the date of termination if the District exercises its right to terminate.

21. TERMINATION WITHOUT CAUSE. Unless otherwise specified in the Invitation for Bid, a contract formed by award of a bid may be unilaterally terminated by the District, for any or no reason, upon sixty (60) days written advance notice to the Bidder. Bidder may submit claims for actual work performed up to and including the day of notice of termination with appropriate documentation supporting such claim for materials, labor, or acquired inventory for equitable adjustment and any such material shall become the property of the District upon settlement.

22. ASSIGNMENT. The Bidder may not assign, subcontract, delegate or otherwise transfer this contract or any of its rights or obligations hereunder, nor may it contract with third parties to perform any of its obligations hereunder except as contemplated in this contract, without the District's prior written consent.

23. FORCE MAJEURE. The obligations of the Bidder to perform under this contract will be excused during each period of delay caused by acts of God or by shortages of power or materials or government orders which are beyond the reasonable control of the Bidder obligated to perform ("Force Majeure Event"). In the event that the Bidder ceases to perform its obligations under any contract formed by award of bid due to the occurrence of a Force Majeure Event, the Bidder shall: (1) immediately notify the District in writing of such Force Majeure Event and its expected duration; (2) take all reasonable steps to recommence performance of its obligations under this contract as soon as possible. In the event that any Force Majeure Event delays Bidder's performance for more than thirty (30) days following notice pursuant to this contract, the District may terminate this contract immediately upon written notice to the Contractor.

24. BID CERTIFICATION. The Bidder's signature on a bid certifies: (a) The bid is genuine and not made in the interest of, or on the behalf of, any undisclosed persons, firms or corporation and is not submitted in conformity with any agreement or rules of any group association, or organization. (b) Bidder has not directly or indirectly induced or solicited any other Bidder to enter a false or sham bid. (c) Bidder has not solicited or induced any person, firm or group to refrain from bidding. (d) Bidder has not sought by collusion or otherwise to obtain for self-interest any advantage over any other Bidder or the Owner. The Bidder's signature on the Bid Form certifies that they have read and understand the contents of this solicitation and agree to furnish at the prices shown any or all of the items and/or services, subject to all instructions, conditions, specifications and attachments hereto. Failure to have read all the provisions of the IFB shall not be cause to alter any resulting contract, request additional compensation, or relieve Bidder from obligation to perform under this contract.

25. MODIFICATIONS. This contract can be modified only by written bi-lateral modification signed by the parties or duly authorized agents.

26. ADDENDA. If it becomes necessary to revise any part of this bid, a written addendum will be provided to all bidders. If the District issues written addenda, such addenda shall become part of the contract documents. A Bidder who fails to receive the District's addenda, and who has previously submitted an offer, shall not be relieved from any obligation in the bid submitted.

27. BINDING EFFECT. The terms, conditions, provisions, and undertakings of any contract formed by award of a bid shall be binding upon and inure to the benefit of each of the parties thereto and their respective successors and assigns.

28. EQUAL OPPORTUNITY EMPLOYER. The Rockford Public School District is an Equal Opportunity Employer and encourages bids or proposals from any company or individual regardless of race, gender, national origin, religion or age.

SUPPLEMENTARY CONDITIONS

The following supplements modify, change, delete from or add to the General Conditions of the Contract for Construction, AIA document A201 2007, as revised by Owner; hereinafter referred to as General Conditions. References herein to Owner shall mean the Board of Education of Rockford School District No. 205, Winnebago-Boone Counties, Illinois. Where any Article of the General Conditions is modified or any paragraph, subparagraph, or clause thereof is modified or deleted by these supplements the unaltered provisions of that article, paragraph, subparagraph or clause shall remain in effect. In the event of a conflict between the General Conditions and these Supplementary Conditions, which are complementary, the Supplementary Conditions shall prevail.

1. INSURANCE
   - A. Contractor's Liability Insurance shall include all major divisions of coverage and be on a comprehensive basis including:
     1. Premises operations
     2. Independent Contractor's protective
     3. Products and completed operations
     4. Personal injury liability with employment exclusion deleted.
     5. Contractual, including specified provision for Indemnification under General Conditions paragraph 3.18.
     6. Owned and non-owned motor vehicles
     7. Broad form property damage including completed operations.
   - B. The insurance required by General Conditions paragraph 11.1.1 shall be written for not less than the following limits, or greater if required by law:
     1. Workman's Compensation:
        - a. Statutory Workman's compensation.
        - b. Employers' liability - $500,000.00 per accident and aggregate disease.
     2. Builder's Risk Insurance will be carried and covered by the Board of Education separately.

Comprehensive general liability and contractual liability limits, automobile liability and umbrella coverage will depend on the category of the project. Category 1 projects will have a contract amount in the range of $0.00 to $1,000,000.00 and category 2 projects will have a contract amount in excess of $1,000,000.00. The minimum liability limits per category are as follows:

SUPPLEMENTARY CONDITIONS

3. Comprehensive general liability and contractual liability

	CATEGORY 1 CONTRACTS	CATEGORY 2 CONTRACTS
a. Bodily injury:	$1,000,000.00 each person	$2,000,000.00 each person
	$1,000,000.00 each occurrence	$2,000,000.00 each occurrence
	$1,000,000.00 aggregate	$4,000,000.00 aggregate
b. Property damage:	$1,000,000.00 each occurrence	$1,000,000.00 each occurrence
	$1,000,000.00 aggregate	$1,000,000.00 aggregate

c. Shall include products and completed operations insurance as above for 1 year after final payment (Category 1 AND Category 2).

4. Comprehensive Automobile Liability Category 1 AND Category 2

a. Bodily Injury: $1,000,000.00 each person
$1,000,000.00 each occurrence

b. Property Damage: $1,000,000.00 each occurrence
$1,000,000.00 aggregate

5. If the general liability coverage is provided by a commercial liability policy, the:

a. General aggregate shall not be less than $2,000,000 for Category 1 and $4,000,000.00 for Category 2 and shall apply in total, to this project.

b. Fire damage limit shall be not less than $50,000 on any one fire.

6. Umbrella liability coverage:

CATEGORY 1	CATEGORY 2
$3,000,000.00 each occurrence	$5,000,000.00 each occurrence
$3,000,000.00 aggregate	$5,000,000.00 aggregate

C. Certificate of Insurance:
The insurance shall be written on the Comprehensive General Liability Policy Form. The certificate shall be submitted on current AIA Document G705. A copy of this document is included herein.

SUPPLEMENTARY CONDITIONS

D. Cancellation Notice:
All certificates and policies shall indicate that the carrying company will not cancel without giving the Owner notice in writing thirty (30) days prior to date cancellation is to become effective.

E. Subcontractors Comprehensive Insurance:
Contractor should protect himself/herself by requiring his subcontractors to maintain workman's compensation insurance and insurance of the same kind in amounts specified above.

F. Contractors Comprehensive Insurance:
Contractor shall carry sufficient comprehensive insurance on his/her equipment at site of work and in route to and from site to fully protect him/her. Contractor shall require same coverage of his/her subcontractors. It is expressly understood and agreed that the Owner and/or Architect shall have no responsibility thereof.

G. At no time shall the Contractor's workers be considered employees of the Board of Education.

2. CLEANING AND PROTECTION OF BUILDING:

A. The Contractor shall not allow rubbish, debris, or unused material related to the execution of this Contract to accumulate on the premises. Contractor shall on a daily basis or otherwise as directed by the Owner's representative or designee, clean or pay the cost of cleaning all debris and dirt, etc., which may accumulate on the site due to the execution of this Contract.

B. The Owner has contracted with an Owner's representative or designee for certain projects under the Master Facilities Plan. In the event this project is managed by the Owner's representative or designee, all communications, requests and instructions shall be copied to the Owner's representative or designee. Contractor shall follow the instructions and decisions of Owner's representative or designee as though made and issued by Owner. Owner's representative or designee shall designate the permitted hours of construction activity for this project and Contractor shall not conduct construction or other activities relating to this project at the project site outside the permitted hours without the express prior consent of the Owner's representative or designee.

3. SCHEDULE OF VALUES:
Contractor shall submit a schedule of values to the Architect before submitting the first payment request. Use AIA Document G703. File in accordance with Article 9 of General Conditions.

SUPPLEMENTARY CONDITIONS

4. APPLICATION FOR PAYMENTS:

   A. Payment requests shall be with 10% retainage. First request, per school, may be made when the work is substantially completed at that school. Final request for the "retainage" amount shall be after completion of "Final Acceptance of Contracted Project" form.

   B. "Request for Payment" shall be submitted to the Architect on AIA Document G702/G703. Contract's Partial Waiver of Lien will be required, current with each payment request, in the net amount of each request. Waivers of Lien from each subcontractor and material supplier to whom payment has been made, shall be required with the following payment request. Final waiver of lien from subcontractors and material suppliers shall be submitted with final pay request.

   C. The Board of Education regular meetings generally occur on the second and fourth Tuesdays of each month as specified by Board of Education Resolution and found on the web site for the Board of Education as the Board Calendar (www.rps205.com). Architect approved payment requests must be received in the Finance Department not less than 10 calendar days prior to a scheduled Board meeting for the request to be considered at that Board meeting.

   D. The Board of Education shall comply with the provisions of the Local Government Prompt Payment Act, 50 ILCS 515/1, et. seq.

   E. The provisions of the Addendum shall govern.

5. GUARANTEES:

   If within one (1) year after the date of "Final Acceptance of Contracted Project" any of the work is found to be defective or not in accordance with 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.

6. CONFLICT OF INTEREST:

   The State of Illinois School Code is very explicit in its direction as to the relationship of the parties involved in contracts and transactions. Below please find a reproduction of Section 33-5 (105 ILCS 5/33-5) of said code:

   No member or employee of the Board of Education shall be directly or indirectly interested in any contract, work, or business of the District, or in the sale of any article, the expense, price or consideration of which is paid by the District nor in the purchase of any real estate or property belonging to the District or which shall be sold by virtue of legal process at the suit of the District. Whoever violates any provision of this Section shall be guilty of a Class A misdemeanor. (P.A.-2267)

SUPPLEMENTARY CONDITIONS

7. TEMPORARY USE OF FACILITIES:

A. Utilities. Owner will allow Contractor use of Owner's existing electric, gas and water utilities conditioned on full compliance by Contractor with Architect's connection and use specifications. Owner may revoke any or all utility use at any time or times in the event such use by Contractor disrupts or interferes with the normal daily operations of Owner's schools.

B. The Contractor may NOT use Owners toilet facilities or washrooms.

8. EMPLOYEE CONDUCT:

All of Contractor' s employees, agents, principals, and consultants shall abide by Federal, State and Local Laws and Board of Education policy while on District premises. No employee, agent or principal of Contractor and its consultants and vendors shall fraternize with any student of the school district. Any employee whose conduct is judged unfit by District shall not be permitted to work on the project. Contractor agrees to comply with and abide by all rules, regulations and policies of the District and the direction of the Owner's representative or designee relating to access to and conduct upon District Premises.

Contractor employees, agents and principals and its consultants and consultants employees and agents shall not perform work within District buildings for more than 30 school days within any school year (July 1 to June 30) unless a criminal history records check has been conducted by Contractor, the individual(s) is found to have not violated any of the drug or criminal offenses listed in the criminal history records check provisions in the School Code 105 ILCS 5/10-21.9(f) (the Act), and the Contractor so certifies the same to be true on the Certified Cleared Employee List.

Contractor employees, agents and principals and its consultants and consultant's employees and agents shall not be permitted to be present on District grounds unless a Statewide Sex Offender Database check and a Statewide Child Murderer and Violent Offender Against Youth Database check has been conducted regarding all such employees in accordance with and subject to the provisions of the Act. Contractor employees, agents and principals and its consultants and consultant's employees and agents who are found to have had convictions of the enumerated criminal or drug offenses listed in the Act or who appear in the noted databases shall not be permitted at any time to be present on school grounds.

Contractor employees accessing school grounds are required to have in their possession identification issued by the District. All such persons must check in with the school main office to receive a visitor's identification at which time the individual must present a government issued photo identification which will be used to verify the individual's name appears on the Certified Cleared Employee List. At the conclusion of the work day, plastic or hard cover identification must be returned to the school.

SUPPLEMENTARY CONDITIONS

Not less than 10 days prior to the commencement of work, Contractor shall submit to Owner, with a copy to Owner's representative or designee, a written certification on a form provided by Owner (Certified Cleared Employee List), signed by Contractor under oath that the employees listed on the certification have been the subject of a criminal history records check (for employees working more than 30 school days in District buildings), and a Statewide Sex Offender Database check and a Statewide Child Murderer and Violent Offender Against Youth Database check for all employees accessing District grounds. Contractor shall update the certification as and when necessary to keep such certification list current.

The Owner and Owner's representative or designee may from time to time and at multiple times in their discretion and without notice check the identification of all persons accessing school grounds by or through the Contractor to assure such persons appear on the certification list and have in their possession a valid District issued identification. Contractor warrants that it shall immediately notify the District if a certified cleared employee is convicted of an enumerated offense or their name appears on any of the noted Databases. A violation of this section 6 is a material breach of contract.

9. MANDATORY PRE-CONSTRUCTION CONFERENCE:
Prior to beginning the work, contractor shall meet at project site with Owner's representative or designee/Owner, installers, installers of related items, and other entities including (where applicable) Owner's insurer and Architect. A Record of discussions and agreements will be kept and a copy furnished to each participant.

The conference shall be conducted not less than 7 nor more than 21 days prior to the commencement of construction and shall be scheduled by the Owner's representative or designee. Owner's representative or designee may schedule additional mandatory conferences in its discretion. Owner's representative or designee shall provide advance notice to participants prior to convening Pre-construction Conferences.

10. COMPLETION REQUIREMENTS:
The Order to Proceed, which will be issued by the Owner at a date following the contract award, will indicate the date the work is to commence and establish the completion date.

11. MEASUREMENT AND LAYOUT:
Before ordering material or doing work, each Contractor shall be responsible for measuring the physical dimensions of the site to his/her needs sufficient to execute the work desired by the Owner. Each Contractor shall be responsible for the correctness of his/her measurements. Measurements given on the drawings are for references only, for which the Owner accepts no responsibility for accuracy.

SUPPLEMENTARY CONDITIONS

12. SITE SECURITY.
Contractor shall be responsible for site security including the erection of temporary construction site fencing which shall be of a chain link variety and which shall be maintained by contractor at all times from commencement of construction to final acceptance of the Work. Contractor shall take reasonable actions in order to restrict access to construction sites, both inside and outside of District buildings, 24 hours per day, 7 days per week until construction is complete. Contractor shall provide site security to assure that unauthorized persons do not access the construction site (outside of school buildings) and proper barricades and safety notices and warnings are posted within buildings to assure the integrity and safety of persons and property in buildings and on the construction site, construction activities and construction materials.

13. CONSTRUCTION ACTIVITIES:
No construction activities shall occur on construction sites and within school buildings outside the limits established by Owner or Owner's representative or designee. Owner's representative or designee shall issue construction time periods with proper description as to when and where construction activities may occur at each construction and school site. No construction activities shall proceed in the absence of appropriate barricades and warnings.

14. BID PROPOSAL:
Each Contractor is to return two (2) sets of their proposal with original signatures.

15. HOLD HARMLESS:
To the fullest extent permitted by applicable law, Contractor and its employees and consultants shall and do agree to indemnify and hold harmless the District, and its respective Board members, officers, directors, and employees, and Owner's representative or designee from and against all claims, damages, losses, causes of action, suits, judgments and expenses, including reasonable attorney's fees to the extent arising out of, caused by or resulting from the performance or non-performance of the Work by Contractor, anyone directly or indirectly employed by it or anyone for whose acts it may be liable even if caused in part by District. This paragraph shall be construed in accordance with the Construction Contract Indemnification for Negligence Act (740 ILCS 35/1).

School District #205 will require that any Contractor or Subcontractors performing work in connection with any Drawings and Specifications hold harmless, indemnify and defend School District #205 and each of their officers, agents and employees from any and all liability claims, losses or damage arising out of alleged to arise from the Contractor's (or Subcontractor's) negligence in the performance of the work described in the Contract Documents.

16. ASSIGNMENT OF WARRANTIES/DELIVERY OF MANUALS
On or before the date of substantial completion of the project, Contractor shall assign to Owner all right, title and interest in and to equipment and product warranties issued by the product manufacturer. Contractor shall provide to Owner's representative or designee a complete list of all products and equipment furnished and or installed by

SUPPLEMENTARY CONDITIONS

Contractor in and to the project along with the name of the manufacturer of each product and item of equipment and take all necessary steps to transfer warranties to the Owner. Contractor shall within the same time frame deliver to Owner all product and equipment manuals installation instructions and operating instructions and registration materials.

17. COMPLIANCE WITH FREEDOM OF INFORMATION ACT

The District is required by law to comply with the provisions of the Freedom of Information Act, 5ILCS 140/1 et seq., as amended from time to time ("Act"). The Act requires the District to provide, if requested to do so by any person, copies of documents that maybe in your possession and related to this contract. As a condition of this contract, Contractor agrees to and shall provide to the District, copies of any and all such documents when directed to do by the District. All such documents shall be delivered to the District's Legal Department NO LATER THAN five (5) working days after the date of the District's direction to provide such documents. Failure of the

Contractor to provide documents within said five (5) working days as provided above shall result in the assessment of any and all penalties, damages, and/or costs incurred by the District to the Contractor which shall be paid immediately by the Contractor upon demand of the same by the District.

18. RECORDS, RETENTION, AUDIT

a. Records. The Contractor shall have or upon award of bid establish and maintain a reasonable accounting system that enables the District to readily identify Contractor's assets, expenses, costs of goods and use of funds related to the Project (the Records). Such Records shall include, but not limited to, accounting records, written policies and procedures; subcontractor files (including proposals of successful and unsuccessful bidders, bid recaps, etc.); all paid vouchers, including those for out-of–pocket expenses, other reimbursement supported by invoices; ledgers; cancelled checks; deposit slips, bank statements; journals; original estimates; estimating work sheets; contract amendments and change order files; backcharge logs and supporting documentation; insurance documents, payroll documents; timesheets; memoranda; and correspondence.

b. Retention. The Contractor shall, at all times during its performance of the Project and for a period of seven years after the completion of the Project, maintain Records, together with all supporting or underlying documents and materials. The Contractor shall upon written request by the District at any time or times, whether during or after completion of the Project, and at the Contractor's expense, produce the Records for inspection, copying and audit (including copies and extracts of records as required) by the District. The Records shall be made available to the District, upon three-day written notice, during normal business hours at Contractor's principal office if located in Rockford, Illinois or at such other location specified by the District including the District offices. Upon expiration of the retention period specified in this paragraph 18b, prior to destruction of the Records, Contractor shall provide not less than 30 days written notice of its intent to destroy any part or all of the Records, specifying the nature, character and extent

SUPPLEMENTARY CONDITIONS

of Records to be destroyed and the District may at its discretion and expense obtain all Records or copies of Records intended to be destroyed. The Contractor shall ensure the District's right to access and audit the Records in the possession, created or maintained by Contractor's agents, assigns, successors, and subcontractors. Contractor shall notify in writing its agents, assigns, successors and subcontractors of the requirements of records, retention and audit as set forth in this paragraph 18. Any and all contracts or agreements between Contractor and any other party related to the Project shall expressly include the records, retention and audit provisions of this paragraph 18.

c. The District and its authorized representatives shall have the right to audit, to examine, and to make copies of or extracts from all Records (in whatever form they may be kept, whether written, electronic, or other), including, but not limited to, those kept by the Contractor, its agents, assigns, successors, and subcontractors.

Cost of any examination or audit of Records conducted by the District will be borne by the District (excluding any cost to produce Records under paragraph 18b), except where the examination or audit identifies overpricing or overcharges (of any nature) by the Contractor to the District in excess of one-half of one percent (0.5%) of the total contract billings in which event the entire cost of the examination or audit shall be Contractor's cost and Contractor shall reimburse the District for the total cost of the examination or audit. If the examination or audit reveals substantive findings of fraud, misrepresentation, or non-performance by Contractor, its employees, agents, representatives, assigns, successors or subcontractors, the Contractor shall pay all costs of the examination or audit; and if paid by the District, reimburse the District for all such costs. In the event Contractor fails to pay such costs within 30 days of demand by the District, District may offset any such costs unpaid by Contractor from any balance due Contractor by the District or at the election of the District proceed to collect such costs by any available means including litigation in which event the costs of collection including reasonable attorney's fees shall also be paid by Contractor.

QUESTIONS

Any questions regarding this bid; may be referred to Stacie Talbert Scott, Executive Director of Budget and Purchasing at stacie.scott@rps205.com or 815-966-3097.

Winnebago County Prevailing Wage for July 2015

(See explanation of column headings at bottom of wages)

Trade Name	RG	TYP	C	Base	FRMAN	M-F>8	OSA	OSH	H/W	Pensn	Vac	Trng
ASBESTOS ABT-GEN		BLD		31.790	32.790	1.5	1.5	2.0	8.420	15.17	0.000	0.800
ASBESTOS ABT-MEC		BLD		18.950	0.000	1.5	1.5	2.0	2.700	3.350	0.000	0.000
BOILERMAKER		BLD		47.070	51.300	2.0	2.0	2.0	6.970	18.13	0.000	0.400
BRICK MASON		BLD		37.050	39.800	1.5	1.5	2.0	9.230	12.57	0.000	0.640
CARPENTER		BLD		37.890	42.060	1.5	1.5	2.0	9.300	12.70	0.000	0.600
CARPENTER		HWY		42.630	44.380	1.5	1.5	2.0	8.600	11.00	0.000	0.490
CEMENT MASON		ALL		35.740	38.490	1.5	1.5	2.0	9.750	14.04	0.000	0.500
CERAMIC TILE FNSHER		BLD		32.850	0.000	1.5	1.5	2.0	8.600	5.210	0.000	0.560
COMMUNICATION TECH		BLD		36.440	40.080	1.5	1.5	2.0	10.39	12.09	0.000	0.760
ELECTRIC PWR EQMT OP		ALL		37.890	51.480	1.5	1.5	2.0	5.000	11.75	0.000	0.380
ELECTRIC PWR EQMT OP		HWY		39.220	53.290	1.5	1.5	2.0	5.000	12.17	0.000	0.390
ELECTRIC PWR GRNDMAN		ALL		29.300	51.480	1.5	1.5	2.0	5.000	9.090	0.000	0.290
ELECTRIC PWR GRNDMAN		HWY		30.330	53.290	1.5	1.5	2.0	5.000	9.400	0.000	0.300
ELECTRIC PWR LINEMAN		ALL		45.360	51.480	1.5	1.5	2.0	5.000	14.06	0.000	0.450
ELECTRIC PWR LINEMAN		HWY		46.950	53.290	1.5	1.5	2.0	5.000	14.56	0.000	0.470
ELECTRIC PWR TRK DRV		ALL		30.340	51.480	1.5	1.5	2.0	5.000	9.400	0.000	0.300
ELECTRIC PWR TRK DRV		HWY		31.400	53.290	1.5	1.5	2.0	5.000	9.730	0.000	0.310
ELECTRICIAN		BLD		42.960	47.260	1.5	1.5	2.0	10.39	17.47	0.000	0.860
ELEVATOR CONSTRUCTOR		BLD		46.830	52.680	2.0	2.0	2.0	13.57	14.51	3.770	0.600
GLAZIER		BLD		35.980	37.980	1.5	1.5	1.5	10.30	8.200	0.000	1.250
HT/FROST INSULATOR		BLD		33.930	38.550	0.0	0.0	0.0	7.950	14.77	0.000	0.480
IRON WORKER		ALL		36.290	38.100	2.0	2.0	2.0	10.24	23.19	0.000	0.500
LABORER		BLD		31.790	32.790	1.5	1.5	2.0	8.420	15.17	0.000	0.800
LABORER		HWY		34.340	35.090	1.5	1.5	2.0	8.420	17.42	0.000	0.800
LABORER, SKILLED		HWY		36.990	37.740	1.5	1.5	2.0	8.420	17.42	0.000	0.800
LATHER		BLD		37.890	42.060	1.5	1.5	2.0	9.300	12.70	0.000	0.600
MACHINIST		BLD		45.350	47.850	1.5	1.5	2.0	7.260	8.950	1.850	0.000
MARBLE FINISHERS		BLD		32.850	0.000	1.5	1.5	2.0	8.600	5.210	0.000	0.560
MARBLE MASON		BLD		35.530	35.780	1.5	1.5	2.0	8.600	7.520	0.000	0.590
MATERIAL TESTER I		ALL		33.560	0.000	1.5	1.5	2.0	8.240	16.39	0.000	0.800
MATERIALS TESTER II		ALL		33.560	0.000	1.5	1.5	2.0	8.240	16.39	0.000	0.800
MILLWRIGHT		BLD		37.220	40.940	1.5	1.5	2.0	9.050	15.00	0.000	0.500
OPERATING ENGINEER		BLD	1	48.300	47.800	2.0	2.0	2.0	17.55	11.80	2.350	1.300
OPERATING ENGINEER		BLD	2	43.100	47.800	2.0	2.0	2.0	17.55	11.80	2.350	1.300

OPERATING ENGINEER	BLD	3	40.650	47.800	2.0	2.0	2.0	17.55	11.80	2.350	1.300
OPERATING ENGINEER	BLD	4	38.650	47.800	2.0	2.0	2.0	17.55	11.80	2.350	1.300
OPERATING ENGINEER	BLD	5	47.550	47.800	2.0	2.0	2.0	17.55	11.80	2.350	1.300
OPERATING ENGINEER	BLD	6	46.800	47.800	2.0	2.0	2.0	17.55	11.80	2.350	1.300
OPERATING ENGINEER	BLD	7	43.800	47.800	2.0	2.0	2.0	17.55	11.80	2.350	1.300
OPERATING ENGINEER	HWY	1	43.650	47.650	1.5	1.5	2.0	17.55	11.80	2.350	1.300
OPERATING ENGINEER	HWY	2	43.100	47.650	1.5	1.5	2.0	17.55	11.80	2.350	1.300
OPERATING ENGINEER	HWY	3	41.800	47.650	1.5	1.5	2.0	17.55	11.80	2.350	1.300
OPERATING ENGINEER	HWY	4	40.350	47.650	1.5	1.5	2.0	17.55	11.80	2.350	1.300
OPERATING ENGINEER	HWY	5	38.900	47.650	1.5	1.5	2.0	17.55	11.80	2.350	1.300
OPERATING ENGINEER	HWY	6	46.650	47.650	1.5	1.5	2.0	17.55	11.80	2.350	1.300
OPERATING ENGINEER	HWY	7	44.650	47.650	1.5	1.5	2.0	17.55	11.80	2.350	1.300
PAINTER	ALL		36.500	38.500	1.5	1.5	1.5	10.30	8.460	0.000	1.350
PILEDRIVER	BLD		38.890	43.170	1.5	1.5	2.0	9.300	12.70	0.000	0.600
PILEDRIVER	HWY		42.630	44.380	1.5	1.5	2.0	8.600	11.00	0.000	0.490
PIPEFITTER	ALL		43.100	46.120	1.5	2.0	2.0	8.220	11.29	0.000	1.000
PIPEFITTER	BLD		43.100	46.120	1.5	1.5	2.0	8.220	11.29	0.000	1.000
PLASTERER	BLD		34.250	37.680	1.5	1.5	2.0	9.300	12.30	0.000	0.500
PLUMBER	ALL		43.100	46.120	1.5	2.0	2.0	8.220	11.29	0.000	1.000
PLUMBER	BLD		43.100	46.120	1.5	1.5	2.0	8.220	11.29	0.000	1.000
ROOFER	BLD		41.000	44.000	1.5	1.5	2.0	8.280	10.54	0.000	0.530
SHEETMETAL WORKER	BLD		37.930	40.210	1.5	1.5	2.0	6.000	16.92	0.520	0.290
SPRINKLER FITTER	BLD		37.120	39.870	1.5	1.5	2.0	8.420	8.500	0.000	0.350
STONE MASON	BLD		37.050	39.800	1.5	1.5	2.0	9.230	12.57	0.000	0.640
~~SURVEY WORKER~~ -> NOT IN EFFECT	ALL		35.650	36.400	1.5	1.5	2.0	8.240	13.95	0.000	0.800
TERRAZZO FINISHER	BLD		32.850	0.000	1.5	1.5	2.0	8.600	5.210	0.000	0.560
TERRAZZO MASON	BLD		35.530	35.780	1.5	1.5	2.0	8.600	7.520	0.000	0.590
TILE LAYER	BLD		37.890	42.060	1.5	1.5	2.0	9.300	12.70	0.000	0.600
TILE MASON	BLD		35.530	35.780	1.5	1.5	2.0	8.600	7.520	0.000	0.590
TRUCK DRIVER	ALL	1	35.020	0.000	1.5	1.5	2.0	8.600	8.600	0.000	0.200
TRUCK DRIVER	ALL	2	35.170	0.000	1.5	1.5	2.0	8.600	8.600	0.000	0.200
TRUCK DRIVER	ALL	3	35.370	0.000	1.5	1.5	2.0	8.600	8.600	0.000	0.200
TRUCK DRIVER	ALL	4	35.480	0.000	1.5	1.5	2.0	8.600	8.600	0.000	0.200
TUCKPOINTER	BLD		37.050	39.800	1.5	1.5	2.0	9.230	12.57	0.000	0.640

Legend:
RG (Region)
TYP (Trade Type - All,Highway,Building,Floating,Oil & Chip,Rivers)
C (Class)
Base (Base Wage Rate)
FRMAN (Foreman Rate)
M-F>8 (OT required for any hour greater than 8 worked each day, Mon through Fri.
OSA (Overtime (OT) is required for every hour worked on Saturday)
OSH (Overtime is required for every hour worked on Sunday and Holidays)
H/W (Health & Welfare Insurance)
Pensn (Pension)
Vac (Vacation)
Trng (Training)

Explanations

WINNEBAGO COUNTY

The following list is considered as those days for which holiday rates of wages for work performed apply: New Years Day, Memorial Day, Fourth of July, Labor Day, Thanksgiving Day, Christmas Day and Veterans Day in some classifications/counties. Generally, any of these holidays which fall on a Sunday is celebrated on the following Monday. This then makes work performed on that Monday payable at the appropriate overtime rate for holiday pay. Common practice in a given local may alter certain days of celebration. If in doubt, please check with IDOL.

EXPLANATION OF CLASSES

ASBESTOS - GENERAL - removal of asbestos material/mold and hazardous materials from any place in a building, including mechanical systems where those mechanical systems are to be removed. This includes the removal of asbestos materials/mold and hazardous materials from ductwork or pipes in a building when the building is to be demolished at the time or at some close future date.
ASBESTOS - MECHANICAL - removal of asbestos material from mechanical systems, such as pipes, ducts, and boilers, where the mechanical systems are to remain.

CERAMIC TILE FINISHER, MARBLE FINISHER, TERRAZZO FINISHER

Assisting, helping or supporting the tile, marble and terrazzo mechanic by performing their historic and traditional work assignments required to complete the proper installation of the work covered by said crafts. The term "Ceramic" is used for naming the classification only and is in no way a limitation of the product handled. Ceramic takes into consideration most hard tiles.

COMMUNICATIONS TECHNICIAN

Installing, manufacturing, assembling and maintaining sound and intercom, protection alarm (security), fire alarm, master antenna television, closed circuit television, low voltage control for computers and/or door monitoring, school communications systems, telephones and servicing of nurse and emergency calls, and the installation and maintenance of transmit and receive antennas, transmitters, receivers, and associated apparatus which operates in conjunction with above systems. All work associated with these system installations will be included EXCEPT the installation of protective metallic conduit in new construction projects (excluding less than ten-foot, runs strictly for protection of cable) and 120 volt AC (or higher) power wiring and associated hardware.

LABORER, SKILLED - HIGHWAY

Individuals engaged in the following types of work, irrespective of the site of the work: asbestos abatement worker, handling of any materials with any foreign matter harmful to skin or clothing, track laborer, cement handlers, chloride handlers, the unloading and loading with steel workers and re-bars, concrete workers wet, tunnel helpers in free air, batch dumpers, mason tenders, kettle and tar men, tank cleaners, plastic installers, scaffold workers, motorized buggies or motorized unit used for wet concrete or handling of building materials, laborers with de-watering systems, sewer workers plus depth, rod and chainmen with technical engineers, rod and chainmen with land surveyors, rod and chainmen with surveyors, vibrator operators, cement silica, clay, fly ash, lime and plasters, handlers (bulk or bag), cofferdam workers plus depth, on concrete paving, placing, cutting and tying of reinforcing, deck hand, dredge hand, and shore laborers, bankmen on floating plant, grade checker, power tools, front end man on chip spreaders, cassion workers plus depth, gunnite nozzle men, lead man on sewer work, welders, cutters, burners and torchmen, chainsaw operators, jackhammer and drill operators, layout man and/or drainage tile layer, steel form setter - street and highway, air tamping hammermen, signal man on crane, concrete saw operator, screedman on asphalt pavers, laborers tending masons with hot material or where foreign materials are used, mortar mixer operators, multiple concrete duct - leadsman, lumen, asphalt raker,

curb asphalt machine operator, ready mix scalemen (permanent, portable or temporary plant), laborers handling masterplate or similar materials, laser beam operator, con-crete burning machine operator, coring machine operator, plaster ten-der, underpinning and shoring of buildings, pump men, manhole and catch basin, dirt and stone tamper, hose men on concrete pumps, haz-ardous waste worker, lead base paint abatement worker, lining of pipe, refusing machine, assisting on direct boring machine, the work of lay-ing watermain, fire hydrants, all mechanical joints to watermain work, sewer worker, and tapping water service and forced lift station mechanical worker.

MATERIAL TESTER I: Hand coring and drilling for testing of materials; field inspection of uncured concrete and asphalt.

MATERIAL TESTER II: Field inspection of welds, structural steel, fireproofing, masonry, soil, facade, reinforcing steel, formwork, cured concrete, and concrete and asphalt batch plants; adjusting proportions of bituminous mixtures.

OPERATING ENGINEERS - BUILDING

Class 1. Asphalt Plant; Asphalt Spreader; Autograde; Backhoes with Caisson Attachment; Batch Plant; Benoto (requires Two Engineers); Boiler and Throttle Valve; Caisson Rigs; Central Redi-Mix Plant; Combination Back Hoe Front End-loader Machine; Compressor and Throttle Valve; Concrete Breaker (Truck Mounted); Concrete Conveyor; Concrete Paver (over 27E cu. ft.): Concrete Paver (27 cu. ft. and under); Concrete Placer; Concrete Pump (Truck Mounted); Concrete Conveyor (Truck Mounted); Concrete Tower; Cranes, All; GCI and similar types (required two operators only); Cranes, Hammerhead; Creter Crane; Crusher, Stone, etc.; Derricks, All; Derricks, Traveling; Formless Curb and Gutter Machine; Grader, Elevating; Grouting Machines; Highlift Shovels or Front Endloader 2-1/4 yd. and over; Hoists, Elevators, outside type rack and pinion and similar machines; Hoists, one, two and three Drum; Hoists, Two Tugger One Floor; Hydraulic Backhoes; Hydraulic Boom Trucks; Hydro Vac (and similar equipment - excluding hose work and any sewer work); Locomotives, All; Lubrication Technician; Manipulators; Motor Patrol; Pile Drivers and Skid Rig; Post Hole Digger; Pre-Stress Machine; Pump Cretes Dual Ram; Pump Cretes: Squeeze Cretes - Screw Type Pumps, Gypsum Bulker and Pump; Raised and Blind Hole Drill; Rock Drill (self-propelled); Rock Drill - Truck Mounted; Roto Mill Grinder; Scoops - Tractor Drawn; Slipform Paver; Scrapers Prime Movers; Straddle Buggies; Tie Back Machine; Tractor with Boom and Side Boom; Trenching Machines.

Class 2. Bobcat (over 3/4 cu. yd.); Boilers; Brick Forklift; Broom, All Power Propelled; Bulldozers; Concrete Mixer (Two Bag and Over); Conveyor, Portable; Forklift Trucks; Highlift Shovels or Front Endloaders under 2-1/4 yd.; Hoists, Automatic; Hoists, Sewer Dragging Machine; Hoists, Tugger Single Drum; Laser Screed; Rollers, All; Steam Generators; Tractors, All; Tractor Drawn Vibratory Roller; Winch Trucks with "A" Frame.

Class 3. Air Compressor; Asphalt Spreader; Combination - Small Equipment Operator; Generators; Heaters, Mechanical; Hoists, Inside Elevators - (Rheostat Manual Controlled); Hydraulic Power Units (Pile Driving, Extracting, or Drilling - with a seat); Lowboys; Pumps, Over 3" (1 to 3 not to exceed total of 300 ft.); Pumps, Well Points; Welding Machines (2 through 5); Winches, 4 Small Electric Drill Winches; Bobcat (up to and including 3/4 cu. yd.).

Class 4. Elevator push button with automatic doors; Hoists, Inside; Oilers; Brick Forklift.

Class 5. Assistant Craft Foreman

Class 6. Mechanics; Welders.

Class 7. Gradall

OPERATING ENGINEERS - HIGHWAY CONSTRUCTION

Class 1. Asphalt Plant; Asphalt Heater and Planer Combination; Asphalt Heater Scarfire; Asphalt Silo Tender; Asphalt Spreader; Autograder; ABG Paver; Backhoes with Caisson Attachment; Ballast Regulator; Belt Loader; Caisson Rigs; Car Dumper; Central Redi-Mix Plant; Backhoe w/shear attachments; Combination Backhoe Front Endloader Machine, (1 cu. yd. Backhoe Bucket or over or with attachments); Concrete Breaker

(Truck Mounted); Concrete Conveyor; Concrete Paver over 27E cu. ft.; Concrete Placer; Concrete Tube Float; Cranes, all attachments; Cranes, Tower of all types; Creter Crane; Crusher, Stone, etc.; Derricks, All; Derrick Boats; Derricks, Traveling; Directional Boring Machine over 12"; Dredges; Formless Curb and Gutter Machine; Grader, Elevating; Grader, Motor Grader, Motor Patrol, Auto Patrol, Form Grader, Pull Grader, Subgrader; Guard Rail Post Driver Mounted; Hoists, One, Two and Three Drum; Hydraulic Backhoes; Hydro Vac, Self Propelled, Truck Mounted (excluding hose work and any sewer work); Lubrication Technician; Manipulators; Pile Drivers and Skid Rig; Pre-Stress Machine; Pump Cretes Dual Ram; Rock Drill - Crawler or Skid Rig; Rock Drill - Truck Mounted; Rock/Track Tamper; Roto Mill Grinder; Slip-Form Paver; Snow Melters; Soil Test Drill Rig (Truck Mounted); Straddle Buggies; GCI Crane; Hydraulic Telescoping Form (Tunnel); Tie Back Machine; Tractor Drawn Belt Loader; Tractor Drawn Belt Loader with attached pusher; Tractor with Boom; Tractaire with Attachments; Traffic Barrier Conveyor Machine; Raised or Blind Hole Drills; Trenching Machine (over 12"); Truck Mounted Concrete Pump with Boom; Truck Mounted Concrete Conveyor; Work Boat (no license required - 90 h.p. or above); Underground Boring and/or Mining Machines; Wheel Excavator; Widener (APSCO).

Class 2. Batch Plant; Bituminous Mixer; Boiler and Throttle Valve; Bulldozers; Car Loader Trailing Conveyors; Combination Backhoe Front Endloader Machine (less than 1 cu. yd. Backhoe Bucket or over or with attachments); Compressor and Throttle Valve; Compressor, Common Receiver (3); Concrete Breaker or Hydro Hammer; Concrete Grinding Machine; Concrete Mixer or Paver 7S Series to and including 27 cu. ft.; Concrete Spreader; Concrete Curing Machine, Burlap Machine, Belting Machine and Sealing Machine; Concrete Wheel Saw (large self-propelled - excluding walk-behinds and hand-held); Conveyor Muck Cars (Haglund or Similar Type); Drills, all; Finishing Machine - Concrete; Highlift Shovels or Front Endloader; Hoist - Sewer Dragging Machine; Hydraulic Boom Trucks (All Attachments); Hydro Blaster; All Locomotives, Dinky; Off-Road Hauling Units; Non-Self Loading Dump; Ejection Dump; Pump Cretes: Squeeze Cretes - Screw Type Pumps, Gypsum Bulker and Pump; Roller, Asphalt; Rotary Snow Plows; Rototiller, Seaman, etc., self-propelled; Scoops - Tractor Drawn; Self-Propelled Compactor; Spreader - Chip - Stone, etc.; Scraper; Scraper - Prime Mover in Tandem (Regardless of Size); Tank Car Heater; Tractors, Push, Pulling Sheeps Foot, Disc, Compactor, etc.; Tug Boats.

Class 3. Boilers; Brooms, All Power Propelled; Cement Supply Tender; Compressor, Common Receiver (2); Concrete Mixer (Two Bag and Over); Conveyor, Portable; Farm-Type Tractors Used for Mowing, Seeding, etc.; Fireman on Boilers; Forklift Trucks; Grouting Machine; Hoists, Automatic; Hoists, All Elevators; Hoists, Tugger Single Drum; Jeep Diggers; Low Boys; Pipe Jacking Machines; Post-Hole Digger; Power Saw, Concrete Power Driven; Pug Mills; Rollers, other than asphalt; Seed and Straw Blower; Steam Generators; Stump Machine; Winch Trucks with "A" Frame; Work Boats; Tamper - Form - Motor Driven.

Class 4. Air Compressor - Small and Large; Asphalt Spreader, Backend Man; Bobcat (Skid Steer) all; Brick Forklift; Combination - Small Equipment Operator; Directional Boring Machine up to 12"; Generators; Heaters, Mechanical; Hydraulic Power Unit (Pile Driving, Extracting, or Drilling); Hydro-Blaster; Light Plants, All (1 through 5); Pumps, over 3" (1 to 3 not to exceed a total of 300 ft.); Pumps, Well Points; Tractaire; Trencher 12" and under; Welding Machines (2 through 5); Winches, 4 Small Electric Drill Winches.

Class 5. Oilers and Directional Boring Machine Locator.

Class 6. Field Mechanics and Field Welders

Class 7. Gradall and machines of like nature.

SURVEY WORKER - Operated survey equipment including data collectors, G.P.S. and robotic instruments, as well as conventional levels and transits.

TRUCK DRIVER - BUILDING, HEAVY AND HIGHWAY CONSTRUCTION
Class 1. Two or three Axle Trucks. A-frame Truck when used for transportation purposes; Air Compressors and Welding Machines, including those pulled by cars, pick-up trucks and tractors; Ambulances; Batch Gate Lockers; Batch Hopperman; Car and Truck Washers; Carry-alls; Fork Lifts and Hoisters; Helpers; Mechanics Helpers and Greasers; Oil Distributors 2-man operation; Pavement Breakers; Pole Trailer, up to 40 feet; Power Mower Tractors; Self-propelled Chip Spreader; Skipman; Slurry Trucks, 2-man operation; Slurry Truck Conveyor Operation, 2 or 3 man; TTeamsters

Unskilled dumpman; and Truck Drivers hauling warning lights, barricades, and portable toilets on the job site.

Class 2. Four axle trucks; Dump Crets and Adgetors under 7 yards; Dumpsters, Track Trucks, Euclids, Hug Bottom Dump Turnapulls or Turnatrailers when pulling other than self-loading equipment or similar equipment under 16 cubic yards; Mixer Trucks under 7 yeards; Ready-mix Plant Hopper Operator, and Winch Trucks, 2 Axles.

Class 3. Five axle trucks; Dump Crets and Adgetors 7 yards and over; Dumpsters, Track Trucks, Euclids, Hug Bottom Dump Turnatrailers or turnapulls when pulling other than self-loading equipment or similar equipment over 16 cubic yards; Explosives and/or Fission Material Trucks; Mixer Trucks 7 yards or over; Mobile Cranes while in transit; Oil Distributors, 1-man operation; Pole Trailer, over 40 feet; Pole and Expandable Trailers hauling material over 50 feet long; Slurry trucks, 1-man operation; Winch trucks, 3 axles or more; Mechanic--Truck Welder and Truck Painter.

Class 4. Six axle trucks; Dual-purpose vehicles, such as mounted crane trucks with hoist and accessories; Foreman; Master Mechanic; Self-loading equipment like P.B. and trucks with scoops on the front.

Other Classifications of Work:

For definitions of classifications not otherwise set out, the Department generally has on file such definitions which are available. If a task to be performed is not subject to one of the classifications of pay set out, the Department will upon being contacted state which neighboring county has such a classification and provide such rate, such rate being deemed to exist by reference in this document. If no neighboring county rate applies to the task, the Department shall undertake a special determination, such special determination being then deemed to have existed under this determination. If a project requires these, or any classification not listed, please contact IDOL at 217-782-1710 for wage rates or clarifications.

LANDSCAPING

Landscaping work falls under the existing classifications for laborer, operating engineer and truck driver. The work performed by landscape plantsman and landscape laborer is covered by the existing classification of laborer. The work performed by landscape operators (regardless of equipment used or its size) is covered by the classifications of operating engineer. The work performed by landscape truck drivers (regardless of size of truck driven) is covered by the classifications of truck driver.

AIA® Document A201™ – 2007

General Conditions of the Contract for Construction

for the following PROJECT:
Rockford Public Schools Master Facilities Plan Construction
General Conditions template

THE OWNER:
(Name, legal status and address)
Board Of Education of Rockford School District No.205 Winnebago and Boone Counties Illinois

THE ARCHITECT:
(Name, legal status and address)

ADDITIONS AND DELETIONS:
The author of this document has added information needed for its completion. The author may also have revised the text of the original AIA standard form. An *Additions and Deletions Report* that notes added information as well as revisions to the standard form text is available from the author and should be reviewed. A vertical line in the left margin of this document indicates where the author has added necessary information and where the author has added to or deleted from the original AIA text.

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

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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. The Contract Documents 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.

§ 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.

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§ 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 Owner shall be deemed the owner of the 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 prior written consent of the Owner.

§ 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 where otherwise required by law or Owners policy or practice. 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.

§2.1.3 Owner has procured and contracted with a Program Manager for this project. Program Manager is responsible to the Owner for overall project management. In all cases where notice is required or permitted to be given under the Agreement, a copy is to be furnished to Program Manager. The Program Manager is the Owner's agent (provided, the Owner does not delegate to Program Manager any statutory powers and authority nor the authority to bind the Owner absent express consent in each instance approved by the Owner's Board of Education). Contractor will interact with the Program Manager in the same manner as with the Owner.

§ 2.2 INFORMATION AND SERVICES REQUIRED OF THE OWNER

§ 2.2.1 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.

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§ 2.2.2 The Owner may 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.

§ 2.2.3 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.

§ 2.2.4 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.

(Paragraph deleted)

§ 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 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 actual 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. If payments then or thereafter due the Contractor are not sufficient to cover such amounts, the Contractor shall pay the difference to the Owner upon Owner's demand.

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

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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 and Program Manager any nonconformity discovered by or made known to the Contractor as a request for information.

§ 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, Manager 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.

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§ 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,. 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 or Program Manager, the Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment.

§ 3.6 TAXES

The Contractor shall pay consumer, use and similar taxes for the Work provided by the Contractorif, as and when due, 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 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;

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.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 full-time superintendent and necessary assistants who shall be in attendance at each 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, Program Manager and 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, Program Manager 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.

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§ 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.

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§ 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, it administrators and Board Members, the Program Manager 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, Program Manager 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 and Program Manager.

§ 3.18 INDEMNIFICATION

§ 3.18.1 To the fullest extent permitted by law the Contractor shall indemnify and hold harmless the Owner, Program Manager 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 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.

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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.

§ 4.1.3 If the employment of the Architect is terminated, the Owner may employ a successor architect whose status under the Contract Documents shall be that of the Architect.

§ 4.2 ADMINISTRATION OF THE CONTRACT

§ 4.2.1 The Architect, except to the extent inconsistent with the responsibility of the Program Manager, 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 Program Manager 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 or Program Manager.

§ 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

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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 Program Manager with a copy to 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

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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 may, in the sole discretion of the Owner, 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.

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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 for maintaining the premises and surrounding area free from waste materials and rubbish, the Owner may clean up the actual cost of which to the Owner shall be deducted from and monies due Contractor at any time under the Agreement.

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.

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§ 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:

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.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 and Program Manager have 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.

§8.1.5 The term "School Day" when used in any Contract Documents including documents issued following execution of the Agreement shall mean those student attendance days during the Owner's "School Year" which is defined as the period of July 1 to the following June 30 of any year.

§ 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.

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§ 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 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 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.

(Paragraph deleted)

§ 9.3.2 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.

(Paragraph deleted)

§ 9.4 CERTIFICATES FOR PAYMENT

§ 9.4.1 The Architect will, within ten 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.

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§ 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. 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 at the Owner's request, or 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 agree on a revised amount, the Architect will promptly issue a Certificate for Payment for the agreed 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 upon Contractor's application for payment in due form for which the Architect issues an approved certificate for payment and subject to the payment procedures identified in the Addendum attached hereto..

§ 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.

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§ 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
(Paragraphs deleted)
SUBSTANTIAL COMPLETION
§ 9.7.1 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.

§ 9.7.2 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.

§ 9.7.3 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.

§ 9.7.4 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.

§ 9.7.5 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.

§ 9.8 PARTIAL OCCUPANCY OR USE
§ 9.8.1 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

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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.

§ 9.8.2 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.

§ 9.8.3 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.

(Paragraphs deleted)

§ 9.9 FINAL COMPLETION AND FINAL PAYMENT

§ 9.9.1 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.

§ 9.9.2 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.

§ 9.9.3 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.

(Paragraphs deleted)

§ 9.9.4 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

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.3 terms of special warranties required by the Contract Documents.

§ 9.9.5 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 and accepted by 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.

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§ 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.

(Paragraph deleted)

§ 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:

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.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, Program Manager, 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

(Paragraphs deleted)

PROPERTY INSURANCE

(Paragraphs deleted)

§ 11.2.1 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.

(Paragraphs deleted)

§ 11.2.1.1 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

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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.

(Paragraph deleted)

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

(Paragraph deleted)

§ 11.2.1.3 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.

(Paragraph deleted)

§ 11.2.2 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.

(Paragraphs deleted)

§ 11.2.3 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.

(Paragraph deleted)

§ 11.2.4 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.

(Paragraph deleted)

§ 11.2.5 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.

§ 11.2.6 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.

§ 11.2.7 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

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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.

§ 11.2.8 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.

§ 11.2.9 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.

§ 11.2.10 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 Contractor shall furnish bonds covering faithful performance of the Contract and payment of obligations arising thereunder in an amount equal to 100.00% of the bid award of bid number 13-16.

§ 11.4.2 The Contractor shall furnish a copy of the bonds at the time of execution of the Agreement.

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.

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§ 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.

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§ 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 unless otherwise specified in the Contract documents 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 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.

(Paragraphs deleted)

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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;

(Paragraphs deleted)

§ 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.**§ 14.1.3** If one of the reasons described in Section 14.1.1 or 14.1.2 exists, the Contractor may, upon thirty days' written notice to the Owner, Program Manager and Architect, terminate the Contract and recover from the Owner payment for Work completed.

(Paragraphs deleted)

§ 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 breach of a provision of the Contract Documents.

§ 14.2.2 When any of the above reasons exist, the Owner 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 may be adjusted by Owner in Owner's sole discretion 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

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.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 completed.

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

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.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, 11.2.9, and 11.2.10, 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 (provided that neither party hereto is bound to proceed 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; provided that the parties may each independently agree to submit the claim to mediation and or arbitration however, such agreement must be mutual by all parties to the Agreement. The claim may also be submitted by eithr party to a court of competent jurisdiction for enforcement of the Agreement terms.

§ 15.2.6 Either party may request voluntary mediation of an initial decision at any time.

(Paragraph deleted)

§ 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.

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§ 15.3 MEDIATION

§ 15.3.1 The parties may by their independent agreement on a case by case basis agree to submit any one or more 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 to mediation Each party must agree in writing to the submission of any claim, dispute or other matter in controversy to mediation. Notwithstanding anything to the contrary set forth in this Agreement, no party to this Agreement is required or mandated to submit to mediation. Submission to mediation is not a prerequisite to voluntary arbitration nor to submission of claims, disputes or other matters in controversy to a court of competent jurisdiction.

§ 15.3.2 If the parties independently agree to mediation, mediation shall be conducted by the American Arbitration Association in accordance with its Construction Industry Mediation Procedures in effect on the date of the Agreement and shall be conducted in Rockford, Illinois. The parties shall jointly submit a mediation request if both agree to mediation. .

§ 15.3.3 The parties shall share the mediator's fee and any filing fees equally. 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. The parties may, but are not required, to agree to submit a dispute to binding arbitration. Any agreement to arbitrate must be the subject of an agreement to proceed to arbitration in writing signed by all parties to this Agreement. The agreement to arbitrate shall set forth with specificity all matters in controversy being submitted to arbitration. Arbitration if agreed to by the parties hereto shall be administered by the American Arbitration Association in accordance with its Construction Industry Arbitration Rules in effect on the date of the Agreement.

(Paragraph deleted)

§ 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.

(Paragraph deleted)

§ 15.4.4 SUBMISSION TO COURT

The parties agree, absent the express agreement of the parties to submit a matter to mediation or arbitration, the means of dispute resolution shall be submission to a court of competent jurisdiction. This Agreement shall be interpreted in accordance with the laws of the state of Illinois and venue for all purposes shall lie in the Circuit court of the 17th Judicial Circuit, Winnebago County Illinois.

(Paragraphs deleted)

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ADDENDUM

ADDENDUM TO A CERTAIN CONTRACT FOR CONSTRUCTION BY AND BETWEEN [CONTRACTOR] AND THE BOARD OF EDUCATION OF ROCKFORD SCHOOL DISTRICT No. 205, WINNEBAGO AND BOONE COUNTIES, ILLINOIS

THIS ADDENDUM IS ATTACHED TO AND MADE A PART OF SUCH CONTRACT

This Addendum is attached to and made a part of the contract for construction (Agreement) dated _____ between _____ (Contractor) (_____ Project-IFB__-__) and the Board of Education of Rockford School District No. 205, Winnebago and Boone Counties, Illinois (District).

1. Conflict.

In the event of conflict between the terms of the Agreement and this Addendum, the terms of this Addendum shall govern.

2. Certifications.

Upon or prior to execution of this Addendum, Contractor shall deliver to the District the following fully executed Certifications in the form as advertised by the District or as otherwise required by the District:

1. Certificate regarding Debarment, Suspension, Ineligibility, and Voluntary Exclusion;
2. Bid Rigging Certification;
3. Certificate Regarding Lobbying;
4. Certification regarding the Office of Foreign Asset Control;
5. Certified Cleared Employee List;
6. Vendor Conflict of Interest Disclosure Form.

By execution of this Addendum, Contractor represents and warrants that the certifications set forth in certificates 1 2,3, 4,5 and 6 shall remain true at all times during the existence of this Addendum and the Agreement and shall immediately notify the District in the event Contractor becomes subject to debarment, suspension, ineligibility, or voluntarily excludes itself from federal programs; or, becomes barred from participation in public contracts due to a violation of the bid-rigging or bid-rotating statutes of the State of Illinois, or in the event an employee of Contractor becomes ineligible to be present on District grounds.

Contractor further certifies by execution of this Agreement that it shall comply, if the Project is funded in whole or in part with federal grant funds, with the Pilot Program for Enhancement of Employee Whistleblower Protection applicable to Contractors under federal grant funded programs as specified in the National Defense Authorization Act (NDAA) for Fiscal Year (FY) 2013 (Pub. L. 112-239, enacted January 2, 2013). Contractor shall comply with the following requirements of such Act if providing services funded by federal grants:

1. Inform its employees working on the Projects they are subject to the Whistleblower rights and remedies of the pilot program;
2. Inform its employees in writing of employee whistleblower protections under 41 U.S.C. §4712 in the predominantly native language of the workforce; and
3. Include such requirements in and agreements made with any subcontractor.

Whistleblower rights include that an employee of a Consortium may not be discharged, demoted, or otherwise discriminated against as a reprisal for “Whistleblowing”; and such rights cannot be waived by

agreement, policy, form or condition of employment. Whistleblowing is defined as making a disclosure to an authorized person or entity that the employee reasonably believes is evidence of:

1. Gross mismanagement of a federal contract or grant;
2. A gross waste of federal funds;
3. An abuse of authority relating to a federal contract or grant;
4. A substantial and specific danger to public health or safety; or
5. A violation of law, rule, or regulation related to a federal contract or grant (including competition for, or negotiation of, a contract or grant).

3. Conflict of Interest.

Contractor and its officers, employees and agents shall at all times during the duration of this Addendum and the Agreement refrain from violation of conflict of interest statutes in the state of Illinois.

4. Illinois Use Tax.

Contractor shall require in applicable circumstances that all vendors who supply goods or services to Contractor in the performance of its obligations under the Addendum and Agreement will comply with the terms of 105 ILCS 5/10-20.21(b) relating to Illinois Use Tax.

5. Employment Costs and Compliance with Laws.

Contractor shall keep and perform and be solely responsible for all the duties and responsibilities of an employer in the state of Illinois including without limitation providing and paying for Unemployment Compensation coverage and Workers Compensation coverage for its employees. Contractor herewith stipulates and agrees that all persons acting by and through Contractor are employees of Contractor or its consultants, and not the District, and Contractor shall keep and hold harmless the District from and against any and all claims relating to employment matters of Contractor employees. Contractor herewith expressly stipulates and agrees that it will adhere to and abide by all Federal, State and local laws, ordinances, regulations and rules applicable to its performance under the Addendum and Agreement. Contractor is an "independent contractor" and the Agreement and this Addendum shall not create nor infer an employer/employee relationship between the District and Contractor. Contractor shall bear all risk of loss and remain liable for any Federal or State Income, Social Security, Unemployment Compensation and Workers Compensation taxes, contributions or deductions and shall indemnify the District, its Board members, agents, officers, employees, successors and assigns for any liability including interest and penalties and attorney's fees, if any, assessed against the District as a result of any violation of this provision.

6. Access to School Grounds, Activities and Conduct.

All of Contractor' s employees, agents, principals, and consultants shall abide by Federal, State and Local Laws and Board of Education policy while on District premises. No employee, agent or principal of Contractor and its consultants and vendors shall fraternize with any student of the school district. Any employee whose conduct is judged unfit by District shall not be permitted to work on the Projects. Contractor agrees to comply with and abide by all rules, regulations and policies of the District and the direction of any District representative relating to access to and conduct upon District Premises.

Contractor employees, agents and principals and its consultants and consultants employees and agents shall not perform work within District buildings for more than 30 school days within any school year (July 1 to June 30) unless a criminal history records check has been conducted by Contractor, the individual(s) is found to have not violated any of the drug or criminal offenses listed in the criminal history records check provisions in the School Code 105 ILCS 5/10-21.9(f) (the Act), and the Contractor so certifies the same to be true on the Certified Cleared Employee List. Contractor employees, agents and principals and its consultants and consultant's employees and agents shall not be permitted to be present on District

grounds unless a Statewide Sex Offender Database check and a Statewide Child Murderer and Violent Offender Against Youth Database check has been conducted regarding all such employees in accordance with and subject to the provisions of the Act. Contractor employees, agents and principals and its consultants and consultant's employees and agents who are found to have had convictions of the enumerated criminal or drug offenses listed in the Act or who appear in the noted databases shall not be permitted at any time to be present on school grounds.

All persons accessing school grounds pursuant to this Addendum and the Agreement are required to have in their possession identification issued by the District. All such persons must check in with the school main office to receive a visitor's identification at which time the individual must present a government issued photo identification which will be used to verify the individual's name appears on the Certified Cleared Employee List. At the conclusion of the work day, plastic or hard cover identification must be returned to the school.

Not less than 10 days prior to the commencement of work, Contractor shall submit to the District a written certification on a form provided by the District (Certified Cleared Employee List), signed by Contractor under oath that the employees listed on the certification have been the subject of a criminal history records check (for employees working more than 30 school days in District buildings), and a Statewide Sex Offender Database check and a Statewide Child Murderer and Violent Offender Against Youth Database check for all employees accessing District grounds. Contractor shall update the certification as and when necessary to keep such certification list current.

The District and Program Manager, if any, may from time to time and at multiple times in their discretion and without notice check the identification of all persons accessing school grounds by or through the Contractor to assure such persons appear on the certification list and have in their possession a valid District issued identification. Contractor warrants that it shall immediately notify the District if a certified cleared employee is convicted of an enumerated offense or their name appears on any of the noted Databases. A violation of this section 6 is a material breach of contract.

7. Certifications of Hours Worked.

In all circumstances where Contractor seeks payment based upon an hourly rate for itself or its consultants, time cards or time records of such person or persons for whom such hourly rate compensation is requested shall be kept and maintained by Contractor. At any time or times, at the election of the District, the District may inspect and audit all time records kept by Contractor. Each submission of requests for payment of hourly rate amounts shall be accompanied by a certification under oath that the payment requested is for time actually worked which has been verified by Contractor.

8. Drugs, Alcohol and Smoking.

The District maintains a drug and alcohol free workplace. Contractor shall prohibit the use of drugs and alcohol on District premises at all times. The District also maintains all its properties as smoke free, tobacco free environments. Smoking and tobacco use (including chewing tobacco and snuff) is not permitted on any District property; Contractor shall require all its employees, agents and representatives and its consultants to refrain from smoking and tobacco use on District property.

8.01 No Contractor employee, agent, representative, consultant and consultant's employees, agents and representatives may use, possess, distribute, deliver, or be under the influence of a drug, or use or be under the influence of alcohol, while performing work on a public works project. An employee is considered to be under the influence of alcohol for purposes of this Act (820 ILCS 265) if the alcohol concentration in his or her blood or breath at the time alleged as shown by analysis of the employee's blood or breath is at or above 0.02.

8.02 Contractor acknowledges and agrees that the provisions and requirements established by the Substance Abuse Prevention on Public Works Projects Act has been complied with and

Contractor has in place all requirements for testing of its employees suspected of or challenged to be tested by the District as provided under the Act (820 ILCS 265).

9. Contract Payments.

All contract payments shall be processed in the manner specified in the Agreement. The Board of Education regular meetings generally occur on the second and fourth Tuesdays of each month as specified by the Board Calendar. The Board Calendar may be accessed at the District web site www.rps205.com. Payment applications by the Contractor must be received in the District Finance Department not less than 10 calendar days prior to a scheduled Board meeting for the approved application for payment to be considered at that Board meeting.

The Board of Education will comply with the provisions of the Local Government Prompt Payment Act, 50 ILCS 515/1.

10. Records Maintenance and Security.

A. Records. The Contractor shall establish and maintain a reasonable accounting system that enables the District to readily identify Contractor's assets, expenses, costs of goods and use of funds related to the Project (the Records). Such Records shall include, but not limited to, accounting records, written policies and procedures; all paid vouchers, including those for out-of-pocket expenses, other reimbursement supported by invoices; ledgers; cancelled checks; deposit slips, bank statements; journals; original estimates; estimating work sheets; contract amendments and change order files; back-charge logs and supporting documentation; insurance documents, payroll documents; timesheets; memoranda; and correspondence.

B. Retention. The Contractor shall, at all times during its performance of the Project and for a period of seven years after the completion of the Project, maintain Records, together with all supporting or underlying documents and materials. The Contractor shall upon written request by the District at any time or times, whether during or after completion of the Project, and at the Contractor's expense, produce the Records for inspection, copying and audit (including copies and extracts of records as required) by the District. The Records shall be made available to the District, upon three-day written notice, during normal business hours at Contractor's principal office if located in Rockford, Illinois or at such other location specified by the District including the District offices. Upon expiration of the retention period specified in this paragraph 10B, prior to destruction of the Records, Contractor shall provide not less than 30 days written notice of its intent to destroy any part or all of the Records, specifying the nature, character and extent of Records to be destroyed and the District may at its discretion and expense obtain all Records or copies of Records intended to be destroyed. The Contractor shall ensure the District's right to access and audit the Records in the possession of, created or maintained by Contractor and Contractor's agents and representatives. Contractor shall notify in writing its agents and representatives of the requirements of records, retention and audit as set forth in this paragraph 10. Any and all contracts or agreements between Contractor and any other party related to the Project shall expressly include the records, retention and audit provisions of this paragraph 10.

C. Audit. The District and its authorized representatives shall have the right to audit, to examine, and to make copies of or extracts from all Records (in whatever form they may be kept, whether written, electronic, or other), including, but not limited to, those kept by the Contractor, its agents and representatives. Cost of any examination or audit of Records conducted by the District will be borne by the District (excluding any cost to produce Records under paragraph 10B), except where the examination or audit identifies overpricing or overcharges (of any nature) by the Contractor to the District in excess of one-half of one percent (0.5%) of the total contract billings in which event the entire cost of the examination or audit shall be Contractor's cost and Contractor shall reimburse the District for the total cost of the examination or audit. If the examination or audit reveals substantive findings of fraud, misrepresentation, or non-performance by Contractor, its employees, agents or representatives, the Contractor shall pay all costs of the examination or audit; and if paid by the District, reimburse the District for all such costs. In the

event Contractor fails to pay such costs within 30 days of demand by the District, District may offset any such costs unpaid by Contractor from any balance due Contractor by the District or at the election of the District proceed to collect such costs by any available means including litigation in which event the costs of collection including reasonable attorney's fees shall also be paid by Contractor.

D. Records ownership and security. Contractor hereby acknowledges and agrees that all records and documents, whether in electronic or written form or otherwise, received by Contractor from the District and all records, whether in electronic or written form or otherwise, created by Contractor in performance of its obligations under the Agreement shall be and remain owned by the District. Contractor shall use all reasonable and timely means to protect and preserve all such records and to deliver the same to the District upon demand. The Records are subject to access and examination by the District and any federal agency with relevant responsibility for any federal grant funds providing funding for the Project. Contractor shall cooperate and produce all records of the Project for inspection and examination by any governmental agency, including District, providing funding for the Program.

E. Confidentiality. The Records and all documents and information received, accessed or observed by Contractor in performance of the Agreement shall be and remain confidential. In the performance of its obligations under the Agreement Contractor may acquire access to certain information, including but not limited to, information concerning students and/or school personnel, and other confidential and/or proprietary information (collectively, "Confidential Information"). Contractor will not, without the prior written consent of the Board, and regarding student record information, without the express prior written consent of the parent/guardian, disclose, re-disclose or make available to anyone, at any time, either during Contractor's engagement with the Board or following termination of this Agreement, for any reason whatsoever, any of the Confidential Information. The provisions of this Section shall survive the termination of the Agreement.

11. Miscellaneous.

11.1 To the fullest extent permitted by applicable law, Contractor and its employees and consultants shall and do agree to indemnify and hold harmless the District, and its respective Board members, officers, directors, and employees from and against all claims, damages, losses, causes of action, suits, judgments and expenses, including reasonable attorney's fees, to the extent arising out of, caused by or resulting from the performance or non-performance of the Contractor regarding work under the Agreement caused in whole or in part by any negligent act or omission of Contractor, anyone directly or indirectly employed by it or anyone for whose acts it may be liable even if caused in part by District. This paragraph shall be construed in accordance with the Construction Contract Indemnification for Negligence Act (740 ILCS 35/1).

11.2 Notwithstanding any other provision in any document, the District shall not, in any manner, be deemed or intended to have waived any claim by making a payment of any amount.

11.3 The Certificate of Insurance and all insurance policies required to be obtained by Contractor shall provide that coverages afforded under the policies will not be cancelled, reduced or allowed to expire without at least thirty (30) days prior written notice to the District.

11.4 Under no circumstances shall the District be deemed to have waived any of the insurance requirements of this Agreement by any action or omission.

11.5 Subject to the waiver of subrogation as may otherwise apply by agreement, nothing contained in the insurance requirements of the Agreement is to be construed as limiting the liability of Contractor or any of its insurance carriers. District does not represent that the coverages or limits of insurance specified is sufficient or adequate to protect the District or Contractor's interest or liabilities but are mere minimums. The obligation of Contractor to purchase insurance shall not limit its obligations to the District in the event the District should suffer an injury or loss in excess of the amount recoverable through insurance, or any loss or portion of loss which is not covered by insurance.

11.6 Contractor shall notify District, in writing, of any actual or potential claim for personal injury or property damage relating to the Project and of any occurrence which might give rise to such claim, promptly upon receiving first knowledge of same.

11.7 Contractor agrees to fully comply with the requirements of the Illinois Human Rights Act, 775 ILCS 5/1-101 et. seq. including but not limited to the provisions regarding sexual harassment policies and procedures under Section 2-105 of said Act. Contractor further agrees to comply with all federal Equal Employment Opportunity laws including, without limitation, the American's with Disabilities Act and the rules and regulations promulgated thereunder. Pursuant to the requirements of the regulations of the Illinois Department of Human Rights (Department), Title 44, Part 750 of the Illinois Administrative Code and to the extent applicable Contractor will comply with Illinois human rights laws. In the event of non-compliance with the provisions of this Equal Employment Opportunity Clause, the Illinois Human Rights Act or the rules and regulations of the Illinois Department of Human Rights, this Agreement may be cancelled or voided in whole or in part, and Contractor acknowledges that it may be subject to further sanctions or penalties imposed by the Illinois Human Rights Commission, as provided for in the Illinois Human Rights Act, and to such other sanctions or penalties may be imposed or remedies invoked as provided by statute or regulations. During the performance of this Agreement, Contractor agrees:

A. It will not discriminate against any employee or applicant for employment because of race, color, religion, creed, sex, marital status, national origin or ancestry, age, citizenship, physical or mental handicap or disability, military status, or an unfavorable discharge from military service or arrest record status; and further that it will examine all job classifications to determine if minority persons or women are underutilized and will take appropriate affirmative action to rectify any such underutilization.

B. If it hires additional employees in order to perform this Agreement it will determine the availability (in accordance with applicable agency rules) of minorities and women in the areas(s) from which it may reasonably recruit and it will hire for each job classification for which employees are hired in such a way that minorities and women are not underutilized.

C. In all solicitations or advertisements for employees placed by it or on its behalf, it will state that all applicants will be afforded equal opportunity without discrimination because of race, color, religion, sex, marital status, national origin, ancestry, age, physical or mental handicap unrelated to ability, or an unfavorable discharge from military service.

D. It will send to each labor organization or representative of workers with which it has or is bound by a collective bargaining agreement or understanding, a notice advising such labor organization or representative of Contractor's obligation under the Illinois Human Rights Act and the Rules of the Department. If any such labor organization or representative fails or refuses to cooperate with Contractor in its efforts to comply with such Act and Rules, Contractor will promptly so notify the Department and the contracting agency and will recruit employees from other sources when necessary to fulfill its obligations thereunder.

E. Contractor will submit reports as required by the District's rules, furnish all relevant information as may, from time to time, be requested by the Department or the District, and in all respects comply with the Illinois Human Rights Act and the Department rules.

F. Contractor will permit access to all relevant books, records, accounts and work sites by personnel of the contracting agency and the Department for purposes of investigation to ascertain compliance with the Illinois Human Rights Act and Department rules.

G. Contractor will include verbatim or by reference the provisions of this clause in every subcontract it awards under which any portion of the Agreement obligations are undertaken or assumed. In the same manner as with other provisions of the Agreement, Contractor will be liable for compliance with applicable provisions of this clause by its consultants or contractors; and further it will promptly notify the contracting agency and the Department in the event any consultant or contractor fails or refuses to comply therewith. In addition, Contractor will not utilize any consultant or contractor

declared by the Illinois Human Rights Commission to be ineligible for contracts or subcontracts with the State of Illinois or any of its political subdivisions or municipal corporations.

11.8 Weapons. Neither Contractor nor any of its employees, officers, agents or representatives shall be in possession of any firearm or weapon (as defined by the District's designated representative) while on District premises, including on the person or within any vehicle parked on or adjacent to any District property. Violation of this section may result in immediate removal from District premises and referral to local law enforcement.

12. Federal Funds Contract.

The Agreement provides for the construction of certain improvements on behalf of the District identified as the Projects. If the Projects are funded in whole or in part by federal grant funds the Projects are subject to certain rules and regulations as may be contained in the regulations of the funding agency, in the federal common rule as set forth in 45 CFR Part 92, and in the grant award. Contractor agrees to abide by all such rules and regulations as part of its basic services.

13. No Waiver.

No failure of either party to exercise any powers granted in this Agreement or to insist upon strict compliance by the other party with any obligation hereunder and no custom or practice of the District or Contractor at variance with the terms hereof shall constitute a waiver of the right of either party to demand exact compliance with the terms of this Agreement.

14. Representation of Authority.

Contractor herewith covenants, represents and warrants that the person executing this Addendum and the Agreement and any and all amendments hereto and thereof, as and if such may occur, are fully empowered to execute this Addendum, the Agreement and any amendments thereto in such fashion as to fully and completely bind Contractor to these agreements and undertakings; the signature on this Addendum and the Agreement further serves to assure the District that any and all action necessary by law, and under the terms of Contractor's by-laws, and pursuant to the policies of Contractor have been taken prior to execution of this document on behalf of Contractor; the signatures on the Agreement and this Addendum are a representation that the Contractor is a corporation in good standing in the state of Illinois. This representation, covenant and warranty are made by Contractor with the intent that the District fully rely hereon and as an inducement to the District to execute this Addendum and the Agreement.

15. Entire Agreement.

The Agreement together with all its Exhibits and this Addendum shall constitute the complete understanding between the parties and no other or further agreement shall be or constitute an amendment to or modification of this Agreement absent the same being reduced to writing and executed by both parties hereto.

DISTRICT:	**CONTRACTOR:**
BOARD OF EDUCATION OF ROCKFORD SCHOOL DISTRICT NO. 205, WINNEBAGO AND BOONE COUNTIES, ILLINOIS	_____
BY: _____	**BY:** _____
Its President	**Its President**
Attest: _____	**ATTEST:** _____
Its Secretary	**Its Secretary**

RAGNAR BENSON CONSTRUCTION
A WILLIAM CHARLES COMPANY

1907 KISHWAUKEE STREET
ROCKFORD, ILLINOIS 61104
PHONE (815) 966-3116

CHANGE ORDER PROCEDURES

In order to process change orders it is important that procedures are followed and documentation provided in a manner that allows timely processing.

Field Orders will be issued for all changes that occur on the project. Changes are typically associated with a response to a RFI, Bulletins, or Field Conditions.

This document contains information needed for Field Orders, processing changes from RFIs, Bulletins and Field Conditions. Requirements for Change Order Requests are also provided.

FIELD ORDERS

A Field Order will be issued for all change conditions. It is a document that tracks changes to the project and will provide directions for processing.

The Field Order heading contains the following tracking information, it is important that this information is contained in all change order requests:

1. Field Order Number
2. RFQ Number
3. PCO Number

The Field Order provides direction on how to proceed.

1. You are authorized to proceed with the change, subject to the method of payment listed in the following section, or
2. You are directed not to proceed until you have submitted all cost and schedule information within 7 days and the costs have been approved by RPS.

There are 4 methods of payment listed.

1. No Cost
2. Lump Sum
3. Time and Materials
4. Submit Quotations

NO COST CHANGE

If this box is selected, it means that the information that you have received is a clarification of information contained in your contract and will not require a change to your contract.

LUMP SUM

If this box is selected, it means that an agreement exists on a lump sum amount for a contract modification. This is rarely used as a way to process contract changes.

CHANGE ORDER PROCEDURES

TIME & MATERIALS
If this box is selected, tickets will need to be submitted to Ragnar Benson on a daily basis. Tickets that are not submitted on a daily basis will be subject to rejection.

If a ticket is signed by a Ragnar Benson representative, it does not guarantee additional payment or acceptance of pricing. The signature is only to confirm that the time spent on a particular task has been accepted. The only authority that can accept, approve, and or modify changes to the contract is a RPS project representative. A RPS employee that is not a project representative is not authorized to commit the district for additional work. This would include but not be limited to school administrators, teachers, or maintenance personnel.

SUBMIT QUOTATIONS
If this box is checked then you will need to submit a Change Order Request subject to the change order requirements listed in a subsequent section of this document.

Please note that you are not to proceed with any additional work unless you have a signed field order. If you proceed with extra work without a signed field order you do so at your own risk.

CHANGE CONDITIONS

RFI's
All RFI's will be submitted by the general contractor to the Architect of Record with a copy sent to Ragnar Benson. The response will include a field order will direct you on how you are to proceed.

BULLETINS
When a Bulletin is issued, a Field Order will be included and it will direct you on how to proceed.

FIELD CONDITIONS
If you encounter unknown conditions and think that you are entitled to additional compensation, notify the Architect of Record and Ragnar Benson immediately and include all appropriate documentation. A Field Order will provide direction on how you are to proceed.

CHANGE ORDER REQUESTS
To aid in the processing of change orders, we will need certain information included in each of the change order requests.

A detailed cost breakdown that includes quantities, man hours, labor and material costs needs to be included for each trade that is requesting additional compensation. Please use the Cost Proposal Worksheet that is included in this document.

Include all backup that is needed to evaluate the change order request. Examples of this would be quotes received from subcontractors , material suppliers, sketches that identify how quantities were calculated, worksheets, and pictures may also be appropriate for our analysis.

CHANGE ORDER PROCEDURES

FEES

The fees shall be calculated as a lump sum to all changes. The fees are to be calculated per the information provided below.

GENERAL CONTRACTOR FEES

12% allowed for self-performed work- this includes overhead, profit, bond and insurance.

5% allowed for subcontracted work - this includes overhead, profit, bond and insurance.

SUBCONTRACTOR FEES

12% allowed for self-performed work - this includes overhead, profit, bond and insurance.

Please see a sample change order request that is included with this attachment.

RAGNAR BENSON CONSTRUCTION
A WILLIAM CHARLES COMPANY

FIELD ORDER
#: 4

Project:	**10101- CSX - Worcester IMF Expansion**	**Date:**	**11/07/2011**
To:	**David Marois**	**From:**	**Carl Zeigler**
	MAROIS BROS		**RAGNAR BENSON CONSTRUCTION LLC**
	115 Blackstone River Road		250 South Northwest Highway
	Worcester, MA 01697		Park Ridge, IL 60068
Phone:	508-791-8134	**Phone:**	847-698-4900
Fax:	508-754-4214	**Fax:**	847-692-9320
Email:	dmarois@maroisbrothers.com	**Email:**	carl.zeigler@rbic.com
		RBRFQ#:	6 **PCO#:** 109

CC: *Tim Brown - ARCADIS - Phone: 508-421-8307 - Fax: 508-421-8305,*
Keith Goldberg - ARCADIS - Phone: 508-421-8307 - Fax: 508-421-8305,
Dennis Dunn - RAGNAR BENSON CONSTRUCTION LLC - Phone: 847-698-4900 - Fax: 847-692-9320,
Stephen Groh - RAGNAR BENSON CONSTRUCTION LLC - Phone: 847-698-4900 - Fax: 847-692-9320,
Fred Jewel - RAGNAR BENSON CONSTRUCTION LLC - Phone: 847-698-4900 - Fax: 847-692-9320,
Steven Kehm - RAGNAR BENSON CONSTRUCTION LLC - Phone: 847-698-4900 - Fax: 847-692-9320,
Knut Olberg - RAGNAR BENSON CONSTRUCTION LLC - Phone: 847-698-4900 - Fax: 847-692-9320,
Paul Paolini - RAGNAR BENSON CONSTRUCTION LLC - Phone: 847-698-4900 - Fax: 847-692-9320,
Randy Perdue - RAGNAR BENSON CONSTRUCTION LLC - Phone: 847-698-4900 - Fax: 847-692-9320,
Greg Stambaugh - RAGNAR BENSON CONSTRUCTION LLC - Phone: 847-698-4900 - Fax: 847-692-9320,
Chris Swanson - WILLIAM CHARLES CONSTRUCT COMPANY LLC - Phone: 815-654-4700 - Fax: 8156544736

Description: Foundation Removal at Franklin and Plastic Streeets

☐ You are hereby authorized to proceed with the following terms of work on the above project. All work shall be performed in accordance with the requirements of the Contract Documents.

☑ Do not proceed with the modifications or clarifications. Please submit your proposal listing both schedule and cost impact of the modifications or clarifications with 7 days. If we do not receive a proposal within 7 days, we will assume there are no schedule or cost impacts associated with this work.

Item	PCO Description	Detail Notes:
2	WCC -Foundations found at underground detention pipes	
3	Marois - Foundations found at underground detention pipes	

Notes:

Method of Payment:

☐ No Cost

☐ Lump Sum

☐ Time and materials

☑ Submit quotations promptly for the above described work. The cost of the work will be determined from the Subcontractor Proposal, subject to review, and will be resolved to be mutually agreeable.

Schedule: The effect of this order on the contract completion date is as follows:

☑ No Change.

☐ Impact is unknown at this time.

☐ Completion Date is estimated at days.

☐ Subcontractor to submit a revised schedule listing duration changes to specific activities.

RAGNAR BENSON CONSTRUCTION
A WILLIAM CHARLES COMPANY

FIELD ORDER
#: 4

		Date
David Marois	MAROIS BROS	11/07/2011
Carl Zeigler	RAGNAR BENSON CONSTRUCTION LLC	11/07/2011
Keith Goldberg	Arcadis	

In Scope Change N

P.C.O. #: #

F.O. #:

DATE

ROCKFORD PUBLIC SCHOOLS #205 - FACILITIES UPGRADES PROJECT
COST SUMMARY FORM

LOCATION & PROJECT NAME

CONTRACT INFORMATION

CONTRACTOR: **Name**

RPS P.O. #: **#**

C.O.R. #: **#**

REASON FOR CHANGE \ CLARIFICATIONS

Descripton

Field Condition _____ _____ Value Engineering

Owner Requested Change _____ _____ Design Modification

COST BREAKDOWN SUMMARY

General Contractor's * SUB-TOTAL COSTS:	$	-
General Contractor's * Overhead & Profit on *SUB-CONTRACTOR @ 5%* :	$	-
GENERAL CONTRACTOR * SELF PERFORMED WORK:	$	-
General Contractor * Overhead & Profit on *SELF-PERFORMED WORK @ 12%* :	$	-
UNIT PRICE including Sub-Contractor & Self-Performed Work Markups: **( ):**	$	-
GRAND TOTAL:	$	-

ATTACHMENTS

Cost Summary Form:	*Included*	*Pages*	*1*
Change Order Request **(COR)** #:		*Pages*	
VOIDED - Change Order Request **(COR)** #:		*Pages*	
Ragnar Benson's Field Order **(FO)** #:		*Pages*	
Supplemental Instructions **(SI)** #:		*Pages*	
Request for Information **(RFI)** #:		*Pages*	
Sub-Contractor Backup Documents - (Name):		*Pages*	
Sub-Contractor Backup Documents - (Name):		*Pages*	
		Pages	
		Pages	
		Pages	

TOTAL Number of Pages Attached: *1*

APPROVALS

RPS's Field Order Authorization: _____ *Confirmation Received*

Architect Approval: _____

Engineer Approval: _____

ROCKFORD PUBLIC SCHOOLS
School District #205

COST PROPOSAL WORKSHEET

Contractor Name: _____

Project: _____ **Project No.:** _____ **Change Order Request No.:** _____

DESCRIPTION	Qty.	Unit	Unit Labor	Total Labor	Unit Material	Total Material	Unit Sub	Total Sub	TOTAL

RAGNAR BENSON CONSTRUCTION
A WILLIAM CHARLES COMPANY

ROCKFORD PUBLIC SCHOOLS
REQUIRED BID FORMS CHECK LIST
Bid/RFP/RFQ No.: 16-49 Washington Academy Renovations

Listed below are the REQUIRED forms all bidders are REQUIRED to submit with sealed bids on or before the bid due date and time. Failure to submit ALL required forms may result in bidder being deemed non-responsive.

Required Forms	Yes	Comments
Bid Security Bond	☐	5% of Base Bid
Bid Form	☐	
Bid Rigging Certification	☐	
Minority and Women Owned Business Concern Representation	☐	
Certificate Regarding Debarment, Suspension, Ineligibility, and Voluntary Exclusion	☐	
Certificate Regarding Lobbying	☐	
OFAC Compliance	☐	
Vendor Conflict of Interest Disclosure Form	☐	
Certified Cleared Employee List	☐	Complete, sign, and notarize the form. If you are uncertain of which employees will be working on the project, note this information on the form that the employee information will be forth coming BEFORE you start on the project, if awarded the contract.
Asbestos Notification	☐	
AIA Document A305-1986 Contractor's Qualification Statement	☐	
Form W-9 Department of the Treasury Internal Revenue Service	☐	

Listed below are REQUIRED FORMS/DOCUMENTS that must be submitted prior to starting work, if awarded the contract. Failure to submit forms below may result in project start delay.

☐ Certificate of Liability Insurance	☐ Performance Bond (100% of contract)
☐ AIA Document A101-2007 Standard Form of Agreement between Owner and Contractor (as revised by owner)	☐ Labor and Material Payment Bond (100% of contract)

FORM OF PROPOSAL FOR SINGLE CONTRACT

TOTAL PROJECT

BID SUBMITTED BY _____

Date _____

Gentlemen/Ladies:

The undersigned, having become familiar with the local conditions affecting cost of work and with the Bidding Documents, including Advertisement for Bids, Instructions to Bidders, Bid Form, General Conditions, Supplementary Conditions, Drawings and Specifications, and Addenda issued thereto, as prepared by Operations and Facilities, Rockford Public Schools, Rockford, Illinois, hereby agrees to furnish all labor, material and equipment necessary to complete Renovations to Washington Academy, Rockford Public Schools for the amount shown below:

BASE BID:

Total _____ ($_____).

COST BREAKDOWN - INFORMATIONAL PURPOSES ONLY:

Contractor to provide the portion of Base Bid that includes the reroofing scope of work including the associated sheet metal work. The Contractor will have to invoice for the reroofing work separate from the rest of the project.

Total _____ ($_____).

Contractor to provide the portion of Base Bid that includes the window replacement scope of work including window treatments. The Contractor will have to invoice for the window work separate from the rest of the project.

Total _____ ($_____).

ALTERNATE BIDS:

Add Alternate #1: Remove and replace west entrance system and associated drainage

_____ Dollars ($_____).

Add Alternate #2: Remove glass block and install new window system

_____ Dollars ($_____).

Add Alternate #3: Paint existing decorative grilles

_____ Dollars ($_____).

Add Alternate #4: Replace panel boards and feeders

_____ Dollars ($_____).

Add Alternate #5: Provide a factory painted finish in a standard color on the aluminum window systems in lieu of the natural anodized aluminum

_____ Dollars ($_____).

Add Alternate #6: Renovate the canopies including new lighting

_____ Dollars ($_____).

Alternate #7: This Alternate Bid has been omitted.

Add Alternate #8: Provide air handling renovation work

_____ Dollars ($_____).

Add Alternate #9: Provide wireless thermostats

_____ Dollars ($_____).

Add Alternate #10: Provide power receptacles(Alternate Bid #10 can only be accepted if Alternate Bid #4 is accepted)

_____ Dollars ($_____).

UNIT PRICES -SEE SPECIFICATION SECTION 012200 FOR MORE DETAILS

ITEMS	UNIT	UNIT PRICE
Unit Price #1 - Duplex receptacle	each.	$ _____
Unit Price #2 - 100 amp electrical panel with feeder	each.	$ _____
Unit Price #3 - 200 amp electrical panel with feeder	each.	$ _____
Unit Price #4 - Wireless thermostat	each.	$ _____
Unit Price #5 - Moisture mitigation to existing concrete floor slabs	sf.	$ _____

Unit prices above will be used for adds or deducts. The same cost will be used as an add or deduct.

Contractor to include in the Base Bid the cost to provide moisture mitigation to 1,000 sf of existing concrete slab. Once the actual square footage of moisture mitigation is required during construction, the unit prices will be used to adjust the contract amount.

START AND COMPLETION DATES:

Refer to Architectural drawings Sheet A101 for all start and completion dates.

ADDENDA RECEIVED

The undersigned acknowledges receipt of Addenda _____ to _____ inclusive.

COMMENCEMENT AND COMPLETION OF CONTRACT

The undersigned agrees, if awarded the Contract, to commence the contract work within five (5) days of receipt of Order to Proceed and to complete said Work within the specified completion time. The undersigned further agrees to execute the Contract, furnish satisfactory performance and payment bond as well as insurance coverage, as specified in strict accordance with the Contract Documents.

BIDDER _____
(Corporation) (Partnership) (Individual) Use One

Address _____
Street

_____
City State Zip Code

_____
Phone No.

By _____

Title _____

FEIN NO. _____ Affix Corporation Seal if Corporation:
If not a Corporation this Bid must be notarized.

Date _____

BID DEPOSIT CERTIFICATION

A Bid Deposit is required in the amount of 5% of the total Bid including Alternate Bids. This Bid Deposit is to be a Bid Bond, Bank Draft or Certified Check made payable to the "Rockford School District No. 205", as a guarantee that if awarded all or part of the Bid, the firm will enter into contract to perform as per specification.

Amount of Total Bid $_____

Amount of Bank draft or Certified Check $ _____

_____
Signature of Authorized Representative

Company Name _____

Street Address _____

City & State _____
Zip

Telephone _____
Area Code Number

_____
FEIN OR SOCIAL SECURITY NUMBER

SUBCONTRACTOR LISTING

1. Pursuant to bidding requirements for the Work titled:

   Renovations to Washington Academy for portions of the Work equaling or exceeding ½ of 1% of the total proposed Contract Sum the undersigned proposes to use the following Subcontractors. The undersigned proposes to perform all other portions of the Work with his/her own forces. The Owner reserves the right to qualify all Subcontractors.

2. Portion of the Work	Subcontractor Name and City
_____	_____
	_____
	_____
_____	_____
	_____
	_____
_____	_____
	_____
	_____
_____	_____
	_____
	_____

Provide signature identical to that shown on the bid form

Bidder: _____

By _____

SUBSTITUTION LISTING

1. Pursuant to bidding requirements of the Work titled:

Renovations to Washington Academy the Contract sum proposed by the undersigned on the Bid Form is for the Work as shown on the drawings. Described in the specifications, and otherwise defined in the Contract Documents. However, the undersigned proposes the following for Owner's consideration. Should the Owner accept any or all of the proposed substitutions, the Bidder's proposed Base Bid amount will be changed by the amount shown.

2.

Specified Product or Material	Drawing No. or Spec. Section	Proposed Substitution	Proposed Change in Contract sum

Provide signature identical to that shown on the bid form

Bidder: _____

By _____

END OF BID FORM

ROCKFORD PUBLIC SHOOLS
BID-RIGGING CERTIFICATION

I, _____, a duly authorized agent of
(Agent)

_____, do hereby certify that neither
(Contractor)

_____nor any individual presently
(Contractor)

affiliated with _____has been barred from bidding on a
(Contractor)

public contract as a result of a violation of either Section 33E-3 (bid-rigging) or Section 33E-4 (bid rotating) of the Illinois Criminal Code, contained in Chapter 750, Article 5 of the Illinois Compiled Statutes.

_____
Authorized Agent

_____
Contractor

ROCKFORD PUBLIC SCHOOLS

MINORITY, WOMEN and DISABLED-OWNED BUSINESS CONCERN REPRESENTATION

Minority-Owned Business: a minority-owned business concern means a business concern that: (1) is at least 51 percent unconditionally owned by one or more individuals who are considered to be a member of a minority group, or a publicly owned business having at least 51 percent of its stock unconditionally owned by one or more members of a minority group; and (2) has its management and daily business controlled and operated by one or more such individuals. Individuals who certify that they are members of minority groups (African Americans, Hispanic Americans, Native Americans, Asian-Pacific Americans, Asian-Indian Americans, and other minorities) are to be considered minority-owned enterprises.

Women-Owned Business: a business that is at least 51 percent owned by a woman or women who also control and operate it.

Disabled Owned Business: a business that is at least 51 percent owned by a person or persons with severe physical or mental disabilities which substantially limits one or more of the person's major life activities and which person or persons control and operate such business.

"Control" in this referenced context means exercising the power to make policy decisions. "Operate" means being actively involved in the day- to-day management of the business.

The District shall rely on written representations of concerns regarding their status as minority/women/disabled-owned businesses. Offeror agrees to submit information regarding the minority ownership of its subcontractors on request of District.

COMPLETE THE SECTION BELOW AND RETURN THIS FORM WITH BID. FAILURE TO DO SO MAY RENDER THE OFFEROR'S BID UNACCEPTABLE.

A. Representation. The offeror represents that it is ( ), is not ( ) a minority-owned business concern.

B. Representation. The offeror represents that it is ( ), is not ( ) a women-owned business concern.

C. Representation. The offeror represents that it is ( ), is not ( ) a disabled-owned business concern.

Please Check Appropriate Box/Boxes

☐ African American (AFRAM) ☐ Caucasian (CAUC) ☐ Native American (NAAM)

☐ Hispanic American (HISP) ☐Asian-Pacific American (ASIAP) ☐ Asian-Indian (ASIAI) American

☐ Other _____ ☐ Woman Owned (W) ☐ Disabled Owned (D)

Please identify

The offeror has ☐/ has not ☐ used the following procedures in searching for and obtaining suppliers and subcontractors:

- •Place qualified Minority-Owned Businesses on solicitation lists
- •Ensure that Minority-Owned Businesses are solicited whenever they are potential sources
- •Consider contracting with consortia of Minority-Owned Businesses when an intended contract is too large for any one such firm to handle on its own or, if economically feasible, divide larger requirements into smaller transactions for which such organizations might compete
- •Make information on contracting opportunities available and establish delivery schedules that encourage participation by Minority-Owned Businesses
- •Use the services and assistance of the SBA and Department of Commerce Minority Business Development Agency, as appropriate.

Company Name _____ Address _____

City _____ State _____ Zip _____

Phone # _____ Fax # _____ FEIN # _____

Signature of Company Official _____ Title _____

Date _____

ILLINOIS STATE BOARD OF EDUCATION
100 North First Street
Springfield, IL 62777-0001

CERTIFICATION REGARDING DEBARMENT, SUSPENSION, INELIGIBILITY, AND VOLUNTARY EXCLUSION LOWER TIER COVERED TRANSACTIONS

This certification is required by the regulations implementing Executive Orders 12549 and 12689, Debarment and Suspension, 2 CFR 417 Subpart C Responsibilities of Participants Regarding Transactions. The regulations were published in the May 25, 2010 Federal Register (pages 29183-29189). Copies of the regulations may be obtained by contacting the Illinois State Board of Education.

BEFORE COMPLETING CERTIFICATION, READ INSTRUCTIONS BELOW.

CERTIFICATION

The prospective lower tier participant certifies, by submission of this Certification, that:
(1) Neither it nor its principals are presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from participation in this transaction by any Federal department or agency;
(2) It will provide immediate written notice to whom this Certification is submitted if at any time the prospective lower tier participant learns its certification was erroneous when submitted or has become erroneous by reason of changed circumstances;
(3) It shall not knowingly enter 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;
(4) It will include the 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;
(5) The certifications herein are a material representation of fact upon which reliance was placed when this transaction was entered into; and
(6) 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 Certification.

Organization Name	*PR/Award Number or Project Name*
Name of Authorized Representative	*Title*
Original *Signature of Authorized Representative*	*Date*

Instructions for Certification

1. By signing and submitting this Certification, the prospective lower tier participant is providing the certifications set out herein.
2. 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 all available remedies, including suspension and/or debarment.
3. Except for transactions authorized under paragraph 3 above, 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 all available remedies, including suspension and/or debarment.
4. The terms covered transaction, debarred, suspended, ineligible, lower tier covered transaction, participant, person, primary covered transaction, principal, proposal, and voluntarily excluded, as used herein, have the meanings set out in the Definitions and Coverage sections of the rules implementing Executive Order 12549 and Executive Order 12689. You may contact the person to which this Certification is submitted for assistance in obtaining a copy of those regulations.
5. 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 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 "GSA Excluded Parties List System" at http://epls.arnet.gov/.
6. 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 herein. 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.

ILLINOIS STATE BOARD OF EDUCATION
100 North First Street
Springfield, IL 62777-0001

CERTIFICATE REGARDING LOBBYING

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 an 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, the making of any Federal loan, the entering into any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.

(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, loan, or cooperative agreement, the undersigned shall complete and submit ISBE 85-37, "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 subcontracts, subgrants, and contracts under grants, loans, and cooperative agreements) 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.

_____	_____
Organization Name	*PR/Award Number or Project Name*
_____	_____
Name of Authorized Representative	*Title*
_____	_____
Original *Signature of Authorized Representative*	*Date*

OFAC Compliance

BID No.:_____

The undersigned hereby certifies and represents that products and/or services provided under any contract with the Rockford Public Schools resulting from this bid shall be in compliance with economic or trade sanctions or restrictions implemented by the United States government such as those administered by the Office of Foreign Assets Control ("OFAC") of the U.S. Department of the Treasury and shall not utilize or engage, for performance of any activities related to the products and/or services, any persons or entities that, (i) appear on OFAC's Specially Designated Nationals and Blocked Persons List ("SDN List"), as that list may be updated from time to time or any other similar list maintained by OFAC; (ii) are owned or controlled by any person or entities appearing on OFAC's SDN List, as that list may be updated from time to time or any other similar list maintained by OFAC; or (iii) are located in any country subject to U.S. economic or trade sanctions, such as those administered by OFAC.

_____

Organization Name

_____

Name of Authorized Representative

_____

Title

_____

Original Signature of Authorized Representative

_____

Date

ROCKFORD PUBLIC SCHOOLS
VENDOR CONFLICT OF INTEREST DISCLOSURE FORM

DISCLOSURE STATEMENT:

All businesses ("Vendors" or "Vendor" or "Vendor's") that wish to conduct business with the Rockford Public Schools "RPS" must complete this form. Please note that all contracts with RPS are subject to RPS Code of Ethics which prohibits RPS employees and Board of Education members from having certain relationships with persons or entities conducting (or proposing to conduct) business with RPS and which limits the acceptance of gifts from Vendors. The entire Board Member Conflict of Interest Board Policy 2.100 and Board Policy 5.120 may be viewed at http://www2.rps205.com/District/BOE/Pages/GP-200.aspx. The Code and its definitions are incorporated by reference into this Disclosure Form. If a Vendor has a disclosable relationship, the Vendor should assume the relationship may pose a conflict of interest until notified to the contrary in writing by a RPS administrative staff member authorized to confirm that a determination has been made that a conflict does not exist. A principle of the Code of Ethics is to ensure that relationships do not influence any official decision or judgment of RPS employees or Board of Education members. Accordingly, disclosure also should be made for any person connected with Vendor (e.g., officer, director, partner, shareholder, employee,) that is likely to: (i) materially contribute to Vendor's preparation, drafting, or presentation of a proposal or bid for services and/or supplies, (ii) materially contribute to Vendor's negotiation of a contract with RPS, or (iii) perform material services under a contract with RPS. Below, these persons are referred to as "Disclosable Persons."

CERTIFICATION:

I hereby certify that, except as disclosed below, to Vendor's knowledge, there is no conflict of interest involving the Vendor named below that would violate the RPS Code of Ethics, including that: (a) after inquiry, neither Vendor nor any Disclosable Person is involved or engaged in any private business venture or enterprise, directly or indirectly, with any RPS employee or Board of Education member or his or her family member; (b) no RPS employee or Board member or his or her family member owns or has a material personal financial interest (directly or indirectly) in Vendor or is engaged in a material personal business transaction with Vendor; and (c) no RPS employee or board of Education member or his or her family is employed by Vendor.

I further certify that neither the Vendor nor anyone acting on its behalf has requested that any RPS employee or RPS Board of Education member exert any influence to secure the award of this bid to the Vendor. Furthermore, no RPS Board of Education member, employee or agent has offered to influence to secure the award of this bid to the Vendor

VENDOR INFORMATION:

Vendor Name: _____

Vendor Address: _____

_____

Vendor Phone Number _____

Vendor Email: _____

Vendor FEIN: _____

ROCKFORD PUBLIC SCHOOLS

VENDOR CONFLICT OF INTEREST DISCLOSURE FORM

DISCLOSURE STATEMENT:

I BELIEVE THE VENDOR NAMED ABOVE DOES have a potential conflict(s) of interest with a current RPS employee(s), or RPS Board of Education member(s).

☐ YES, the above statement is true.

☐ NO, the above statement is **NOT** true.

If you checked "**YES**" above, please provide the following information:

List all the Name(s) of RPS employee(s), RPS Board of Education member(s), or RPS employees' or RPS Board of Education's family member(s) with whom there may be a conflict of interest:

1. _____

2. _____

3. _____

Provide a brief description of the nature of the potential conflict(s) of interest:

SIGNATURE:
By my signature below, I certify that I am the Authorized Representative of the VENDOR named above and that all of the information provided above by signor is true and complete to the best of the signor's knowledge:

_____ _____

Print the Name of the Vendor's Authorized Representative

Print the Position Title of the Vendor's Authorized Representative

_____ _____

Print the Name of the Vendor's Authorized Representative

Date

CERTIFIED CLEARED EMPLOYEE LIST

The undersigned_____, a vendor, supplier, professional services firm or contractor, hereby certifies under oath as follows:

1- a criminal history records check, a Statewide Sex Offender Database check and a Statewide Child Murderer and Violent Offender Against Youth Database check has been conducted for all employees as indicated by a check mark in the appropriate box in accordance with 105 ILCS 5/10-21.9 (the Act); and

2- that such employees have not been convicted of any of the enumerated criminal or drug offenses listed in the Act and their name does not appear on the noted Databases; and

3-the undersigned is an owner (if sole proprietor) or officer, member or partner of the undersigned authorized to execute this document binding the undersigned.

No.	Last Name	M.I.	First Name	SS # (last four)	Crim. Hst.	Databases

By:_____

This certificate Subscribed and Sworn to before me this ___ day of _____, 20___.

_____

Notary Public
Commission Expires :_____

_____

Vendor Cert. Employee List No.___

ROCKFORD PUBLIC SCHOOLS

ASBESTOS NOTIFICATION

DATE: _____

I, _____ , (Person/Company) understand that

_____ School Building contains asbestos-containing building material and have been informed of the types and locations of this material by the Building Engineer. Furthermore, I will not disturb these materials without written permission from one of the following Building Services Department Officials.

Todd Schmidt, Chief Operating Officer

Rockford Public Schools Project Manager, Operations and Facilities

_____

Signature

cc: Building Engineer

Contractor

Omni: Tax W-9 PM85
Revised 6/06

ROCKFORD BOARD OF EDUCATION
SCHOOL DISTRICT #205
501 7TH Street
Rockford, Illinois 61104
Phone: Area Code 815-966-3098
Fax: Area Code 815-966-3088

W - 9

SUBSTITUTE IRS FORM W-9 – IMPORTANT TAX INFORMATION

IRS regulations require our School District to have on file appropriate taxpayer identification data concerning you or your firm. This information consists of either a Federal Employer Identification Number (F.E.I.N) or Social Security Number (S.S.N.) and will have their payments reported to the IRS on form #1099–Misc.

Below is the legal name and address for you or your firm as shown on our official records. Please make any necessary corrections. Space is also provided to enter the appropriate tax identification number and to indicate (by checking a box) the correct legal status. Failure to complete and return this form could result in a $50,000 IRS penalty. In addition, we would be required to withhold 20% of payments due and remit this amount to the IRS until we receive the correct tax data.

For your convenience we request you fax this form back to sender (or to Purchasing at 815-966-3088). Please do this today so we can both fulfill our reporting obligations and ensure prompt payments.

Reminder: If LEGAL STATUS is "Sole Proprietorship", the Taxpayer Identification Number must be either the Social Security Number of the owner or assigned FEIN.

LEGAL STATUS: (Check One)	**TAXPAYER (federal) ID# -- FEIN or Soc Sec** (use the line corresponding to your legal status line)
☐ Corporation	FEIN: ____ ____ - ____ ____ ____ ____ ____ ____
☐ Limited	FEIN: ____ ____ - ____ ____ ____ ____ ____ ____
☐ Partner(ship)_____(one owner)	FEIN: ____ ____ - ____ ____ ____ ____ ____ ____
☐ Religious, Charitable, Educational or Governmental Agency (**circle one**)	FEIN: ____ ____ - ____ ____ ____ ____ ____ ____
☐ Sole Proprietorship (legal owner's name): _____	FEIN: ____ ____ - ____ ____ ____ ____ ____ ____or SSN: ___ ___ ___ - ___ ___ - ___ ___ ___ ___ Owner's Social Security Number
☐ Individual	SSN: ___ ___ ___ - ___ ___ - ___ ___ ___ ___
☐ Other – Please identify: _____	FEIN: ____ ____ - ____ ____ ____ ____ ____ ____

UNDER PENALTIES OF PERJURY, I CERTIFY THE INFORMATION PROVIDED ON THIS FORM IS TRUE, CORRECT, AND COMPLETE.

Signature: _____ Title: _____ Date: _____

Phone: (_____)_____ Fax: (_____)_____

*Website & Email address:*_____

*If minority/women owned business, list here:*_____

Vendor: Enter Name and Address Below

Vendor #: _____

School: _____

CONFIRMATION OF CALLED INSPECTION RECORDS

☐ 2009 International Building Code Called Inspection Records

	Called Inspection Type	Approval to Proceed Date	A/E or Qualified Inspector Signature	ISBE ID Number or A/E License Number
1.	Footing			
2.	Foundation			
3.	Concrete Slab / Under-floor			
4.	Lowest Floor Elevation			
5.	Framing			
6.	Lathe and Gypsum Board			
7.	Fire Resistant Penetrations			
8.	Energy Efficiency			
9.	Special Inspection			
10.	Final IBC			

☐ 2009 International Electrical Code (Appendix K) Called Inspection Records

	Called Inspection Type	Approval to Proceed Date	A/E or Qualified Inspector Signature	ISBE ID Number or A/E License Number
1.	Prefabricated Assembly Evaluation Report			
2.	Underground			
3.	Rough-in			
4.	Final IEC			

☐ 2009 International Energy Conservation Code Called Inspection Records

	Called Inspection Type	Approval to Proceed Date	A/E or Qualified Inspector Signature	ISBE ID Number or A/E License Number
1.	Foundation (thermal envelope)			
2.	Framing (thermal envelope)			
3.	Insulation (thermal envelope)			
4.	Rough-in "Okay to Cover" (mechanical, service water heating, electrical, lighting)			
5.	Final (mechanical, service water heating, electrical, lighting)			
6.	Final IECC			

☐ 2009 International Fire Code Called Inspection Records

	Called Inspection Type	Approval to Proceed Date	A/E or Qualified Inspector Signature	ISBE ID Number or A/E License Number
1.	Final IFC			

☐ 2009 International Mechanical and Fuel Gas Code Called Inspection Records

	Called Inspection Type	Approval to Proceed Date	A/E or Qualified Inspector Signature	ISBE ID Number or A/E License Number
1.	Prefabricated Assembly Evaluation Report			
2.	Underground Piping			
3.	Rough-in			
4.	Final IMC & IFGC			

AIA® Document A305™ – 1986

Contractor's Qualification Statement

The Undersigned certifies under oath that the information provided herein is true and sufficiently complete so as not to be misleading.

SUBMITTED TO:

ADDRESS:

SUBMITTED BY:

NAME:

ADDRESS:

PRINCIPAL OFFICE:

[ ] Corporation
[ ] Partnership
[ ] Individual
[ ] Joint Venture
[ ] Other

NAME OF PROJECT: *(if applicable)* Sample

TYPE OF WORK: *(file separate form for each Classification of Work)*

[ ] General Construction
[ ] HVAC
[ ] Electrical
[ ] Plumbing
[ ] Other: *(Specify)*

§ 1 ORGANIZATION

§ 1.1 How many years has your organization been in business as a Contractor?

§ 1.2 How many years has your organization been in business under its present business name?

§ 1.2.1 Under what other or former names has your organization operated?

§ 1.3 If your organization is a corporation, answer the following:

§ 1.3.1 Date of incorporation:

§ 1.3.2 State of incorporation:

§ 1.3.3 President's name:

ADDITIONS AND DELETIONS:
The author of this document has added information needed for its completion. The author may also have revised the text of the original AIA standard form. An *Additions and Deletions Report* that notes added information as well as revisions to the standard form text is available from the author and should be reviewed. A vertical line in the left margin of this document indicates where the author has added necessary information and where the author has added to or deleted from the original AIA text.

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

This form is approved and recommended by the American Institute of Architects (AIA) and The Associated General Contractors of America (AGC) for use in evaluating the qualifications of contractors. No endorsement of the submitting party or verification of the information is made by AIA or AGC.

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User Notes: (1230461227)

§ **1.3.4** Vice-president's name(s)

§ **1.3.5** Secretary's name:
§ **1.3.6** Treasurer's name:

§ **1.4** If your organization is a partnership, answer the following:
§ **1.4.1** Date of organization:
§ **1.4.2** Type of partnership (if applicable):
§ **1.4.3** Name(s) of general partner(s)

§ **1.5** If your organization is individually owned, answer the following:
§ **1.5.1** Date of organization:
§ **1.5.2** Name of owner:

§ **1.6** If the form of your organization is other than those listed above, describe it and name the principals:

§ 2 LICENSING

§ **2.1** List jurisdictions and trade categories in which your organization is legally qualified to do business, and indicate registration or license numbers, if applicable.

§ **2.2** List jurisdictions in which your organization's partnership or trade name is filed.

§ 3 EXPERIENCE

§ **3.1** List the categories of work that your organization normally performs with its own forces.

§ **3.2** Claims and Suits. (If the answer to any of the questions below is yes, please attach details.)
§ **3.2.1** Has your organization ever failed to complete any work awarded to it?

§ **3.2.2** Are there any judgments, claims, arbitration proceedings or suits pending or outstanding against your organization or its officers?

§ **3.2.3** Has your organization filed any law suits or requested arbitration with regard to construction contracts within the last five years?

§ **3.3** Within the last five years, has any officer or principal of your organization ever been an officer or principal of another organization when it failed to complete a construction contract? (If the answer is yes, please attach details.)

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User Notes: (1230461227)

§ 3.4 On a separate sheet, list major construction projects your organization has in progress, giving the name of project, owner, architect, contract amount, percent complete and scheduled completion date.

§ 3.4.1 State total worth of work in progress and under contract:

§ 3.5 On a separate sheet, list the major projects your organization has completed in the past five years, giving the name of project, owner, architect, contract amount, date of completion and percentage of the cost of the work performed with your own forces.

§ 3.5.1 State average annual amount of construction work performed during the past five years:

§ 3.6 On a separate sheet, list the construction experience and present commitments of the key individuals of your organization.

§ 4 REFERENCES

§ 4.1 Trade References:

§ 4.2 Bank References:

§ 4.3 Surety:

§ 4.3.1 Name of bonding company:

§ 4.3.2 Name and address of agent:

§ 5 FINANCING

§ 5.1 Financial Statement.

§ 5.1.1 Attach a financial statement, preferably audited, including your organization's latest balance sheet and income statement showing the following items:

Current Assets (e.g., cash, joint venture accounts, accounts receivable, notes receivable, accrued income, deposits, materials inventory and prepaid expenses);

Net Fixed Assets;

Other Assets;

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Current Liabilities (e.g., accounts payable, notes payable, accrued expenses, provision for income taxes, advances, accrued salaries and accrued payroll taxes);

Other Liabilities (e.g., capital, capital stock, authorized and outstanding shares par values, earned surplus and retained earnings).

§ 5.1.2 Name and address of firm preparing attached financial statement, and date thereof:

§ 5.1.3 Is the attached financial statement for the identical organization named on page one?

§ 5.1.4 If not, explain the relationship and financial responsibility of the organization whose financial statement is provided (e.g., parent-subsidiary).

§ 5.2 Will the organization whose financial statement is attached act as guarantor of the contract for construction?

§ 6 SIGNATURE

§ 6.1 Dated at this day of

Name of Organization:

By:

Title:

§ 6.2

M being duly sworn deposes and says that the information provided herein is true and sufficiently complete so as not to be misleading.

Subscribed and sworn before me this day of

Notary Public:

My Commission Expires:

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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 20__.

BETWEEN the Owner:

Board of Education of Rockford School District No.205
Winnebago and Boone Counties, Illinois
501 7th Street
Rockford, Illinois 61104

and the Contractor:
(Paragraphs deleted)

for the following Project:

Bid No.

_____
_____
_____

The Architect:

Program Manager:

The Owner and Contractor agree as follows.

Owner is an Illinois public school district. This Contract is the result of the award of a publicly bid contract pursuant to the provisions of the Illinois School Code pertaining to public contracts, particularly the provisions of 105 ILCS 5/10-20.21. The invitation to bid No. , all amendments thereof and Contractor's bid all form a part of this Contract. The terms of Illinois statutes applicable hereto shall govern all terms and conditions of this contract as though fully set forth herein.

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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) AIA Document A201-2007, as revised by Owner, Drawings, Specifications, Addenda issued prior to execution of this Agreement with Bid No. , 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 Work is comprised of multiple dates of commencement of the Work. The construction start date, substantial completion date and final completion date are as follows:

Construction start date:
Substantial completion date:

Final Completion date: _____

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

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 consistent with the award of a public bid # awarded by Owner to Contractor shall be the total contract sum of
( ) subject to additions and deductions as provided in the Contract Documents.

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§ 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:

§ 4.3 Unit prices, if

any, including all associated costs including, but not limited to, excavation, backfilling offsite transportation/site fee, labor, overhead, insurance and bond:
§ 4.4 Allowances included in the Contract Sum, if any:

ARTICLE 5 PAYMENTS

§ 5.1 PAYMENTS
§ 5.1.1 Based upon Applications for Payment submitted to and approved by the Architect by the Contractor and Certificates for Payment issued by the Architect, the Owner shall make payments on account of the Contract Sum to the Contractor pursuant to its policies and procedures more fully explained in the Addendum attached hereto and made a part hereof marked Exhibit A, and as provided elsewhere in the Contract Documents.

§ 5.1.2 Contractor shall submit to the Architect not more than one Application for Payment per month. The payment may cover a time period up to and including the date of submission of the draft Application for Payment. Contractor shall submit a draft Application for Payment on or before the date established by Program Manager. A supplemental Application for Payment may be required at the end of Owner's School Year (June 30).

§ 5.1.3 Payments to Contractor shall be pursuant to the policies and procedures of Owner as set forth in Addendum Exhibit A attached.

§ 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 payment shall be the amount of Architect approved certificate for payment 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 TEN percent (10.00%). 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 as revised by Owner;

.2 Subtract the aggregate of previous payments made by the Owner.

§ 5.1.7 The 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

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

NONE

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§ 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, as revised by Owner, 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:

In accordance with Owners policies and procedures for payment as described in the Addendum Exhibit A attached hereto.

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 as revised by Owner.

§ 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, as revised by Owner, the method of binding dispute resolution shall be as follows:
Owner and Contractor may but shall not be required to submit claims to arbitration or mediation. If Owner and Contractor each independently agree to mediation or arbitration of claims, such mediation and arbitration shall proceed according to the provisions of AIA Document A201-2007 as revised by Owner. Mediation or arbitration may be requested by either party in writing. If the responding party declines to mediate or arbitrate or fails to respond to the request within 7 days of receipt of a request the sole remedy and method of dispute resolution for such claim shall be litigation in a court of competent

jurisdiction. **Jurisdiction for purposes of this Agreement and all parties hereto shall be the laws of the State of Illinois and venue shall lie in the 17th Judicial Circuit Court, Winnebago County, Illinois.**

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 as revised by Owner.

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

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; however, in the case of AIA Document A201-2007, it shall refer to AIA Document A201-2007 as revised by Owner and attached as Exhibit B.

§ 8.2 The Owner's representative:

Todd Schmidt
Chief of Operations
Rockford Public Schools
501 Seventh Street
Rockford, Illinois 61104

§ 8.3 The

Contractor's representative:

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§ 8.4

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

§ 8.5 Other provisions:
If Owner has contracted with a Program Manager for this project, in all cases in which notices are required or permitted to be given by Contractor, a copy of each such notice shall be simultaneously given to Program Manager.

Program Manager:

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 as revised by Owner.

§ 9.1.2 The General Conditions are AIA Document A201–2007 as revised by Owner and attached hereto marked Exhibit B, General Conditions of the Contract for Construction and Supplementary Conditions attached to Bid 14-52.

§ 9.1.3 The Supplementary and other Conditions of the Contract:

As contained in the Invitation to Bid # and as attached hereto marked Exhibit C.

§ 9.1.4 The Specifications:

As set forth in invitation to bid # and addenda thereto attached hereto as Exhibit C and D.

§ 9.1.5 The Drawings:

As set forth in invitation to bid # and addenda thereto attached hereto as Exhibit C and D.

§ 9.1.6 The Addenda, if any:

As set forth and referenced in the document attached hereto marked Exhibit D.

§ 9.1.7 Documents forming the Contract Documents:

1. The Addendum attached hereto marked Exhibit A
2. General Conditions attached hereto marked as Exhibit B.
3. Bid No. issued by Owner attached as Exhibit C (compact disk).

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4. Addenda to Bid as referenced and attached as Exhibit D (compact disk).
5. Contractor's bid dated attached hereto as Exhibit E.

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, as revised by Owner and attached hereto and including the Supplementary Conditions issued by Owner.

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

OWNER:

BOARD OF EDUCATION OF ROCKFORD SCHOOL DISTRICT NO. 205, WINNEBAGO AND BOONE COUNTIES, ILLINOIS

BY: _____
ITS PRESIDENT

ATTEST: _____
ITS SECRETARY

CONTRACTOR:

BY: _____
ITS PRESIDENT

ATTEST: _____
ITS SECRETARY

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ACORD®

CERTIFICATE OF LIABILITY INSURANCE

DATE (MM/DD/YYYY)

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 #
INSURER A :	
INSURER B :	
INSURER C :	
INSURER D :	
INSURER E :	
INSURER F :	

INSURED

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 INSR	SUBR WVD	POLICY NUMBER	POLICY EFF (MM/DD/YYYY)	POLICY EXP (MM/DD/YYYY)	LIMITS	
	GENERAL LIABILITY						EACH OCCURRENCE	$
	☐ COMMERCIAL GENERAL LIABILITY						DAMAGE TO RENTED PREMISES (Ea occurrence)	$
	☐ CLAIMS-MADE ☐ OCCUR						MED EXP (Any one person)	$
							PERSONAL & ADV INJURY	$
							GENERAL AGGREGATE	$
	GEN'L AGGREGATE LIMIT APPLIES PER:						PRODUCTS - COMP/OP AGG	$
	☐ POLICY ☐ PRO-JECT ☐ LOC							$
	AUTOMOBILE LIABILITY						COMBINED SINGLE LIMIT (Ea accident)	$
	☐ ANY AUTO						BODILY INJURY (Per person)	$
	☐ ALL OWNED AUTOS ☐ SCHEDULED AUTOS						BODILY INJURY (Per accident)	$
	☐ HIRED AUTOS ☐ NON-OWNED AUTOS						PROPERTY DAMAGE (Per accident)	$
								$
	UMBRELLA LIAB ☐ OCCUR						EACH OCCURRENCE	$
	EXCESS LIAB ☐ CLAIMS-MADE						AGGREGATE	$
	DED ☐ RETENTION $							$
	WORKERS COMPENSATION AND EMPLOYERS' LIABILITY Y / N						WC STATU-TORY LIMITS ☐ OTH-ER	
	ANY PROPRIETOR/PARTNER/EXECUTIVE OFFICE/MEMBER EXCLUDED? ☐ N / A						E.L. EACH ACCIDENT	$
	(Mandatory in NH) If yes, describe under DESCRIPTION OF OPERATIONS below						E.L. DISEASE - EA EMPLOYEE	$
							E.L. DISEASE - POLICY LIMIT	$

DESCRIPTION OF OPERATIONS / LOCATIONS / VEHICLES (Attach ACORD 101, Additional Remarks Schedule, if more space is required)

CERTIFICATE HOLDER

Rockford Public School District 205
Attn: Jim Heathscott
501 Seventh Street
Rockford, IL 61104

CANCELLATION

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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SECTION 011000
SUMMARY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Project information.
2. Work covered by Contract Documents.
3. Work under separate contracts.
4. Access to site.
5. Coordination with occupants.
6. Work restrictions.
7. Specification and drawing conventions.
8. Miscellaneous provisions.

B. Related Requirements:

1. Section 015000 "Temporary Facilities and Controls" for limitations and procedures governing temporary use of Owner's facilities.

1.3 PROJECT INFORMATION

A. Project Identification: Renovations to Washington Academy.

1. Project Location: 1421 West Street, Rockford, IL 61102.

B. Owner: Board of Education of Rockford School District No. 205, 501 Seventh Street, Rockford, Illinois 61104.

C. Architect: Richard L Johnson Associates, Inc., 4703 Charles Street, Rockford, IL 61108.

1.4 WORK COVERED BY CONTRACT DOCUMENTS

A. The Work of Project is defined by the Contract Documents and consists of the following:

1. Reroofing Work.
2. Window and Door Replacement Work
3. Boiler Replacement Work.

4. Canopy Renovation Work
5. Parking Lot Drainage Work
6. Mechanical, Plumbing and Electrical Work
7. Interior Renovation Work
8. A separate contract will be awarded for Asbestos Abatement work.

B. Contractor is responsible for construction means, methods and sequencing. Architect will not have control over, be in charge of, or be responsible for construction means, methods, techniques, sequences, procedures or safety precautions and programs in connection with the Work, as these are solely within the responsibility of the Contractor. Architect shall not be responsible for the Contractor's failure to carry out the Work in accordance with the Contract Documents.

1.5 WORK UNDER SEPARATE CONTRACTS

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

B. Concurrent Work: Owner will award a separate contract for the following construction operations at the project site. Those operations will be conducted simultaneously with work under the contract.

1. An Environmental Demolition Contractor (Asbestos Abatement) will be removing existing windows and doors prior to new window and door installation. These openings will be watertight prior to window and door replacement construction phase of this project.
2. The Environmental Demolition Contractor(Asbestos Abatement) will be responsible for making sure that, after they have remove any and all of the existing windows, that they are required to provide a weather-tight exterior seal as well as an interior seal, prior to the window subcontractor starting his scope of work.
3. Once the Window Contractor removes any of the Demolition Contractor's weather-tight seals, it will be the Window Contractor's responsibility to provide any and all exterior and interior weather-tight seals as required to complete their scope of work.
4. The Environmental Demolition Contractor (Asbestos Abatement) will be responsible for Asbestos Abatement Work in the Boiler Room.
5. The Environmental Demolition Contractor (Asbestos Abatement) will be responsible for Asbestos Abatement Work of interior material as listed on the drawings.

1.6 ACCESS TO SITE

A. General: Contractor shall have limited use of Project site for construction operations as indicated on Drawings by the Contract limits and as indicated by requirements of this Section.

1. Driveways, Walkways and Entrances: Keep driveways loading areas, and entrances serving premises clear and available to Owner, Owner's employees, and

emergency vehicles at all times. Do not use these areas for parking or storage of materials.

a. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.

B. Condition of Existing Building: Maintain portions of existing building affected by construction operations in a weathertight condition throughout construction period. Repair damage caused by construction operations.

1.7 COORDINATION WITH OCCUPANTS

A. Partial Owner Occupancy: Owner will occupy the premises during entire construction period, with the exception of areas under construction. Cooperate with Owner during construction operations to minimize conflicts and facilitate Owner usage. Perform the Work so as not to interfere with Owner's operations. Maintain existing exits unless otherwise indicated.

1. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities. Do not close or obstruct walkways, corridors, or other occupied or used facilities without written permission from Owner and authorities having jurisdiction.
2. Provide not less than 72 hours' notice to Owner of activities that will affect Owner's operations.

1.8 WORK RESTRICTIONS

A. Work Restrictions, General: Comply with restrictions on construction operations.

1. Comply with limitations on use of public streets and with other requirements of authorities having jurisdiction.

B. On-Site Work Hours: Normal business working hours will be 7:00 a.m. to 3:30 p.m., Monday through Friday. However, Contractor can work weekends and nights with prior notification to the Owner.

C. Noise, Vibration, and Odors: Coordinate operations that may result in high levels of noise and vibration, odors, or other disruption to Owner occupancy with Owner.

1. Notify Architect and Owner not less than two days in advance of proposed disruptive operations.

D. Nonsmoking Building: Smoking is not permitted within the building or anywhere on the site.

E. Controlled Substances: Use of tobacco products and other controlled substances on Project site is not permitted.

1.9 SPECIFICATION AND DRAWING CONVENTIONS

A. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:

1. Imperative mood and streamlined language are generally used in the Specifications. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.
2. Specification requirements are to be performed by Contractor unless specifically stated otherwise.

B. Division 01 General Requirements: Requirements of Sections in Division 01 apply to the Work of all Sections in the Specifications.

C. Drawing Coordination: Requirements for materials and products identified on Drawings are described in detail in the Specifications. One or more of the following are used on Drawings to identify materials and products:

1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.
2. Abbreviations: Materials and products are identified by abbreviations published as part of the U.S. National CAD Standard and scheduled on Drawings.
3. Keynoting: Materials and products are identified by reference keynotes referencing Specification Section numbers found in this Project Manual.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 011000

SECTION 012200
UNIT PRICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for unit prices.

B. Related Requirements:

1. Section 012600 "Contract Modification Procedures" for procedures for submitting and handling Change Orders.
2. Section 014000 "Quality Requirements" for general testing and inspecting requirements.

1.3 DEFINITIONS

A. Unit price is a price per unit of measurement for materials, equipment, or services, or a portion of the Work, **added to or deducted** from the Contract Sum by appropriate modification, if the scope of Work or estimated quantities of Work required by the Contract Documents are increased or decreased. **Contractor to include one unit cost that would be the same cost to add or deduct from the contract for each unit price**.

1.4 PROCEDURES

A. Unit prices include all necessary material, plus cost for delivery, installation, insurance, overhead, and profit.

B. Measurement and Payment: See individual Specification Sections for work that requires establishment of unit prices. Methods of measurement and payment for unit prices are specified in those Sections.

C. Owner reserves the right to reject Contractor's measurement of work-in-place that involves use of established unit prices and to have this work measured, at Owner's expense, by an independent surveyor acceptable to Contractor.

D. List of Unit Prices: A schedule of unit prices is included in Part 3. See drawings and specifications for more information regarding the unit prices.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF UNIT PRICES

A. Unit Price 1: Provide for a complete installation of new duplex receptacle. Including 100'-0" of wiring and conduit or surface raceway to nearest available panelboard.

B. Unit Price 2: Provide for a complete installation of new 100 amp, 120/208V,3PH,4W, main breaker panelboard with forty-two (42), 20A/1P circuits. Include 200'-0" of wiring and conduit to nearest new switchboard "WES-SBLA" or "WES-SBLB", with new 100A over-current protection device at switchboard. Provide Four (4) No. 3 THWN wires and #8 ground in 1-1/2" conduit.

C. Unit Price 3: Provide for a complete installation of new 200 amp, 120/208V,3PH,4W, main breaker panelboard with forty-two (42), 20A/1P circuits. Include 200'-0" of wiring and conduit to nearest new switchboard "WES-SBLA" or "WES-SBLB", with new 200A over-current protection device at switchboard. Provide Four (4) No. 3/0 THWN wires and #6 ground in 2-1/2" conduit.

D. Unit Price 4: Provide pneumatic to wireless thermostat including all labor, materials, and programming for a complete installation of thermostat.

E. Unit Price 5: Provide moisture mitigation to existing concrete slabs prior to the new flooring being installed. Contractor to include in the Base Bid the cost to provide moisture mitigation to 1,000 sf of existing concrete slab. Once the actual square footage of moisture mitigation is required during construction, the unit prices will be used to adjust the contract amount.

END OF SECTION 012200

SECTION 012300
ALTERNATES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for alternates.

1.3 DEFINITIONS

A. Alternate: An amount proposed by bidders and stated on the Bid Form for certain work defined in the bidding requirements that may be added to or deducted from the base bid amount if Owner decides to accept a corresponding change either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.

1. Alternates described in this Section are part of the Work only if enumerated in the Agreement.
2. The cost or credit for each alternate is the net addition to or deduction from the Contract Sum to incorporate alternate into the Work. No other adjustments are made to the Contract Sum.

1.4 PROCEDURES

A. Coordination: Revise or adjust affected adjacent work as necessary to completely integrate work of the alternate into Project.

1. Include as part of each alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation whether or not indicated as part of alternate.

B. Notification: Immediately following award of the Contract, notify each party involved, in writing, of the status of each alternate. Indicate if alternates have been accepted, rejected, or deferred for later consideration.

C. Execute accepted alternates under the same conditions as other work of the Contract.

D. Schedule: A schedule of alternates is included at the end of this Section.

PART 2 - EXECUTION

2.1 SCHEDULE OF ALTERNATES

A. Add Alternate No. 1.

1. Alternate Bid: At West Entrance,

a. Environmental Demolition Contractor (Asbestos Abatement) to remove doors, framing, glass and hardware from west entrance and install plywood and framing to fill openings.
b. General Contractor to remove plywood and framing and turn over to Asbestos Contractor and install new doors, frames, glass and hardware.
c. General Contractor to provide all site work shown on the Civil drawings.

B. Add Alternate No. 2.

1. Environmental Demolition Contractor (Asbestos Abatement) to remove glass block from locations as shown on drawings and install plywood and framing to fill openings.
2. General Contractor to remove plywood and framing and turn over to Asbestos Contractor and install new window system as detailed.

C. Add Alternate No. 3.

1. General Contractor to paint existing decorative grilles.

D. Add Alternate No. 4.

1. Replace panelboards and associated feeders as shown on drawings and specifications.

E. Add Alternate No. 5.

1. Provide a factory painted finish in a standard color on the aluminum window systems in lieu of the natural anodized aluminum.

F. Add Alternate No. 6.

1. Renovate the canopies including new lighting. Reroofing of the canopies is included under the Base Bid.

G. Alternate No. 7 - Omitted from the project.

H. Add Alternate No. 8.

1. Provide air handling renovation work as shown on the drawings and specifications.

I. Add Alternate No. 9.

1. Provide wireless thermostats in locations shown on the drawings.

J. Add Alternate No. 10.

1. Provide power receptacles in locations shown on the drawings.

PART 3 - END OF SECTION 012300

SECTION 012500
SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for substitutions.

B. Related Requirements:

1. Section 012300 "Alternates" for products selected under an alternate.
2. Section 016000 "Product Requirements" for requirements for submitting comparable product submittals for products by listed manufacturers.

1.3 DEFINITIONS

A. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.

1. Substitutions for Cause: Changes proposed by Contractor that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms.
2. Substitutions for Convenience: Changes proposed by Contractor or Owner that are not required in order to meet other Project requirements but may offer advantage to Contractor or Owner.

1.4 ACTION SUBMITTALS

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

1. Substitution Request Form: Provide on Contractor’s letterhead.
2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:

a. Statement indicating why specified product or fabrication or installation cannot be provided, if applicable.
b. Coordination information, including a list of changes or revisions needed to other parts of the Work and to construction performed by Owner and separate contractors, that will be necessary to accommodate proposed substitution.

c. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Include annotated copy of applicable Specification Section. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.
d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
e. Samples, where applicable or requested.
f. Certificates and qualification data, where applicable or requested.
g. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners.
h. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
i. Research reports evidencing compliance with building code in effect for Project.
j. Detailed comparison of Contractor's construction schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.
k. Cost information, including a proposal of change, if any, in the Contract Sum.
l. Contractor's certification that proposed substitution complies with requirements in the Contract Documents except as indicated in substitution request, is compatible with related materials, and is appropriate for applications indicated.
m. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.

3. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within seven days of receipt of a request for substitution. Architect will notify Contractor of acceptance or rejection of proposed substitution within 15 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.

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

1.5 QUALITY ASSURANCE

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

1.6 PROCEDURES

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

PART 2 - PRODUCTS

2.1 SUBSTITUTIONS

A. Substitutions for Cause: Submit requests for substitution immediately on discovery of need for change, but not later than 15 days prior to time required for preparation and review of related submittals.

1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:

a. Requested substitution is consistent with the Contract Documents and will produce indicated results.
b. Substitution request is fully documented and properly submitted.
c. Requested substitution will not adversely affect Contractor's construction schedule.
d. Requested substitution has received necessary approvals of authorities having jurisdiction.
e. Requested substitution is compatible with other portions of the Work.
f. Requested substitution has been coordinated with other portions of the Work.
g. Requested substitution provides specified warranty.
h. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

PART 3 - EXECUTION (Not Used)

END OF SECTION 012500

SECTION 012600
CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for handling and processing Contract modifications.

1.3 MINOR CHANGES IN THE WORK

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

1.4 PROPOSAL REQUESTS

A. Owner-Initiated Proposal Requests: Architect will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.

1. Work Change Proposal Requests issued by Architect are not instructions either to stop work in progress or to execute the proposed change.
2. Within time specified in Proposal Request or 10 days, when not otherwise specified, after receipt of Proposal Request, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.

    a. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
    b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
    c. Include costs of labor and supervision directly attributable to the change.
    d. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.

B. Contractor-Initiated Proposals: If latent or changed conditions require modifications to the Contract, Contractor may initiate a claim by submitting a request for a change to Architect.

1. Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.
2. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
4. Include costs of labor and supervision directly attributable to the change.
5. Include an updated Contractor's construction schedule.

1.5 CHANGE ORDER PROCEDURES

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

B. The combined overhead and profit included in the total cost to the Owner for a change in the Work shall be based on the following schedule:

1. For the Contractor, for Work performed by the Contractor's own forces, twelve percent of the cost.

2. For the Contractor, for Work performed by the Subcontractor's, five percent of the amount due the Subcontractors.

3. For each Subcontractor involved, for Work performed by the Subcontractor's own forces, five percent of the cost.

4. For each Subcontractor involved, for Work performed by the Subcontractor's Sub-subcontractors, five percent of the amount due the Sub-subcontractor.

5. In order to facilitate checking of quotations for extras and credits, all proposals, except those so minor that their propriety can be seen by inspection, shall be accompanied by a complete itemization of costs including labor, materials and Subcontracts. Labor and materials shall be itemized in the manner prescribed above. Where major cost items are Subcontracts, they shall be itemized also.

1.6 CONSTRUCTION CHANGE DIRECTIVE

A. Construction Work Change Directive: Architect may issue a Construction Work Change Directive on AIA Document G714 Change Directive instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.

1. Construction Change Directive contains a complete description of change in the Work. It also designates method to be followed to determine change in the Contract Sum or the Contract Time.

B. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.

1. After completion of change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

END OF SECTION 012600

SECTION 012900
PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements necessary to prepare and process Applications for Payment.

B. Related Requirements:

1. Section 012600 "Contract Modification Procedures" for administrative procedures for handling changes to the Contract.

1.3 DEFINITIONS

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

1.4 SCHEDULE OF VALUES

A. Coordination: Coordinate preparation of the schedule of values with preparation of Contractor's construction schedule.

1. Coordinate line items in the schedule of values with other required administrative forms and schedules, including the following:

   a. Application for Payment forms with continuation sheets.
   b. Submittal schedule.
   c. Items required to be indicated as separate activities in Contractor's construction schedule.

2. Submit the schedule of values to Architect at earliest possible date, but no later than seven days before the date scheduled for submittal of initial Applications for Payment.
3. Subschedules for Phased Work: Where the Work is separated into phases requiring separately phased payments, provide subschedules showing values coordinated with each phase of payment.

B. Format and Content: Use Project Manual table of contents as a guide to establish line items for the schedule of values. Provide at least one line item for each Specification Section.

1. Identification: Include the following Project identification on the schedule of values:

   a. Project name and location.
   b. Name of Architect.
   c. Architect's project number.
   d. Contractor's name and address.
   e. Date of submittal.

2. Arrange schedule of values consistent with format of AIA Document G703.

3. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with Project Manual table of contents. Provide multiple line items for principal subcontract amounts in excess of five percent of the Contract Sum.

4. Round amounts to nearest whole dollar; total shall equal the Contract Sum.

5. Provide a separate line item in the schedule of values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.

   a. Differentiate between items stored on-site and items stored off-site. If required, include evidence of insurance.

6. Each item in the schedule of values and Applications for Payment shall be complete. Include total cost and proportionate share of general overhead and profit for each item.

   a. Temporary facilities and other major cost items that are not direct cost of actual work-in-place may be shown either as separate line items in the schedule of values or distributed as general overhead expense, at Contractor's option.

7. Schedule Updating: Update and resubmit the schedule of values before the next Applications for Payment when Change Orders or Construction Change Directives result in a change in the Contract Sum.

1.5 APPLICATIONS FOR PAYMENT

A. Each Application for Payment following the initial Application for Payment shall be consistent with previous applications and payments as certified by Architect and paid for by Owner.

1. Initial Application for Payment, Application for Payment at time of Substantial Completion, and final Application for Payment involve additional requirements.

B. Payment Application Times: The date for each progress payment is indicated in the Agreement between Owner and Contractor. The period of construction work covered by each Application for Payment is the period indicated in the Agreement.

C. Payment Application Times: Submit Application for Payment to Architect by the 10th of the month. The period covered by each Application for Payment is one month, ending on the last day of the month.

D. Application for Payment Forms: Use AIA Document G702 and AIA Document G703 as form for Applications for Payment.

E. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. Architect and/or Project Manager will return incomplete applications without action.

1. Entries shall match data on the schedule of values and Contractor's construction schedule. Use updated schedules if revisions were made.
2. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.

F. Transmittal: Submit three signed and notarized original copies of each Application for Payment to Architect or Program Manager by a method ensuring receipt within 24 hours. One copy shall include waivers of lien and similar attachments if required.

1. Transmit each copy with a transmittal form listing attachments and recording appropriate information about application.

G. Waivers of Mechanic's Lien: With each Application for Payment, submit waivers of mechanic's lien from entities lawfully entitled to file a mechanic's lien arising out of the Contract and related to the Work covered by the payment.

1. Submit partial waivers on each item for amount requested in previous application, after deduction for retainage, on each item.
2. When an application shows completion of an item, submit conditional final or full waivers.
3. Owner reserves the right to designate which entities involved in the Work must submit waivers.
4. Waiver Forms: Submit executed waivers of lien on forms acceptable to Owner.

H. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:

1. List of subcontractors.
2. Schedule of values.
3. Contractor's construction schedule (preliminary if not final).
4. Submittal schedule (preliminary if not final).
5. List of Contractor's staff assignments.
6. List of Contractor's principal consultants.
7. Copies of building permits.
8. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
9. Initial progress report.
10. Certificates of insurance and insurance policies.
11. Performance and payment bonds.

I. Application for Payment at Substantial Completion: After Architect issues the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion for portion of the Work claimed as substantially complete.

1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.
2. This application shall reflect Certificate(s) of Substantial Completion issued previously for Owner occupancy of designated portions of the Work.

J. Final Payment Application: After completing Project closeout requirements, submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:

1. Evidence of completion of Project closeout requirements.
2. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
3. Updated final statement, accounting for final changes to the Contract Sum.
4. AIA Document G706-1994, "Contractor's Affidavit of Payment of Debts and Claims."
5. AIA Document G706A-1994, "Contractor's Affidavit of Release of Liens."
6. AIA Document G707-1994, "Consent of Surety to Final Payment."

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012900

SECTION 013100
PROJECT MANAGEMENT & COORDINATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:

1. Coordination drawings.
2. Requests for Information (RFIs).
3. Project meetings.

B. Related Requirements:

1. Section 011200 "Multiple Contract Summary" for a description of the division of work among separate contracts and responsibility for coordination activities not in this Section.
2. Section 017300 "Execution" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.

1.3 DEFINITIONS

A. RFI: Request from Owner, Architect, or Contractor seeking information required by or clarifications of the Contract Documents.

1.4 INFORMATIONAL SUBMITTALS

A. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:

1. Name, address, and telephone number of entity performing subcontract or supplying products.
2. Number and title of related Specification Section(s) covered by subcontract.
3. Drawing number and detail references, as appropriate, covered by subcontract.

1.5 GENERAL COORDINATION PROCEDURES

A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations, included in different Sections that depend on each other for proper installation, connection, and operation.

1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
2. Coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair.
3. Make adequate provisions to accommodate items scheduled for later installation.

B. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities and activities of other contractors to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:

1. Preparation of Contractor's construction schedule.
2. Preparation of the schedule of values.
3. Installation and removal of temporary facilities and controls.
4. Delivery and processing of submittals.
5. Progress meetings.
6. Preinstallation conferences.
7. Project closeout activities.
8. Startup and adjustment of systems.

1.6 COORDINATION DRAWINGS

A. Coordination Drawings, General: Prepare coordination drawings according to requirements in individual Sections, and additionally where installation is not completely shown on Shop Drawings, where limited space availability necessitates coordination, or if coordination is required to facilitate integration of products and materials fabricated or installed by more than one entity.

1. Content: Project-specific information, drawn accurately to a scale large enough to indicate and resolve conflicts. Do not base coordination drawings on standard printed data. Include the following information, as applicable:

    a. Use applicable Drawings as a basis for preparation of coordination drawings. Prepare sections, elevations, and details as needed to describe relationship of various systems and components.
    b. Coordinate the addition of trade-specific information to the coordination drawings by multiple contractors in a sequence that best provides for coordination of the information and resolution of conflicts between installed components before submitting for review.

1.7 REQUESTS FOR INFORMATION (RFIs)

A. General: Immediately on discovery of the need for additional information or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI in the form specified.

1. Architect will return RFIs submitted to Architect by other entities controlled by Contractor with no response.
2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.

B. Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:

1. Project name.
2. Project number.
3. Date.
4. Name of Contractor.
5. Name of Architect.
6. RFI number, numbered sequentially.
7. RFI subject.
8. Specification Section number and title and related paragraphs, as appropriate.
9. Drawing number and detail references, as appropriate.
10. Field dimensions and conditions, as appropriate.
11. Contractor's suggested resolution. If Contractor's suggested resolution impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
12. Contractor's signature.
13. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.

C. RFI Forms: AIA Document G716.

1. Attachments shall be electronic files in Adobe Acrobat PDF format.

D. Architect's Action: Architect and will review each RFI, determine action required, and respond. Allow seven working days for Architect's response for each RFI. RFIs received by Architect after 1:00 p.m. will be considered as received the following working day.

1. The following Contractor-generated RFIs will be returned without action:

a. Requests for approval of submittals.
b. Requests for approval of substitutions.
c. Requests for approval of Contractor's means and methods.
d. Requests for coordination information already indicated in the Contract Documents.
e. Requests for adjustments in the Contract Time or the Contract Sum.
f. Requests for interpretation of Architect's actions on submittals.
g. Incomplete RFIs or inaccurately prepared RFIs.

2. Architect's action may include a request for additional information, in which case Architect's time for response will date from time of receipt of additional information.
3. Architect's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Section 012600 "Contract Modification Procedures."

1.8 PROJECT MEETINGS

A. General Contractor: Schedule and conduct meetings and conferences at Project site unless otherwise indicated.

1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Architect of scheduled meeting dates and times.
2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
3. Minutes: Entity responsible for conducting meeting will record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner, and Architect, within three days of the meeting.

B. Preconstruction Conference: Architect will schedule and conduct a preconstruction conference before starting construction, at a time convenient to Owner and Architect.

1. Attendees: Authorized representatives of Owner, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. Participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
2. Agenda: Discuss items of significance that could affect progress, including the following:

    a. Tentative construction schedule.
    b. Phasing.
    c. Critical work sequencing and long-lead items.
    d. Designation of key personnel and their duties.
    e. Lines of communications.
    f. Procedures for processing field decisions and Change Orders.
    g. Procedures for RFIs.
    h. Procedures for testing and inspecting.
    i. Procedures for processing Applications for Payment.
    j. Distribution of the Contract Documents.
    k. Submittal procedures.
    l. Preparation of record documents.
    m. Use of the premises and existing building.
    n. Work restrictions.
    o. Working hours.
    p. Owner's occupancy requirements.
    q. Responsibility for temporary facilities and controls.
    r. Procedures for moisture and mold control.
    s. Procedures for disruptions and shutdowns.
    t. Construction waste management and recycling.
    u. Parking availability.

v. Office, work, and storage areas.
w. Equipment deliveries and priorities.
x. First aid.
y. Security.
z. Progress cleaning.

3. Minutes: Entity responsible for conducting meeting will record and distribute meeting minutes.

C. Progress Meetings: General Contractor to conduct progress meetings at weekly intervals.

1. Coordinate dates of meetings with preparation of payment requests.
2. Attendees: In addition to representatives of Owner, and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
3. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.

a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.

1) Review schedule for next period.

b. Review present and future needs of each entity present, including the following:

1) Interface requirements.
2) Sequence of operations.
3) Status of submittals.
4) Deliveries.
5) Off-site fabrication.
6) Access.
7) Site utilization.
8) Temporary facilities and controls.
9) Progress cleaning.
10) Quality and work standards.
11) Status of correction of deficient items.
12) Field observations.
13) Status of RFIs.
14) Status of proposal requests.
15) Pending changes.
16) Status of Change Orders.
17) Pending claims and disputes.
18) Documentation of information for payment requests.

4. Minutes: Entity responsible for conducting the meeting will record and distribute the meeting minutes to each party present and to parties requiring information.

    a. Schedule Updating: Revise Contractor's construction schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 013100

SECTION 013300
SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

B. Related Requirements:

1. Section 012900 "Payment Procedures" for submitting Applications for Payment and the schedule of values.
2. Section 017839 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.

1.3 DEFINITIONS

A. Action Submittals: Written and graphic information and physical samples that require Architect's responsive action. Action submittals are those submittals indicated in individual Specification Sections as "action submittals."

B. Informational Submittals: Written and graphic information and physical samples that do not require Architect's responsive action. Submittals may be rejected for not complying with requirements. Informational submittals are those submittals indicated in individual Specification Sections as "informational submittals."

1.4 ACTION SUBMITTALS

A. Submittal Schedule: Submit a schedule of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or revisions to submittals noted by Architect and additional time for handling and reviewing submittals required by those corrections.

1.5 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.

1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
2. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.
    a. Architect reserve the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

B. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.

1. Initial Review: Allow 5 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination.
2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
3. Resubmittal Review: Allow 15 days for review of each resubmittal.

C. Paper Submittals: Place a permanent label or title block on each submittal item for identification.

1. Indicate name of firm or entity that prepared each submittal on label or title block.
2. Provide a space approximately 6 by 8 inches (150 by 200 mm) on label or beside title block to record Contractor's review and approval markings and action taken by Architect.
3. Include the following information for processing and recording action taken:
    a. Project name.
    b. Date.
    c. Name of Architect.
    d. Name of Contractor.
    e. Name of subcontractor.
    f. Name of supplier.
    g. Name of manufacturer.
    h. Submittal number or other unique identifier, including revision identifier.
        1) Submittal number shall use Specification Section number followed by a decimal point and then a sequential number (e.g., 061000.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., 061000.01.A).
    i. Number and title of appropriate Specification Section.
    j. Drawing number and detail references, as appropriate.
    k. Location(s) where product is to be installed, as appropriate.
    l. Other necessary identification.

4. Additional Paper Copies: Unless additional copies are required for final submittal, and unless Architect observes noncompliance with provisions in the Contract Documents, initial submittal may serve as final submittal.

    a. Submit one copy of submittal to concurrent reviewer in addition to specified number of copies to Architect.

5. Transmittal for Paper Submittals: Assemble each submittal individually and appropriately for transmittal and handling. Transmit each submittal using a transmittal form. Architect will return without review submittals received from sources other than Contractor.

    a. Transmittal Form for Paper Submittals: Provide locations on form for the following information:

        1) Project name.
        2) Date.
        3) Destination (To:).
        4) Source (From:).
        5) Name and address of Architect.
        6) Name of Contractor.
        7) Name of firm or entity that prepared submittal.
        8) Names of subcontractor, manufacturer, and supplier.
        9) Category and type of submittal.
        10) Submittal purpose and description.
        11) Specification Section number and title.
        12) Specification paragraph number or drawing designation and generic name for each of multiple items.
        13) Drawing number and detail references, as appropriate.
        14) Indication of full or partial submittal.
        15) Transmittal number, numbered consecutively.
        16) Submittal and transmittal distribution record.
        17) Remarks.
        18) Signature of transmitter.

D. Electronic Submittals: Identify and incorporate information in each electronic submittal file as follows:

    1. Assemble complete submittal package into a single indexed file incorporating submittal requirements of a single Specification Section and transmittal form with links enabling navigation to each item.

PART 2 - PRODUCTS

2.1 SUBMITTAL PROCEDURES

A. General Submittal Procedure Requirements:

    1. Submit electronic submittals via email as PDF electronic files.

        a. Architect will return annotated file. Annotate and retain one copy of file as an electronic Project record document file.

2. Action Submittals: Submit three paper copies of each submittal unless otherwise indicated. Architect will return two copies.
3. Informational Submittals: Submit two paper copies of each submittal unless otherwise indicated. Architect will not return copies.
4. Certificates and Certifications Submittals: Provide a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.

    a. Provide a digital signature with digital certificate on electronically submitted certificates and certifications where indicated.
    b. Provide a notarized statement on original paper copy certificates and certifications where indicated.

B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.

1. If information must be specially prepared for submittal because standard published data are not suitable for use, submit as Shop Drawings, not as Product Data.
2. Mark each copy of each submittal to show which products and options are applicable.
3. Include the following information, as applicable:

    a. Manufacturer's catalog cuts.
    b. Manufacturer's product specifications.
    c. Standard color charts.
    d. Statement of compliance with specified referenced standards.
    e. Testing by recognized testing agency.
    f. Application of testing agency labels and seals.
    g. Notation of coordination requirements.
    h. Availability and delivery time information.

4. Submit Product Data before or concurrent with Samples.
5. Submit Product Data in the following format:

    a. PDF electronic file.
    b. Three paper copies of Product Data unless otherwise indicated. Architect will return two copies.

C. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data**,** unless submittal based on Architect's digital data drawing files is otherwise permitted.

1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:

    a. Identification of products.
    b. Schedules.
    c. Compliance with specified standards.
    d. Notation of coordination requirements.
    e. Notation of dimensions established by field measurement.
    f. Relationship and attachment to adjoining construction clearly indicated.
    g. Seal and signature of professional engineer if specified.

2. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches (215 by 280 mm), but no larger than 30 by 42 inches (750 by 1067 mm).
3. Submit Shop Drawings in the following format:

    a. PDF electronic file.
    b. Two opaque (bond) copies of each submittal. Architect will return one copy.

D. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed.

1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
2. Identification: Attach label on unexposed side of Samples that includes the following:

    a. Generic description of Sample.
    b. Product name and name of manufacturer.
    c. Sample source.
    d. Number and title of applicable Specification Section.
    e. Specification paragraph number and generic name of each item.

3. For projects where electronic submittals are required, provide corresponding electronic submittal of Sample transmittal, digital image file illustrating Sample characteristics, and identification information for record.
4. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.

    a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.
    b. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.

5. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.

    a. Number of Samples: Submit one full set of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect will return submittal with options selected.

6. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.

a. Number of Samples: Submit three sets of Samples. Architect will retain two Sample sets; remainder will be returned. Mark up and retain one returned Sample set as a project record sample.

1) Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
2) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least three sets of paired units that show approximate limits of variations.

E. Product Schedule: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:

1. Submit product schedule in the following format:

a. PDF electronic file.
b. Three paper copies of product schedule or list unless otherwise indicated. Architect will return two copies.

F. Coordination Drawing Submittals: Comply with requirements specified in Section 013100 "Project Management and Coordination."

G. Application for Payment and Schedule of Values: Comply with requirements specified in Section 012900 "Payment Procedures."

H. Test and Inspection Reports and Schedule of Tests and Inspections Submittals: Comply with requirements specified in Section 014000 "Quality Requirements."

I. Closeout Submittals and Maintenance Material Submittals: Comply with requirements specified in Section 017700 "Closeout Procedures."

J. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of architects and owners, and other information specified.

K. Installer Certificates: Submit written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.

L. Manufacturer Certificates: Submit written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.

M. Product Certificates: Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.

N. Material Certificates: Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.

O. Schedule of Test and Inspections: Comply with requirements specified in Section 014000 “Quality Requirements”.

P. Field Test Reports: Submit written reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.

PART 3 - EXECUTION

3.1 CONTRACTOR'S REVIEW

A. Action and Informational Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect.

B. Project Closeout and Maintenance Material Submittals: See requirements in Section 017700 "Closeout Procedures."

C. Contractor’s Review Stamp: review each submittal with a uniform, review stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

3.2 ARCHITECT'S ACTION

A. General: Architect will not review submittals that do not bear Contractor’s review stamp and will return them without action.

B. Action Submittals: Architect’s review is performed to determine general conformance with the design concept set forth in the Contract Documents. Review does not relieve Contractor of sole responsibility for means, methods, sequencing, scheduling of work, verification of quantities and dimensions or the performance of the work in a safe manner. No comments on the shop drawings will relieve the Contractor from performing the work in a manner consistent with the Contract Documents. Architect’s review will indicate action mark as follows:

1. Reviewed.
2. Note Comments.
3. Rejected.
4. Not reviewed/Outside scope of Services.
5. Resubmit After Required General Contractor Review.
6. Revise.
7. Resubmit.

C. Subcontractors are not to use shop drawings and submittals to ask questions or request information. All questions must be asked through the RFI.

D. Architect is not responsible for correcting errors in the shop drawings or submittals.

E. Informational Submittals: Architect will review each submittal and will not return it, or will return it if it does not comply with requirements. Architect will forward each submittal to appropriate party.

F. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.

G. Submittals not required by the Contract Documents may be returned by the Architect without action.

END OF SECTION 013300

SECTION 014200
REFERENCES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 DEFINITIONS

A. General: Basic Contract definitions are included in the Conditions of the Contract.

B. "Approved": When used to convey Architect's action on Contractor's submittals, applications, and requests, "approved" is limited to Architect's duties and responsibilities as stated in the Conditions of the Contract.

C. "Directed": A command or instruction by Architect. Other terms including "requested," "authorized," "selected," "required," and "permitted" have the same meaning as "directed."

D. "Indicated": Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including "shown," "noted," "scheduled," and "specified" have the same meaning as "indicated."

E. "Regulations": Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.

F. "Furnish": Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.

G. "Install": Unload, temporarily store, unpack, assemble, erect, place, anchor, apply, work to dimension, finish, cure, protect, clean, and similar operations at Project site.

H. "Provide": Furnish and install, complete and ready for the intended use.

I. "Project Site": Space available for performing construction activities. The extent of Project site is shown on Drawings and may or may not be identical with the description of the land on which Project is to be built.

1.3 INDUSTRY STANDARDS

A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.

B. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.

C. Copies of Standards: Each entity engaged in construction on Project should be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.

1. Where copies of standards are needed to perform a required construction activity, obtain copies directly from publication source.

1.4 ABBREVIATIONS AND ACRONYMS

A. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities indicated in the following list:

1. AA – Aluminum Association (The).
2. AIA - American Institute of Architects (The); www.aia.org.
3. AISC - American Institute of Steel Construction; www.aisc.org.
4. AISI - American Iron and Steel Institute; www.steel.org.
5. ANSI - American National Standards Institute; www.ansi.org.
6. ASTM - ASTM International; www.astm.org.
7. AWPA - American Wood Protection Association; www.awpa.com.
8. CSI - Construction Specifications Institute (The); www.csinet.org.
9. DASMA - Door and Access Systems Manufacturers Association; www.dasma.com.
10. DHI - Door and Hardware Institute; www.dhi.org.
11. GANA - Glass Association of North America; www.glasswebsite.com.
12. ICBO - International Conference of Building Officials; (See ICC).
13. ICC - International Code Council; www.iccsafe.org.
14. IGMA - Insulating Glass Manufacturers Alliance; www.igmaonline.org.
15. NFPA - National Fire Protection Association; www.nfpa.org.
16. NFPA - NFPA International; (See NFPA).
17. NFRC - National Fenestration Rating Council; www.nfrc.org.
18. NOMMA - National Ornamental & Miscellaneous Metals Association; www.nomma.org.
19. SPIB - Southern Pine Inspection Bureau; www.spib.org.
20. UL - Underwriters Laboratories Inc.; www.ul.com.
21. WCMA - Window Covering Manufacturers Association; www.wcmanet.org.
22. WDMA - Window & Door Manufacturers Association; www.wdma.com.
23. WWPA - Western Wood Products Association; www.wwpa.org.

B. Code Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. This information is believed to be accurate as of the date of the Contract Documents.

1. ICC - International Code Council; www.iccsafe.org.
2. ICC-ES - ICC Evaluation Service, LLC; www.icc-es.org.

C. Federal Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Information is subject to change and is up to date as of the date of the Contract Documents.

1. CPSC - Consumer Product Safety Commission; www.cpsc.gov.
2. DOC - Department of Commerce; National Institute of Standards and Technology; www.nist.gov.
3. DOE - Department of Energy; www.energy.gov.
4. EPA - Environmental Protection Agency; www.epa.gov.
5. FG - Federal Government Publications; www.gpo.gov.
6. LBL - Lawrence Berkeley National Laboratory; Environmental Energy Technologies Division; www.eetd.lbl.gov.
7. OSHA - Occupational Safety & Health Administration; www.osha.gov.

D. Standards and Regulations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the standards and regulations in the following list. This information is subject to change and is believed to be accurate as of the date of the Contract Documents.

1. FED-STD - Federal Standard; (See FS).

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 014200

SECTION 015000
TEMPORARY FACILITIES & CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes requirements for temporary utilities, support facilities, and security and protection facilities.

B. Related Requirements:

1. Section 011000 "Summary" for work restrictions and limitations on utility interruptions.

1.3 USE CHARGES

A. General: Installation and removal of and use charges for temporary facilities shall be included in the Contract Sum unless otherwise indicated. Allow other entities to use temporary services and facilities without cost, including, but not limited to, Architect, testing agencies, and authorities having jurisdiction.

B. Electric Power Service from Existing System: Electric power from Owner's existing system is available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations.

1.4 INFORMATIONAL SUBMITTALS

A. Moisture-Protection Plan: Describe procedures and controls for protecting materials and construction from water absorption and damage.

1. Describe delivery, handling, and storage provisions for materials subject to water absorption or water damage.
2. Indicate procedures for discarding water-damaged materials, protocols for mitigating water intrusion into completed Work, and replacing water-damaged Work.

PART 2 - PRODUCTS

2.1 MATERIALS

A. None.

2.2 TEMPORARY FACILITIES

A. Storage and Fabrication Sheds: Provide sheds sized, furnished, and equipped to accommodate materials and equipment for construction operations.

1. Store combustible materials apart from building.

2.3 EQUIPMENT

A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work.

B. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

3.2 SUPPORT FACILITIES INSTALLATION

A. General: Comply with the following:

1. Provide sheds located within construction area or within 30 feet of building lines that is noncombustible according to ASTM E 136. Comply with NFPA 241.

B. Parking: Use designated areas of Owner's existing parking areas for construction personnel.

C. Waste Disposal Facilities: Comply with requirements specified in Section 017419 "Construction Waste Management and Disposal."

D. Lifts and Hoists: Provide facilities necessary for hoisting materials and personnel.

1. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.

E. Temporary Elevator Use: Use of existing elevators is permitted.

F. Existing Stair Usage: Use of Owner's existing stairs will be permitted, provided stairs are cleaned and maintained in a condition acceptable to Owner. At Substantial Completion, restore stairs to condition existing before initial use.

1. Provide protective coverings, barriers, devices, signs, or other procedures to protect stairs and to maintain means of egress. If stairs become damaged, restore damaged areas so no evidence remains of correction work.

3.3 SECURITY AND PROTECTION FACILITIES INSTALLATION

A. Protection of Existing Facilities: Protect existing vegetation, equipment, structures, utilities, and other improvements at Project site and on adjacent properties, except those indicated to be removed or altered. Repair damage to existing facilities.

B. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.

C. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weathertight enclosure for building exterior.

END OF SECTION 015000

SECTION 016000
PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

B. Related Requirements:

1. Section 012300 "Alternates" for products selected under an alternate.
2. Section 014200 "References" for applicable industry standards for products specified.

1.3 DEFINITIONS

A. Products: Items obtained for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.

1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature, that is current as of date of the Contract Documents.
2. New Products: Items that have not previously been incorporated into another project or facility. Products salvaged or recycled from other projects are not considered new products.
3. Comparable Product: Product that is demonstrated and approved through submittal process to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.

B. Basis-of-Design Product Specification: A specification in which a specific manufacturer's product is named and accompanied by the words "basis-of-design product," including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of additional manufacturers named in the specification.

1.4 ACTION SUBMITTALS

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

1. Include data to indicate compliance with the requirements specified in "Comparable Products" Article.
2. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within one week of receipt of a comparable product request. Architect will notify Contractor of approval or rejection of proposed comparable product request within 15 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.

    a. Form of Approval: As specified in Section 013300 "Submittal Procedures."
    b. Use product specified if Architect does not issue a decision on use of a comparable product request within time allocated.

B. Basis-of-Design Product Specification Submittal: Comply with requirements in Section 013300 "Submittal Procedures." Show compliance with requirements.

1.5 QUALITY ASSURANCE

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

1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft and vandalism. Comply with manufacturer's written instructions.

B. Delivery and Handling:

1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
4. Inspect products on delivery to determine compliance with the Contract Documents and to determine that products are undamaged and properly protected.

C. Storage:

1. Store products to allow for inspection and measurement of quantity or counting of units.
2. Store materials in a manner that will not endanger Project structure.
3. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
4. Protect foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
5. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
6. Protect stored products from damage and liquids from freezing.

1.7 PRODUCT WARRANTIES

A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.

1. Manufacturer's Warranty: Written warranty furnished by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.
2. Special Warranty: Written warranty required by the Contract Documents to provide specific rights for Owner.

B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution.

1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
2. Specified Form: When specified forms are included with the Specifications, prepare a written document using indicated form properly executed.
3. See other Sections for specific content requirements and particular requirements for submitting special warranties.

C. Submittal Time: Comply with requirements in Section 017700 "Closeout Procedures."

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

A. General Product Requirements: Provide products that comply with the Contract Documents, are undamaged and, unless otherwise indicated, are new at time of installation.

1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.

3. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
4. Where products are accompanied by the term "as selected," Architect will make selection.
5. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.
6. Or Equal: For products specified by name and accompanied by the term "or equal," or "or approved equal," or "or approved," comply with requirements in "Comparable Products" Article to obtain approval for use of an unnamed product.

B. Product Selection Procedures:

1. Product: Where Specifications name a single manufacturer and product, provide the named product that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
2. Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
3. Products:

    a. Restricted List: Where Specifications include a list of names of both manufacturers and products, provide one of the products listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
    b. Nonrestricted List: Where Specifications include a list of names of both available manufacturers and products, provide one of the products listed, or an unnamed product, that complies with requirements. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product.

4. Manufacturers:

    a. Restricted List: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
    b. Nonrestricted List: Where Specifications include a list of available manufacturers, provide a product by one of the manufacturers listed, or a product by an unnamed manufacturer, that complies with requirements. Comply with requirements in "Comparable Products" Article for consideration of an unnamed manufacturer's product.

5. Basis-of-Design Product: Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product by one of the other named manufacturers.

C. Visual Selection Specification: Where Specifications include the phrase "as selected by Architect from manufacturer's full range" or similar phrase, select a product that complies with requirements. Architect will select color, gloss, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

2.2 COMPARABLE PRODUCTS

A. Conditions for Consideration: Architect will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Architect may return requests without action, except to record noncompliance with these requirements:

1. Evidence that the proposed product does not require revisions to the Contract Documents, that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.
2. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
3. Evidence that proposed product provides specified warranty.
4. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners, if requested.
5. Samples, if requested.

PART 3 - EXECUTION (Not Used)

END OF SECTION 016000

SECTION 017300
EXECUTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

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

B. Related Requirements:

1. Section 011000 "Summary" for limits on use of Project site.
2. Section 017700 "Closeout Procedures" for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, and final cleaning.

1.3 DEFINITIONS

A. Cutting: Removal of in-place construction necessary to permit installation or performance of other work.

B. Patching: Fitting and repair work required to restore construction to original conditions after installation of other work.

1.4 QUALITY ASSURANCE

A. Cutting and Patching: Comply with requirements for and limitations on cutting and patching of construction elements.

1. Structural Elements: When cutting and patching structural elements, notify Architect of locations and details of cutting and await directions from Architect before proceeding. Shore, brace, and support structural elements during cutting and patching. Do not cut and patch structural elements in a manner that could change their load-carrying capacity or increase deflection

    a. Refer to Unit Specifications.

2. Visual Elements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch exposed construction in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

PART 2 - PRODUCTS

2.1 MATERIALS

A. In-Place Materials: Use materials for patching identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.

1. If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to Architect for the visual and functional performance of in-place materials.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examination and Acceptance of Conditions: Before proceeding with each component of the Work, examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.

1. Examine walls for suitable conditions where products and systems are to be installed.
2. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.

B. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

B. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.

C. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents caused by differing field conditions outside the control of Contractor, submit a request for information to Architect according to requirements in Section 013100 "Project Management and Coordination."

3.3 CONSTRUCTION LAYOUT

A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks. If discrepancies are discovered, notify Architect promptly.

3.4 INSTALLATION

A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.

1. Make vertical work plumb and make horizontal work level.
2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.

B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.

C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.

D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.

E. Sequence the Work and allow adequate clearances to accommodate movement of construction items on site and placement in permanent locations.

F. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.

G. Templates: Obtain and distribute to the parties involved templates for work specified to be factory prepared and field installed. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.

H. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions.

1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
2. Allow for building movement, including thermal expansion and contraction.
3. Coordinate installation of anchorages.

I. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.

J. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

3.5 CUTTING AND PATCHING

A. Cutting and Patching, General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.

1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.

B. Temporary Support: Provide temporary support of work to be cut.

C. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.

D. Adjacent Occupied Areas: Where interference with use of adjoining areas or interruption of free passage to adjoining areas is unavoidable, coordinate cutting and patching according to requirements in Section 011000 "Summary."

E. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.

1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots neatly to minimum size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
3. Proceed with patching after construction operations requiring cutting are complete.

F. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other work. Patch with durable seams that are as invisible as practicable. Provide materials and comply with installation requirements specified in other Sections, where applicable.

1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate physical integrity of installation.
2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will minimize evidence of patching and refinishing.

3. Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.

    a. Where patching occurs in a painted surface, prepare substrate and apply primer and intermediate paint coats appropriate for substrate over the patch, and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.

4. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition and ensures thermal and moisture integrity of building enclosure.

G. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

3.6 PROGRESS AND FINAL CLEANING

A. General: Clean Project site and work areas daily, including common areas. Enforce requirements strictly. Dispose of materials lawfully.

1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
2. Do not hold waste materials more than seven days during normal weather or three days if the temperature is expected to rise above 80 deg F (27 deg C).
3. Coordinate progress cleaning for joint-use areas where Contractor and other contractors are working concurrently.

B. Site: Maintain Project site free of waste materials and debris.

C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.

1. Remove liquid spills promptly.
2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.

D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.

E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.

F. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

G. Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways. Comply with waste disposal requirements in Section 017419 "Construction Waste Management and Disposal."

H. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.

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

J. Limiting Exposures: Supervise construction operations to assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

K. Provide final cleaning of all disturbed areas. Clean all glass and frames.

3.7 STARTING AND ADJUSTING

A. Confirm proper operation of components. Remove malfunctioning units, replace with new units and retest.

B. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.

C. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3.8 PROTECTION OF INSTALLED CONSTRUCTION

A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.

END OF SECTION 017300

SECTION 017419
CONSTRUCTION WASTE MANAGEMENT & DISPOSAL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for the following:

1. Disposing of nonhazardous construction waste.

1.3 DEFINITIONS

A. Construction Waste: Building and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.

B. Demolition Waste: Building and site improvement materials resulting from demolition or selective demolition operations.

C. Disposal: Removal off-site of demolition and construction waste and subsequent sale, recycling, reuse, or deposit in landfill or incinerator acceptable to authorities having jurisdiction.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 PLAN IMPLEMENTATION

A. General: Implement approved waste management plan. Provide handling, containers, storage, signage, transportation, and other items as required to implement waste management plan during the entire duration of the Contract.

1. Comply with operation, termination, and removal requirements in Section 015000 "Temporary Facilities and Controls."

2. Provide plywood under the wheels of the dumpsters.

B. Site Access and Temporary Controls: Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

3.2 DISPOSAL OF WASTE

A. General: Except for items or materials to be salvaged, recycled, or otherwise reused, remove waste materials from Project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.

1. Except as otherwise specified, do not allow waste materials that are to be disposed of accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

B. Burning: Do not burn waste materials.

C. Disposal: Remove waste materials from Owner's property and legally dispose of them.

END OF SECTION 017419

SECTION 017700
CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:

1. Substantial Completion procedures.
2. Final completion procedures.
3. Warranties.
4. Final cleaning.
5. Repair of the Work.

B. Related Requirements:

1. Section 017300 "Execution" for progress cleaning of Project site.
2. Section 017839 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.

1.3 ACTION SUBMITTALS

A. Product Data: For cleaning agents.

B. Contractor's List of Incomplete Items: Initial submittal at Substantial Completion.

C. Certified List of Incomplete Items: Final submittal at Final Completion.

1.4 CLOSEOUT SUBMITTALS

A. Certificates of Release: From authorities having jurisdiction.

B. Certificate of Insurance: For continuing coverage.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Schedule of Maintenance Material Items: For maintenance material submittal items specified in other Sections.

1.6 SUBSTANTIAL COMPLETION PROCEDURES

A. Contractor's List of Incomplete Items: Prepare and submit a list of items to be completed and corrected (Contractor's punch list), indicating the value of each item on the list and reasons why the Work is incomplete.

B. Submittals Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.

1. Certificates of Release: Obtain and submit releases from authorities having jurisdiction permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
2. Submit closeout submittals specified in other Division 01 Sections, including project record documents, operation and maintenance manuals, final completion construction photographic documentation, damage or settlement surveys, and similar final record information.
3. Submit closeout submittals specified in individual Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
4. Submit maintenance material submittals specified in individual Sections, including tools, spare parts, extra materials, and similar items, and deliver to location designated by Architect. Label with manufacturer's name and model number where applicable.
5. Submit test/adjust/balance records.

C. Procedures Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.

1. Advise Owner of pending insurance changeover requirements.
2. Perform preventive maintenance on equipment used prior to Substantial Completion.
3. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems.
4. Participate with Owner in conducting inspection and walkthrough.
5. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
6. Complete final cleaning requirements, including touchup painting.
7. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.

D. Inspection: Submit a written request for inspection to determine Substantial Completion a minimum of 10 days prior to date the work will be completed and ready for final inspection and tests. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.

1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
2. Results of completed inspection will form the basis of requirements for final completion.

1.7 FINAL COMPLETION PROCEDURES

A. Preliminary procedures: Before requesting final inspection for determining final completion, complete the following:

1. Submit a final Application for Payment according to Section 012900 "Payment Procedures."
2. Certified List of Incomplete Items: Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. Certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
3. Certificate of Insurance: Submit evidence of final, continuing insurance coverage complying with insurance requirements.

B. Inspection: Submit a written request for final inspection to determine acceptance a minimum of 10 days prior to date the work will be completed and ready for final inspection and tests. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.

1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.8 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

A. Organization of List: Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.

1. Organize list of spaces in sequential order, starting with exterior areas first and proceeding from lowest floor to highest floor.
2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.

3. Submit list of incomplete items in the following format:

    a. MS Excel electronic file. Architect, will return annotated file.
    b. Three paper copies. Architect will return two copies.

1.9 SUBMITTAL OF PROJECT WARRANTIES

A. Time of Submittal: Submit written warranties on request of Architect for designated portions of the Work where commencement of warranties other than date of Substantial Completion is indicated, or when delay in submittal of warranties might limit Owner's rights under warranty.

B. Organize warranty documents into an orderly sequence based on the table of contents of Project Manual.

1. Bind warranties and bonds in heavy-duty, three-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch (215-by-280-mm) paper.
2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.
4. Warranty Electronic File: Scan warranties and bonds and assemble complete warranty and bond submittal package into a single indexed electronic PDF file with links enabling navigation to each item. Provide bookmarked table of contents at beginning of document.

1.10 ELECTRONIC CLOSEOUT DOCUMENTATION

A. General: Provide a complete project Closeout Documentation Package in electronic format. This package shall include:

1. Project Record Documents.
2. Approved submittals.
3. Operation and Maintenance Manuals.
4. Warranties.
5. Project Contact Directory.

B. The Electronic Closeout Document shall be prepared by BHFX, LLC – 8150397-8800 – Rockford@bhfx.net.

C. In order to the Electronic Closeout Documentation process, comply with the following:

1. Contact BHFX a minimum 3 months prior to the date of Substantial Completion to schedule a pre-closeout meeting. Review the following:

a. Format of documents: PDF electronic format for all documents and AutoCAD drawing files.
b. Folder structure for storage and transfer of files.
c. Schedule for collection and turn-over of closeout documentation

d. Record Document Format Procedures: Provide clean and accurate paper copies of marked-up Record Documents (drawings and specifications) for scanning.
e. Provide contact information for the individual responsible for the collection and transfer of the Electronic Closeout Document package contents.
f. Review the complete listing of Closeout Documentation package contents.

2. Provide all documentation to BHFX, LLC for processing no later than 30 days after the date of Substantial Completion.
3. Schedule a training conference with the Owner's Representative, Architect and BHFX to present the completed Electronic Closeoput Documentation package.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

PART 3 - EXECUTION

3.1 FINAL CLEANING

A. General: Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.

B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.

1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a designated portion of Project:

a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
b. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
c. Remove tools, construction equipment, machinery, and surplus material from Project site.
d. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
e. Remove debris and surface dust from limited access spaces.

f. Sweep concrete floors broom clean in unoccupied spaces.
g. Vacuum carpet and similar soft surfaces, removing debris and excess nap; clean according to manufacturer's recommendations if visible soil or stains remain.
h. Clean transparent materials, including and in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Polish glass, taking care not to scratch surfaces.
i. Remove labels that are not permanent.
j. Leave Project clean and ready for occupancy.

C. Construction Waste Disposal: Comply with waste disposal requirements in Section 017419 "Construction Waste Management and Disposal."

3.2 REPAIR OF THE WORK

A. Complete repair and restoration operations before requesting inspection for determination of Substantial Completion.

B. Repair or remove and replace defective construction. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment. Where damaged or worn items cannot be repaired or restored, provide replacements. Remove and replace operating components that cannot be repaired. Restore damaged construction and permanent facilities used during construction to specified condition.

1. Remove and replace chipped, scratched, and broken glass, reflective surfaces, and other damaged transparent materials.
2. Touch up and otherwise repair and restore marred or exposed finishes and surfaces. Replace finishes and surfaces that that already show evidence of repair or restoration.

    a. Do not paint over "UL" and other required labels and identification, including mechanical and electrical nameplates. Remove paint applied to required labels and identification.

3. Replace parts subject to operating conditions during construction that may impede operation or reduce longevity.

END OF SECTION 017700

SECTION 017839
PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for project record documents, including the following:

1. Record Drawings.
2. Record Specifications.
3. Record Product Data.

B. Related Requirements:
1. Section 017300 "Execution" for final property survey.
2. Section 017700 "Closeout Procedures" for general closeout procedures.

1.3 CLOSEOUT SUBMITTALS

A. Record Drawings: Comply with the following:

1. Number of Copies: Submit one set of marked-up record prints.
2. Number of Copies: Submit copies of record Drawings as follows:

a. Initial Submittal:

1) Submit one paper-copy set(s) of marked-up record prints.
2) Submit PDF electronic files of scanned record prints and one of file prints.
3) Submit record digital data files and one set of plots.
4) Architect will indicate whether general scope of changes, additional information recorded, and quality of drafting are acceptable.

b. Final Submittal:

1) Submit three paper-copy sets of marked-up record prints.
2) Submit PDF electronic files of scanned record prints and three sets of prints.
3) Print each drawing, whether or not changes and additional information were recorded.

B. Record Specifications: Submit one paper copy and PDF electronic files of Project's Specifications, including addenda and contract modifications.

C. Record Product Data: Submit one paper copy and PDF electronic files and directories of each submittal.

1. Where record Product Data are required as part of operation and maintenance manuals, submit duplicate marked-up Product Data as a component of manual.

PART 2 - PRODUCTS

2.1 RECORD DRAWINGS

A. Record Prints: Maintain one set of marked-up paper copies of the Contract Drawings and Shop Drawings, incorporating new and revised drawings as modifications are issued.

1. Preparation: Mark record prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked-up record prints.

    a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
    b. Accurately record information in an acceptable drawing technique.
    c. Record data as soon as possible after obtaining it.

2. Mark the Contract Drawings and Shop Drawings completely and accurately. Use personnel proficient at recording graphic information in production of marked-up record prints.
3. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
4. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.

B. Format: Identify and date each record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.

1. Record Prints: Organize record prints and newly prepared record Drawings into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
2. Format: Annotated PDF electronic file with comment function enabled.
3. Identification: As follows:

    a. Project name.
    b. Date.
    c. Designation "PROJECT RECORD DRAWINGS."
    d. Name of Architect.
    e. Name of Contractor.

2.2 RECORD SPECIFICATIONS

A. Preparation: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.

1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
3. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.
4. Note related Change Orders, record Product Data, and record Drawings where applicable.

B. Format: Submit record Specifications as scanned PDF electronic file(s) of marked-up paper copy of Specifications.

2.3 RECORD PRODUCT DATA

A. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.

1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
3. Note related Change Orders, record Specifications, and record Drawings where applicable.

B. Format: Submit record Product Data as annotated PDF electronic file and paper copy.

PART 3 - EXECUTION

3.1 RECORDING AND MAINTENANCE

A. Recording: Maintain one copy of each submittal during the construction period for project record document purposes. Post changes and revisions to project record documents as they occur; do not wait until end of Project.

B. Maintenance of Record Documents and Samples: Store record documents and Samples in the field office apart from the Contract Documents used for construction. Do not use project record documents for construction purposes. Maintain record documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to project record documents for Architect's reference during normal working hours.

END OF SECTION 017839

SECTION 002132
ASBESTOS ABATEMENT - ROOF FLASHINGS

PART 1 - GENERAL

1.1 Introduction

Exterior building spaces are not covered by Illinois Department of Public Health (IDPH) abatement rules, except for covered hallways or porticos connecting buildings and outdoor mechanical systems which condition indoor air (such as air handling units, air conditioners, cooling towers, etc.), or when interior building spaces are involved.

Window components, window caulks, window glazing putty, Door Caulks, exterior transite sheeting, roof flashings, cements, or other products installed on the building exterior are subject to Occupational Safety and Health Administration (OSHA) and National Emission Standards for Hazardous Air Pollutants (NESHAP) rules which, in many cases are less rigorous than IDPH requirements. All exterior asbestos abatement activities shall be conducted from the exterior of the building only. At no time shall any work activity be staged from the interior of the building. Abatement of these items is specified in this section.

1.2 Definitions - In addition to the terms listed below, all definitions in the laws and regulations listed in Section 1.5 are incorporated by reference, whether or not restated herein.

A. Qualified Contractor (QC) means the entity responsible for performing the work in this section and has the training and accreditation to competently perform the work. This entity will obtain and maintain training and accreditations required for work in this section.

B. Qualified Contractor Supervisor, hereinafter referred to as Supervisor means any person who supervises asbestos abatement workers. This person must be trained, accredited, and meet OSHA competent person criteria for asbestos abatement.

C. Asbestos Project Manager (APM) is the individual that performs asbestos abatement project oversight, acts on behalf of the Rockford Public Schools or its agents on the project, and performs “Project Manager” duties as defined by IDPH asbestos regulations.

D. Rockford Public Schools means the owner of the property and the authority ordering the work specified herein.

E. Competent person means one who is capable of identifying existing asbestos hazards in the workplace and selecting the appropriate control strategy for asbestos exposure, who has the authority to take prompt corrective measures to eliminate them, as specified in 29 CFR 1926.32(f): in addition, one who is specially trained in a training course which meets the criteria of EPA's Model Accreditation Plan (40 CFR 763) for supervisor, or its equivalent.

F. HEPA Filter means a High Efficiency Particulate Air filter capable of trapping 99.97% percent of particles greater than 0.3 micrometers in mass median aerodynamic equivalent

diameter.

G. IDPH means the Illinois Department of Public Health.

H. Carnow Conibear & Assoc., Ltd. (CCA) is the RPS 205 District Environmental Consultant and the entity responsible for the testing, design and joint coordination with Architect to ensure compliance with applicable asbestos regulations as well as any investigations, assessments and on-site oversight of abatement related activities.

M. MSDS means Material Safety Data Sheet, required by OSHA for any chemical in the workplace that that could be expected to cause an exposure to workers during normal use or in emergency situations.

N. Plasticize means to apply 6-mil plastic sheeting over surfaces or objects to protect them from contamination or water damage.

O. PPE (Personal Protection Equipment) means the protective suits, head and foot covers, gloves, respirators and other items used to protect persons from asbestos or other hazards.

P. RCRA means the Resource Conservation and Recovery Act and associated regulations.

Q. TCLP means the Toxicity Characteristic Leaching Procedure as specified in EPA 530/SW-846, Test Methods for Evaluating Solid Waste: Physical/Chemical Methods 3rd edition, November 1986.

R. Work Area means the area or areas where asbestos abatement is being conducted.

1.3 Scope of Work - Refer to Environmental Scope Form included in Appendix A.

1.4 Work Included

A. The work includes all labor, equipment, materials, and supplies necessary to perform the scope of work in the Documents by the procedures described herein. The qualified contractor, by submitting a bid for the work, represents itself as knowledgeable and expert in the performance of the work, and includes all things necessary to provide a complete and finished job, whether specifically mentioned or not.

B. Removal of asbestos-containing flashing materials listed in the Documents, including isolating and/or regulating the work areas, protection of adjacent areas, cleanup, proper packaging and disposal of wastes, and all other steps necessary to complete the scope of work.

C. Repair or replacement of damaged surfaces, landscaping, fixtures, or furnishings to restore them to like new condition to the satisfaction of the Architect, Board Authorized Representative or Carnow Conibear.

D. Compliance with all applicable laws, regulations, standards, and these specifications. In the case of a conflict, the contractor will comply with the most stringent.

E. All training, accreditations, permits, fees, notifications, reports, or other documents required

by law, regulation, this specification, or the Documents.

F. Provide project closeout documentation to the Architect of Record and/or Carnow Conibear within thirty (30) days after completion of work. This documentation shall include, but is not limited to, items listed in paragraph 1-7, Submittals.

1.5 Laws, Regulations and Standards

A. The following laws, regulations, and standards are incorporated by reference:

1. 29 CFR 1910 - US OSHA General Industry Standards
2. 29 CFR 1926 - US OSHA Construction Standards
3. 29 CFR 1926.1101 - US OSHA Asbestos Construction Standards
4. 40 CFR Part 61 - US EPA National Emissions Standards for Hazardous Air Pollutants (NESHAP), 11/90 revision
5. 40 CFR Part 763 Subpart E - US EPA Asbestos Model Accreditation Plan (MAP): Appendix CInterim Final Rule

1.6 Assessment, Monitoring, Testing and Analysis

A. Carnow Conibear (CCA) will perform inspection, testing, design services and submittal review(s) prior to the start of work, and during the project, as necessary. CCA may also perform testing, inspection, and monitoring services during the work and upon its completion.

1. Prior to the start of the work, CCA shall

a. Identify suspect materials and confirm their asbestos content through review of the school's existing documentation or by testing;
b. Design the necessary abatement and address any design changes as requested. Approved changes shall be submitted to the Architect, when applicable.

2. During the work, CCA shall:

a. Observe the work periodically, with sufficient frequency to ensure contractor compliance.
b. Collect area air samples in and around the work area, as needed, to verify exposure conditions.
c. Stop the work if airborne asbestos concentrations at the work area perimeter or interior building spaces exceed 0.01 f/cc. or should work being performed not be in compliance with applicable regulations. Contractor will be responsible for taking corrective action to reduce exposure levels and prevent recurrence; cleaning adjacent areas that become contaminated by the asbestos abatement activities and correct any regulatory compliance items required.
d. Maintain copies of contractor training accreditations and/or licenses for RPS 205.

e. Complete design changes that are needed.

3. Upon completion of work, CCA shall:

a. Visually inspect for visible dust and debris, and verify the full completion of the work.
b. Require contractor to re-clean the area or portions of areas until no visible debris remains.
c. Perform air sampling at the completion of the work activities, when necessary.

B. The abatement contractor shall provide OSHA compliance air monitoring to determine exposures to its employees in accordance with OSHA 29 CFR 1926.1101. Frequency of monitoring will comply with OSHA requirements for anticipated and actual exposure levels.

1. If available, a written Exposure Assessment may be provided prior to work activities with air sampling and analysis conducted 6 months or less prior to the start of the work to determine the requirements for respiratory protection and frequency of OSHA monitoring for each type of activity. The contractor should note that a Negative Exposure Assessment (NEA) is encouraged to be provided for the work described herein.

C. Credentials required for testing and analysis of PCM air samples:

1. Air sampling shall be conducted by an individual with certification documenting completion of NIOSH 582 course – Sampling and evaluating airborne asbestos dust.

1.7 Submittals by the Contractor (submitted to Architect):

The following shall be submitted to Architect no less than 10 days prior to the start of the asbestos abatement work activities.

A. Ten (10) day NESHAP notification to the Illinois EPA when the regulated asbestos quantities reach or exceed 260 linear feet or 160 square feet.

1. Ten (10) day IEPA Asbestos Notification on revised form, including inspector license number and landfill permit number.
2. Evidence that all qualified contractor workers performing work under this section are trained and accredited in accordance with OSHA or other applicable regulations. Qualified Contractor shall also provide evidence that workers have been properly fitted for any respiratory protection utilized and has received medical clearance for use of negative pressure air purifying respirators:

a. Current training certificate.
b. Current physician's written opinion
c. Current respirator fit test for negative pressure respirators when respirators are used.

4. Anticipated Schedule including dates for removal of asbestos containing roof flashings and anticipated work hours.
6. Work Plan identifying extent of regulated work areas and location of waste storage container(s).
7. Documentation detailing the arrangements for generated waste storage, packaging and disposal.
8. If available, copy of OSHA Exposure Assessment, with air sampling and analysis conducted 6 months or less prior to the start date of the abatement project.

9. Material Safety Data Sheets (MSDS) for chemicals used on site.

B. The following shall be submitted to Architect at the completion of the project.

1. OSHA compliance air monitoring records generated during the project.
2. Supervisor Logs
3. Worker Daily Sign In Logs
4. Documentation of any Safety Meetings
5. Waste Shipment Records.

2 - PRODUCTS

2.1 Tools and Equipment - All equipment shall at least conform to minimum industry standards:

A. Equipment:

1. Respirators shall be NIOSH approved for use with asbestos.
2. Contractor is fully responsible for complying with OSHA rules for other Safety equipment, such as hard hats, safety harnesses, eye protection, gloves, footwear, and any other safety devices used on the site.

B. Tools:

1. Ladders, scaffolding, lifts and all other rigging devices shall be constructed and/or utilized in a safe manor meeting all regulatory and permitting requirements.

2. Power tools such as, but not limited to saws, pneumatic chisels, brushes, sanders, and needle guns shall be equipped with shrouds and HEPA-filtered local exhaust systems to capture released particles. Power tools shall also be grounded using a ground fault Circuit Interrupter (GFI) breaker or outlet.

2.2 Materials

A. Installed materials which become a part of the work such as, but not limited to, encapsulants foam sealants and permanent enclosures shall be of good quality, non-lead-bearing, free of asbestos, and conform to the respective reinstallation specification sections.

1. Contractor shall ensure that encapsulants and sealants used as primers, basecoats, fillers or covering existing materials are compatible with the respective existing or reinstallation materials and their manufacturers' warranties.

B. Abatement materials

1. Poly sheeting for all applications shall be 6 mil nominal thickness.
2. Tape shall be 2 inch or 3 inch duct tape or other waterproof tape suitable for joining poly seams and attaching poly sheeting to surfaces.
3. Spray adhesives shall be non-flammable and free of methylene chloride solvents.
4. Disposal bags shall be 6 mil.
5. Vacuums shall be equipped with HEPA filtration.
6. Disposable suits, hoods, and foot coverings shall be TYVEK or similar.

7. Solvents shall be compatible with any primers, mastics, adhesives, paints, coatings, or other surfacing materials to be installed following their use.

PART 3 - EXECUTION

3.1 Employee Training, Qualification and Medical Screening

A. Supervisors and Workers shall be trained in accordance with applicable OSHA rules and regulations:

1. Contractor shall keep copies of any licenses, current training course certificates, at the jobsite at all times for all contractor personnel.
2. A Supervisor (competent person) shall be present at the work site at all times when work under this section is being conducted.

B. Medical Screening. All contractor personnel shall have a current medical examination in accordance with OSHA requirements. Copies of the Physician's Written Opinions shall be kept on site along with a current fit test certificate.

3.2 Permissible Exposure Limits

A. The OSHA permissible exposure limit (PEL) for worker exposure to airborne fibers is 0.1 f/cc as an 8-hour time-weighted average (TWA).

B. The OSHA short term excursion limit (STEL) for worker exposure to airborne fibers is 1.0 f/cc for a 30 minute sample.

3.3 Exposure Assessment and Monitoring

A. The abatement contractor shall make an assessment of the airborne exposures. Assessment shall conform to OSHA requirements and may be based upon:

1. Initial monitoring of representative workers who the contractor believes are exposed to the greatest airborne concentrations of asbestos, or
2. Past monitoring (within the past 6 months) or objective data for conditions closely resembling the processes, type of material, control methods, work practices and environmental conditions to be used for this Documents, or

B. The contractor shall perform personal monitoring in accordance with the following requirements:

1. Initially, to establish an exposure assessment when past monitoring or objective data are not available for an initial determination.
2. Daily, if the exposures are, or are expected to be, above the PEL of 0.1 f/cc.
3. Periodically if the exposures are, or are expected to be, below the PEL.
4. Whenever there has been a change of equipment, process, control, personnel, or a new

task has been initiated that may affect employee exposures, the exposure assessment shall be updated, and monitoring shall be reinstituted if exposures are unknown or are expected to exceed the PEL.

5. Area Monitoring may be provided by the owner at the perimeter of work areas and interior building areas to verify that concentrations of airborne fibers remain below 0.01 F/cc.

3.4 Respiratory Protection

Respiratory protection shall be worn by all persons potentially exposed to airborne asbestos fibers.

3.5 Hygiene Practices

A. Eating, drinking, smoking, chewing gum or tobacco, and applying of cosmetics are not allowed in the work area.

B. All persons entering the work area shall wear appropriate PPE.

C. When the use of a Personnel Decontamination Enclosure System is deemed necessary by CCA or regulatory requirements, the abatement contractor shall follow all entry and exit procedures posted in the Personnel Decontamination Enclosure System.

D. Personal Protection Equipment (PPE) shall include:

1. Full body disposable suits, headgear, and footwear.
2. Gloves.
3. Hard hats.
4. Non-disposable footwear and clothing shall remain in the work area and shall be disposed of as contaminated waste when the job is completed.
5. Authorized visitors shall be provided with suitable PPE when required in the work area.
6. PPE is required when exposures are, or are expected to be above the PEL.

E. A Personnel Decontamination Facility is required when worker exposures are expected to be above the PEL. The Decontamination unit may be remotely located if not feasible to locate adjacent to the work area.

1. Establish a negative pressure of at least 0.02 inch wc between the dirty equipment room and adjacent spaces, including the clean room. Assume Negative Air Machines (NAM) operate at 80% design capacity.
2. Provide at least 4 air changes per hour within the decon unit
3. All personnel shall use a double-suiting procedure for traveling between work areas and decon. Persons shall HEPA-vacuum the exterior of their disposable suits at the entry to the work area, put on a clean suit over the existing suit, and proceed to the decon unit for shower decontamination and change into street clothes.

F. To exit, persons shall HEPA-vacuum down clothing at the work area entry, and leave the work area. When disposable suits are used, they shall be HEPA-vacuumed, stripped off, and deposited in an asbestos disposal bag. Personnel may then leave the work area.

3.6 Prohibited Activities

A. Dry removal or dry sweeping, except:

1. During freezing weather. In this case, temperature and weather conditions must be recorded at the start, during, and at the end of the shift.
2. On roofs with 3:1 slope or greater. In this case, roofing shall be removed in an intact condition, as much as possible.
3. When equipment damage or other hazard exists. In this case, written permission from IEPA is required prior to performing dry removal.

B. Use of compressed air for cleaning.

C. Use of high speed power tools not equipped with a HEPA-filtered local exhaust system.

D. Eating, drinking, smoking, chewing gum, or applying cosmetics in the work area.

E. Removing respirators or other PPE in the work area.

3.7 Work Area Isolation and Preparation

A. General Preparation

1. Post caution signs and warning tape meeting the specifications of OSHA 29 CFR 1926.1101 (k)(6) at any location and approaches to a location where airborne concentrations of asbestos may exceed ambient background levels.
2. Secure the work area from entry by unauthorized persons.

B. Exterior Preparation

1. 6 mil plastic sheeting shall be placed over the ground, foundation, or other surfaces below the abatement area.
2. Unauthorized entry shall be prevented by using appropriate barriers, such as warning tape, fencing, or other suitable barriers.
3. Nearby air intakes, grilles, windows, and other openings into the building interior above, below, or beside the work area that could be exposed to released airborne dust shall be closed or otherwise sealed off with six mil poly and tape.
4. All electric power in the work area shall be protected with Ground-Fault Circuit Interrupters.

3.8 Abatement Procedures

A. General Removal Requirements:

1. Asbestos materials shall be wetted and kept wet during removal.
2. ACM shall be bagged or containerized as it is removed. Wastes shall not be dropped or thrown to the ground. Accumulated waste shall be properly packaged and containerized promptly. Unless the material is carried or passed to the ground by hand, it shall be lowered via covered, dust-tight chute, crane, hoist, or other means that prevent the wastes from being dropped or thrown.

3. Appropriate OSHA protection shall be provided when working from exterior access:

    a. Scaffolding shall be equipped with handrails and midrails designed to provide fall protection, or full-body safety harnesses shall be worn and tied off to a secure anchor point.
    b. Workers in manlifts shall wear full body harnesses and tie to the tie-off point provided on the manlift basket whenever the basket is elevated from ground level.
    c. The contractor shall ensure that scaffolding, manlifts and the workers erecting and using the equipment meet all federal, state and local regulations and requirements including the acquisition of all required permits for the erection and use of such equipment.

B. Window Replacements: Asbestos-containing materials are most likely to be found in caulking and glazing putty. When part of work, Windows may be removed under this section if ACM is handled from the building exterior. If ACM materials must be accessed from inside the building or ACM wastes must be transported through the building interior, then IDPH-regulated Interior Asbestos Abatement School Rules and Regulation Section 855, requirements will apply at no additional cost to the building owner.

For exterior work:

1. Close windows and seal from the inside by covering with appropriate board up materials, 6 mil poly and tape. Apply tape directly to window joints and seams if required.
2. Any ACM not required to be disturbed for window removal should be left in place (e.g. perimeter window frame).
3. ACM that must be disturbed (e.g. caulking at the edge of the window frame) must be removed completely, including three-dimensional residues.
4. Collect debris and deposit in asbestos waste bags as the work proceeds. Do not allow wastes to accumulate. Promptly containerize waste as generated.
5. Abate ACM and LBP on all window components to remain in place.
6. When windows and/or doors require removal for abatement purposes then AC responsible for the adequate board up of building openings. Such board up requirements shall include sufficient framing and ½" plywood sheathing covered in one (1) layer 6-mil poly sheeting.

C. Roofing

1. General: Remove ACM roof mastics, cements, underlayments, and flashings in an intact state to the extent feasible. Asbestos-containing shingles may occasionally break even when removed carefully. The fact that otherwise intact roofing materials become separated or broken does not by itself render them non-intact. However, if they become pulverized, reduced to powder or dust, they have become non-intact.

    a. The contractor shall take care to minimize the amount of roofing material damage during removal, or;
    b. If the materials are rendered non-intact, the contractor shall employ methods to contain the dust and debris and utilize hygiene practices appropriate for friable (OSHA Class I) ACM, including PPE, decontamination units, and monitoring. Monitoring may include area samples at the work area perimeter to determine

that airborne asbestos fibers are not being released in concentrations above the PEL.

2. Built-up roofing and asphalt shingles:

   a. Power cutting machines shall be equipped with a HEPA-filtered dust collection system and shall be misted during use.
   b. Dust generated by the cutting operation shall be collected with HEPA vacuums or wet cleaning methods.

3. Rigid roofing materials, such as cement asbestos shingles: remove intact and minimize breakage.

D. Transite, Galbestos sheeting (galvanized metal with a baked-on asbestos paint), Asbestos/Cement pipe, or other rigid panels shall be removed using wet methods.

E. Other

1. Non-LBP paint and other coatings, electric cable insulation or joint coverings, and other miscellaneous materials that are to be removed with the substrate or that can be removed without becoming friable may be removed as intact (OSHA Class II, EPA NESHAP Category I or II non-friable) in accordance with procedures described in the General and Roofing Sections 3.8 A. and C.
2. Non-LBP paint, coatings, and other miscellaneous materials that must be removed from the substrate or that otherwise will become friable must be removed as non-intact (OSHA Class I, EPA NESHAP friable) in accordance with procedures described in General and Roofing Sections 3.8 A. and C.1.b.

3.9 Cleaning and Decontamination

A. All visible accumulations of ACM, debris, tools, and unnecessary equipment shall be removed from the work area.

B. Protective poly or other waste generated during the course of work under this section shall be disposed as required by applicable regulations.

C. Surfaces which have been exposed to ACM or its dust shall be HEPA vacuumed

D. Dry sweeping of surfaces which have been exposed to ACM or its dust is not permitted.

3.10 Final Clearance

A. Cleaning may be discontinued when there is no visible debris. If air monitoring analysis results demonstrate results are at or above the PEL, the abatement contractor is responsible for repeating the cleaning as necessary until tests are satisfactory. All expenses associated with the collection and analysis of additional air monitoring tests are the responsibility of the qualified contractor.

3.11 Waste Disposal and Equipment Load-out

A. Roofing waste may be loaded in bulk into lined enclosed receptacles, such as dumpsters or trailers. Receptacles shall be closeable and lockable to provide security and to prevent air emissions.

B. Packaged asbestos wastes:

1. Asbestos-containing wastes, including removed ACM and debris, poly, critical barrier materials, suits, respirator filters, vacuum HEPA filters, water filters, and other asbestos-containing items shall be properly packaged for disposal.
2. Use 6 mil plastic bags with gooseneck seal, or other impermeable containers.
3. Wrap large or irregular items in 6 mil poly sheeting and seal with tape.
4. Sharp, jagged, or other items that may puncture poly shall be packaged in rigid impermeable containers such as drums or boxes, or wrapped in burlap or other protective covering before sealing in bags or poly sheeting.
5. Label containers as required by OSHA and DOT:

    a. OSHA warning label.
    b. DOT performance-oriented hazardous material label.

C. Removing items from the work area:

1. Packaged asbestos wastes shall be HEPA-vacuumed before removing from the work area.

D. Storage of packaged asbestos wastes shall be in a secure dumpster, or other suitable container that can be secured. The secured area shall be kept secure at all times to prevent unauthorized access.

E. Shipment of items from the project.

1. Decontaminated tools and equipment may be shipped by normal carrier to warehouse, another jobsite, or other destination.
2. For asbestos wastes:

    a. Line enclosed shipping container with 6 mil poly prior to loading packaged asbestos wastes.
    b. Post NESHAP placards during loading of friable asbestos wastes.
    c. Execute the NESHAP-required Waste Shipment Record (WSR) to be signed by the generator, transporter, and landfill. All WSRs shall be returned to Architect and/or CCA within 30 days of shipment.
    d. ACM waste shall be transported from the work site directly to the landfill.

F. Disposal of packaged asbestos wastes.

1. Only landfills approved and permitted by Illinois for accepting asbestos wastes may be used for disposal.

G. A punch list walk-through shall be conducted, as necessary for each completed work area within two working days of completion. Punchlist and visual inspection may be performed by Architect, CCA, and/or designated school official, . All punch list items shall be completed

within five working days of walk through.

ATTACHMENT:

Appendix A Environmental Scope of Work

END OF SECTION

DIVISION 2 – EXISTING CONDITIONS

SECTION 024119
SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Demolition and removal of selected portions of building or structure.
2. Demolition and removal of selected site elements.

B. Related Requirements:

1. Section 011000 "Summary" for restrictions on use of the premises, Owner-occupancy requirements, and phasing requirements.
2. Section 012300 "Alternates" for Alternates which require selective demolition or removal work.
3. Section 017300 "Execution" for cutting and patching procedures.

1.3 DEFINITIONS

A. Remove: Detach items from existing construction and dispose of them off-site unless indicated to be salvaged or reinstalled.

B. Remove and Salvage: Detach items from existing construction, in a manner to prevent damage, and deliver to Owner ready for reuse or store as instructed by Architect.

C. Remove and Reinstall: Detach items from existing construction, in a manner to prevent damage, prepare for reuse, and reinstall where indicated.

D. Existing to Remain: Leave existing items that are not to be removed and that are not otherwise indicated to be salvaged or reinstalled.

E. Dismantle: To remove by disassembling or detaching an item from a surface, using gentle methods and equipment to prevent damage to the item and surfaces; disposing of items unless indicated to be salvaged or reinstalled.

1.4 MATERIALS OWNERSHIP

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

1.5 FIELD CONDITIONS

A. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.

B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.

C. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.

D. Hazardous Materials:

1. Hazardous materials will be removed by Owner before start of the Work.
2. If suspected hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Hazardous materials will be removed by Owner under a separate contract.

E. Storage or sale of removed items or materials on-site is not permitted.

F. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.

1. Maintain fire-protection facilities in service during selective demolition operations.

1.6 COORDINATION

A. Arrange selective demolition schedule so as not to interfere with Owner's operations.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

B. Standards: Comply with ASSE A10.6 and NFPA 241.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that utilities have been disconnected and capped before starting selective demolition operations.

B. Review Project Record Documents of existing construction or other existing condition and hazardous material information provided by Owner. Owner does not guarantee that existing conditions are same as those indicated in Project Record Documents.

C. Perform an engineering survey of condition of building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during selective building demolition operations.

1. Perform surveys as the Work progresses to detect hazards resulting from selective demolition activities.

3.2 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect them against damage.

B. Existing Services/Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off utility services and mechanical/electrical systems serving areas to be selectively demolished.

1. Owner will arrange to shut off indicated services/systems when requested by Contractor.
2. If services/systems are required to be removed, relocated, or abandoned, provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.

3.3 PROTECTION

A. Temporary Protection: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.

1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
2. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
3. Cover and protect furniture, furnishings, and equipment that have not been removed.

B. Temporary Shoring: Design, provide, and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.

1. Strengthen or add new supports when required during progress of selective demolition.

C. Remove temporary barricades and protections where hazards no longer exist.

3.4 SELECTIVE DEMOLITION, GENERAL

A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:

1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.
2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping. Temporarily cover openings to remain.
3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
4. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain portable fire-suppression devices during flame-cutting operations.
5. Maintain fire watch during and for at least 2 hours after flame-cutting operations.
6. Maintain adequate ventilation when using cutting torches.
7. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
8. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
9. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
10. Dispose of demolished items and materials promptly. Comply with requirements in Section 017419 "Construction Waste Management and Disposal."

B. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

C. Removed and Salvaged Items (When requested by Architect):

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

D. Removed and Reinstalled Items (When requested by Architect):

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

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

3.5 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

A. Concrete: Demolish in small sections. Using power-driven saw, cut concrete to a depth of at least 3/4 inch at junctures with construction to remain. Dislodge concrete from reinforcement at perimeter of areas being demolished, cut reinforcement, and then remove remainder of concrete. Neatly trim openings to dimensions indicated.

B. Masonry: Demolish in small sections. Cut masonry at junctures with construction to remain, using power-driven saw, and then remove masonry between saw cuts.

3.6 DISPOSAL OF DEMOLISHED MATERIALS

A. Remove demolition waste materials from Project site and dispose of them according to Section 017419 "Construction Waste Management and Disposal."

1. Do not allow demolished materials to accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
3. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.
4. Comply with requirements specified in Section 017419 "Construction Waste Management and Disposal."

B. Burning: Do not burn demolished materials.

3.7 CLEANING

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

END OF SECTION 024119

SECTION 055000
METAL FABRICATIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes:

1. Items fabricated from iron and steel shapes, plates, bars, strips, tubes and pipes which are not part of the steel structural framing or other metal systems in other Sections of the Specifications. The items of this Section include but are not necessarily limited to the following:

a. Interior steel ladder for roof hatch access.
b. Galvanized exterior ladder from lower roof to higher roof.
c. New interior window security guards

2. Anchorages of type appropriate to the supporting structure and as required to provide a sturdy installation resistant to all reasonable loads.
3. Cutting, reinforcing, drilling and tapping as required to erect the work and to fit it with work provided under other Sections of the Specifications.

B. Related Requirements:

1. Section 099113 "Painting" Finish painting

1.3 COORDINATION

A. Coordinate installation of metal fabrications that are anchored to or that receive other work. Furnish setting drawings, templates, and directions for installing anchorage that are to be embedded in existing masonry. Deliver such items to Project site in time for installation.

1.4 SUBMITTALS

A. Shop Drawings: Show fabrication and installation details. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items. Provide Shop Drawings for:
1. Miscellaneous steel framing members.
2. Steel ladders.
3. Metal security guards.

QUALITY ASSURANCE

B. Field Measurements: Take prior to preparation of Shop Drawings and fabrication, where possible. Take measurements in time, so as to avoid delaying job progress. Allow for trimming and fitting.

C. Qualifications of Welders: Welding operators for shop fabrication shall be qualified, in accordance with AWS "Standard Qualifications Procedure."

D. Codes and Standards: Comply with the following unless otherwise indicated:

1. AISI, Steel Products Manual, Stainless and Heat Resisting Steel.
2. ANSI A58.1, Minimum Design Loads in Buildings and Other Structures.
3. AWS D1.1 "Structural Welding Code."
4. OSHA: 1910.27 and 1926.1053.
5. All applicable building codes having jurisdiction.
6. Americans with Disabilities Architectural Guidelines.

1.5 FIELD CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: For fabrication of miscellaneous metal work that will be exposed to view, use only materials that are smooth and free of surface blemishes, including pitting, seam marks, roller marks, rolled trade names and roughness.

1. Steel Plates, Shapes, and Bars: ASTM A 36.
2. Galvanized Carbon Steel Sheets: ASTM A 526, with ASTM A 525, G 90 zinc coating.
3. Steel Sheets In Assemblies To Be Galvanized: ASTM A 569 or A 570.
4. Bolts and Nuts: Regular hexagon head type, ASTM A 307, Grade A.

B. Anchor Bolts: Unfinished threaded fasteners per ASTM A 307, nonheaded type unless otherwise indicated

C. Metal Primer Paint: Comply with VOC limit requirements of Green Seal Standard GS-11.

D. Touch-Up Paint For Galvanized Surfaces: Zinc-rich, inorganic cold galvanizing compound having a minimum of 80% zinc dust in the dry film, such as Carboline Carbo Zinc or Carbo Weld; or Z.R.C.

2.2 SHOP FINISH

A. Final Painting - See Painting section.

B. Galvanizing:

1. Coating Weights: Items indicated to be galvanized shall be hot-dip galvanized according to the following specifications:

a.	Assembled steel products:	ASTM A 386, 1.25 oz./sq. ft.
b.	Structural steel shapes:	ASTM A 123, 1.25 oz./sq. ft.
c.	Steel hardware:	ASTM A 153, 1.25 oz./sq. ft.

2. Fabrication: Galvanize only after fabrication. Drilling, welding and other fabrication, except bolting, shall be completed before galvanizing. Welds shall be free of slag and residue.
3. Quenching: Galvanized items shall be passivated in a water quench.
4. Galvanizer's Affidavit: Galvanizer shall inspect galvanizing after dipping and submit notarized affidavit certifying compliance with these specifications.
5. Grade Stamp: Stamp each item, indicating ASTM designation and weight of coating.

2.3 FABRICATION – GENERAL

A. Sizes and Thicknesses: As shown, or, if not shown, as required to produce adequate strength and durability in the finished products. Comply with AISC Specifications for bearing, adequacy of temporary connections, alignment, and removal of paint on surfaces adjacent to field welds.

B. Preassembly in Shop: Preassemble the items in the shop to greatest extent possible, to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

C. Dissimilar Metals: Wherever dissimilar metals come into contact, insert lead washers, spacers or gaskets between them to provide electrolytic insulation.

D. Workmanship: Form exposed work true to line and level, with accurate angles and surfaces and straight, sharp smooth edges.

E. Welds: Weld corners and seams continuously and in accordance with recommendations of American Welding Society. Grind exposed welds smooth and flush.

F. Items to be Galvanized: Complete drilling, welding and other fabrication, except bolting, before galvanizing. Clean welds of slag and residue. Provide vent holes as required.

2.4 FABRICATION SPECIFICS

A. Interior Steel Ladder: As detailed and noted on drawings.

B. Exterior Steel ladder: As detailed and noted on drawings.

C. Window Security Guard:

1. 2” x 2” steel angles with ¼” welded wire, 3” o.c. each way.
2. 3/8” masonry anchors @ 24” o.c.

3. Intermediate clips @ mullions @ 24” o.c.
4. Finish: Pre-finished epoxy paint, color as selected by Architect..

2.5 FASTENERS

A. General: Unless otherwise indicated, provide Type 304 stainless-steel fasteners and zinc-plated fasteners with coating complying with ASTM B 633 or ASTM F 1941 (ASTM F 1941M), Class Fe/Zn 5, at exterior walls.

B. Post-Installed Anchors: Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy stainless-steel bolts, and nut.

2.6 MISCELLANEOUS MATERIALS

A. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.

1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.
2. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc-coated metal and compatible with finish paint systems indicated.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Contractor shall verify all opening sizes in field prior to developing shop drawings.

B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

C. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

D. Field Welding: Comply with the following requirements:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
5. All contacts with steel angles shall be welded.

E. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag screws, wood screws, and other connectors.

3.2 ADJUSTING AND CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

1. Apply by brush or spray to provide a minimum 2.0-mil (0.05-mm) dry film thickness.

B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint.

C. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780/A 780M.

END OF SECTION 055000

SECTION 061000
ROUGH CARPENTRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Materials:
   1. Wood blocking and nailers.
   2. Plywood sheathing.
   3. Weather barrier.
   4. Wood treatment.
   5. Thermal insulation at expansion joints.

B. Related Requirements:

   1. Section 012300 "Alternates"
   2. Section 074213 "Formed Metal Wall Panels"
   3. Section 075320 "Adhered TPO Roofing"
   4. Section 084113 "Aluminum Framed Entrances"
   5. Section 085113 "Aluminum Storefront Windows"
   6. Section 086200 "Unit Skylights"

1.3 ACTION SUBMITTALS

A. Product Data: Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.

B. Material Certificates: For dimension lumber specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use and design values approved by the ALSC Board of Review.

C. Evaluation Reports: For Wood-preservative-treated wood, from ICC-ES:

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

1. Factory mark each piece of lumber with grade stamp of grading agency.
2. Dress lumber, S4S, unless otherwise indicated.

B. Maximum Moisture Content of Lumber: 19 percent unless otherwise indicated.

C. Lumber: Worked and graded in accordance with American Lumber Standard PS 20 (U.S. Dep. Comm.), S4S, seasoned to moisture content not exceeding 19% and stamped "S-DRY."

1. Headers, Rough Frames, Nailers and Blocking, etc.: #1 Common Southern Yellow Pine, or equivalent SPF, or Douglas Fir.
2. Studs: Standard grade, any species.

2.2 WOOD BLOCKING AND NAILERS

A. For blocking not used for attachment of other construction, Utility, Stud, or No. 3 grade lumber of any species may be used provided that it is cut and selected to eliminate defects that will interfere with its attachment and purpose.

B. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work

2.3 PLYWOOD SHEATHING

A. Plywood: Conforming to PS 1; APA PRP-108, including grade stamping.

1. Sheathing: Exterior Grade, C-D Grade, with Exterior Glue (CDX), 3/4" thick.
2. Soffit Sheathing: Fire Rated Type Plywood, 1/2" thick.

2.4 INSULATION

A. Insulation: Glass or other inorganic fibers and resinous binders formed into unfaced flexible blankets of thicknesses indicated conforming to ASTM C 665, Type III, with density not less than 0.5 pcf. Use one of the following:

1. Acceptable Product/Manufacturers:

a. Owens-Corning "Fiberglas Thermal Batts"
b. CertainTeed "CertaPro AcoustaTherm Batts"
c. USG "Thermafiber Blanket"
d. Johns Manville "Unfaced Batts"

2. Canopy Wall Thickness: R-Value: Min. 3 1/2"; R 15

2.5 WEATHER BARRIER

A. Weather Barrier: Acceptable products and manufacturers follow:

1. **"**Tyvek CommercialWrap**"** by Dupont.
2. "Styrofoam Weathermate" by Dow.
3. "R-Wrap" by Simplex Products.
4. "Tuff Wrap" by Celotex.

5. Include manufacturer's joint tape.

6. Flashings: Include conformable flashing tape for sealing penetrations and for flashing around openings.

2.6 FASTENERS

A. General: Fasteners shall be of size and type indicated and shall comply with requirements specified in this article for material and manufacture.

1. Where rough carpentry is pressure-preservative treated provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.

B. Nails, Brads, and Staples: ASTM F 1667.

C. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.

2.7 WOOD-PRESERVATIVE-TREATED LUMBER

A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC2 for interior construction. Use Category UC3b for exterior construction.

1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.

B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or that does not comply with requirements for untreated material.

C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.

D. Application: Treat all rough carpentry unless otherwise indicated**.**

PART 3 - EXECUTION

3.1 INSTALLATION

A. Wood Framing: Comply with recommendations of NFPA "Manual for House Framing," NFPA "Recommended Nailing Schedule," and NFPA "National Design Specifications for Wood Construction." Place work accurately, level, plumb and true.

B. Plywood Installation: Comply with recommendations of APA "Design and Construction Guide - Residential and Commercial."

C. Framing, Nailers and Blocking: Execute in a manner to achieve greatest stability.

1. General: Use 2x4 wood studs spaced 16" o.c. except as indicated otherwise. Extend partition studs to the structure above.
2. Plates: Provide single bottom plate and double top plates of matching 2x material; except single top plate may be used for non-load bearing partitions. Joints in top plates shall be lapped at least 6"; do not join over wall openings.
3. Anchorage at Exterior Walls: Anchor the bottom plate with foundation bolts over sill sealer.
4. Corners and Intersections: Construct with not less than 3 studs; or use "The Nailer" screw tabs to eliminate the stud traditionally provided only to back the edge of the drywall. Provide screw tabs 12" o.c. along each edge of drywall.
5. Control Joints: Provide double studs at all gypsum board control joint locations. Place as indicated and so that no expanse of wall exceeds 30 feet, consistent with lines of building spaces, as approved by Architect.
6. Nailers and Blocking Within Walls:

    a. Provide wherever shown and where required for attachment of work of other trades. Cut and fit as required for true line and level of work to be attached.
    b. Attach to substrates as required to support applied loading. Bolts and nuts shall be countersunk flush with surfaces, unless shown otherwise.

D. Plywood Sheathing:

1. Install as recommended by the APA's "Guide to Plywood Sheathing for Floors, Walls, and Roofs" for the spacing of supports or types of substrates involved in the work, using 6d rink shank or threaded nails 6" o.c. at panel edges and 12" o.c. at intermediate framing. Maintain 1/16" to 1/8" spacing between joints of sheets on walls.

E. Weather Barrier for Walls: Install wrapping in accordance with manufacturer's latest printed instructions. Do not use building paper or bitumen impregnated felts.

1. Wrap sheathing all around with Tyvek CommercialWrap Lap the joints 6" and tack down so as to prevent wind damage. Seal joints with manufacturer's approved tape.
2. Assure a thorough air seal at perimeters of windows, doors and any other penetrations through the sheathing.

a. Before placing air barrier fabric over openings, cover edges of sheathing with either **"**StraightWrap or FlexWrap**"** strips, as appropriate for the type of opening, without making joints at the corners of the opening.
b. Apply air barrier fabric over openings. Then make an **"**I**"** cut in the fabric and wrap it around the jambs and window sills. Tape over all cut edges.

3.2 PROTECTION

A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

B. Protect rough carpentry from weather. If, despite protection, rough carpentry becomes wet enough that moisture content exceeds that specified, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label

END OF SECTION 061000

SECTION 070150
PREPARATION FOR RE-ROOFING

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. Removal of existing roofing material**,** roof sheet metal work and related accessories in preparation for installation of new roof membrane systems.
2. Protection of existing rooftop structures designated to remain.

B. Related Requirements:
1. Section 015000 "Temporary Facilities and Controls".
2. Section 075423 " Adhered TPO Roofing" for new reroofing work
3. Section 076200 "Sheet Metal Work" for sheet metal work related to reroofing.
4. Section 086200 "Unit Skylights" for skylights.

1.3 DEFINITIONS

A. Roofing Terminology: Definitions in ASTM D 1079 and glossary of NRCA's "The NRCA Roofing and Waterproofing Manual" apply to work of this Section.

B. Roof Tear-Off: Removal of selected components and accessories from existing roofing system as follows:

1. Remove existing built-up roofing system, existing insulation, perimeter flashings**,** base flashings**,** counter flashings**,** vent stack flashings, sheet metal edge trim/fascia, gutter, downspouts and any wood blocking around perimeter of roof down to existing roof deck.
2. Existing Roofs Composition: Refer to drawings.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Include plans, sections, and details.

1.5 INFORMATIONAL SUBMITTALS

A. Fastener pull-out test report.

1.6 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning roofing removal. Comply with hauling and disposal regulations of authorities having jurisdiction.

1.7 FIELD CONDITIONS

A. Existing Roofing System: Built-up roofing system(Refer to drawings for location of composition of existing roofing system to be reroofed).

B. Owner will occupy portions of building immediately below reroofing area. Conduct reroofing so Owner's operations are not disrupted. Provide Owner with not less than 72 hours' notice of activities that may affect Owner's operations.

1. Coordinate work activities daily with Owner so Owner can place protective dust and water-leakage covers over sensitive equipment and furnishings, shut down HVAC and fire-alarm or -detection equipment if needed, and evacuate occupants from below work area.

C. Protect building to be reroofed, adjacent buildings, walkways, site improvements, exterior plantings, and landscaping from damage or soiling from reroofing operations.

D. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities.

E. Weather Limitations: Proceed with reroofing preparation only when existing and forecasted weather conditions permit Work to proceed without water entering existing roofing system or building.

1. Remove only as much roofing in one day as can be made watertight in the same day.

PART 2 - PRODUCTS

2.1 TEMPORARY PROTECTION MATERIALS

A. Sheet polyethylene or fiber reinforced plastic sheeting. Provide weights to retain sheeting in position.

2.2 AUXILIARY REROOFING MATERIALS

A. General: Use auxiliary reroofing preparation materials recommended by roofing system manufacturer for intended use and compatible with components of existing and new roofing system.

PART 3 - EXECUTION

3.1 PREPARATION

A. Shut off rooftop utilities and service piping, if any, before beginning the Work.

B. Coordinate with Owner to shut down air-intake equipment in the vicinity of the Work. Cover air-intake louvers before proceeding with reroofing work that could affect indoor air quality or activate smoke detectors in the ductwork.

C. During removal operations, have sufficient and suitable materials on-site to facilitate rapid installation of temporary protection in the event of unexpected rain.

3.2 ROOF TEAR-OFF

A. Remove accessories from roofing as required.

B. Roof Tear-Off: Remove existing roofing and other roofing system components down to the existing deck.

1. Inspect wood blocking, curbs, and nailers for deterioration and damage. If wood blocking, curbs, or nailers have deteriorated, immediately notify Architect.

3.3 DECK PREPARATION

A. Inspect deck after tear-off of roofing system.

B. If deck surface is unsuitable for receiving new roofing or if structural integrity of deck is suspect, immediately notify Architect. Do not proceed with installation until directed by Architect.

3.4 BASE FLASHING REMOVAL

A. Remove existing base flashings. Clean substrates of contaminants, such as asphalt, sheet materials, dirt, and debris.

B. Do not damage metal counterflashings that are to remain. Replace metal counterflashings damaged during removal with counterflashings of same metal, weight or thickness, and finish.

C. Inspect wood blocking, curbs, and nailers for deterioration and damage. If wood blocking, curbs, or nailers have deteriorated, immediately notify Architect.

D. When directed by Architect, replace wood blocking, curbs, and nailers to comply with Section 061000 "Rough Carpentry."

3.5 FASTENER PULL-OUT TESTING

A. Obtain roofing manufacturer approval to proceed with specified fastening pattern. Roofing manufacturer may furnish revised fastening pattern commensurate with pull-out test results.

3.6 DISPOSAL

A. Collect demolished materials and place in containers. Promptly dispose of demolished materials. Do not allow demolished materials to accumulate on-site.

1. Storage or sale of demolished items or materials on-site is not permitted.

B. Transport and legally dispose of demolished materials off Owner's property.

END OF SECTION 070150

SECTION 074213
METAL PANEL SOFFITS

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. Exterior metal soffit panels at canopies - Alternate Bid #6

B. Exterior fascia panel and soffit system at various roof edges - Base Bid

C. Related Requirements:

1. Section 061000 "Rough Carpentry" for plywood sheathing framing and weather barrier.

1.3 SYSTEM DESCRIPTION

A. Panel's exposed finishes shall perform according to AAMA 2605-98; exposed anodized aluminum according to AAMA 611-98.

B. Panel composite assembly shall conform to ASTM E84, Flame Spread Resistance, Class A.

C. Panel composite assembly shall pass Modified ASTM E108, External Flame Resistance.

D. Panel composite assembly shall pass UBC 26-3, Fire Standard For Interior Applications.

E. Panel bond integrity shall have a minimum peel strength of 34.5 in-lbs/in when tested according to ASTM D1781.

F. Design wall system to withstand a positive and negative windload pressure acting inward and outward normal to the plane of the wall to meet the requirements of the 2009 International Building Code.

G. Make adequate provisions in the wall system for thermal expansion and contraction of the component parts and fastening of the system to prevent harmful damage caused by buckling, opening of joints, contraction and expansion due to accumulation of dead loads and variations of live loads, in accordance with ASTM E72, Strength Tests For Panels For Building Construction.

H. Water Leakage: No water infiltration into the panel system under static pressure when tested in accordance with ASTM E331 at a differential of 10% of inward acting design load, 6.24 psf (.299 kPa) minimum, after 15 minutes.

I. Air Leakage: Not more than 0.06 (cfm)/sf of wall area (.003 (L/s) m^2), when tested at 1.57 psf (.075 kPa) in accordance with ASTM E283.

1.4 QUALITY ASSURANCE

A. Take field measurements prior to preparation of shop drawings and fabrication, where possible. Take measurements in time, so as to avoid delaying job progress. Allow for trimming and fitting.

B. Panel Manufacturer: Manufacturer shall have a minimum of ten (10) years experience in the manufacture of ACM/MCM and have ISO 9001:2000 Certification.

C. Panel Installers: Installer shall be experienced in performing work of this section and be specialized in the installation of similar work required on this project.

D. Field Measurements: When possible, measurements should be taken prior to the completion of shop manufacturing and assembly.

E. Pre-Installation Meetings: Conduct pre-installation meetings to verify project requirements, substrate condition, installation instructions and warranty requirements.

F. Source Limitations:

1. Obtain each type of wall panel from single source from single manufacture.
2. Installer: Pre-Qualified Company specializing in performing the work of this Section shall install the system in strict compliance with the written manufacturer's instruction.

G. References:

1. American Society for Testing and Materials (ASTM):

   a. ASTM E84: Surface Burning Characteristics.
   b. ASTM D1781: Climbing Drum Peel for Adhesives.
   c. ASTM E108 (Modified): Standard Test Methods for Fire Tests of Roof Coverings.
   d. ASTM E72: Strength Tests for Panels for Building Construction.
   e. ASTM E331: Test for Water Penetration of Exterior Walls by Uniform Static Air Pressure Difference.
   f. ASTM E283: Test Method for Rate of Air Leakage through Exterior Walls

2. Architectural Aluminum Manufacturers' Association (AAMA):

   a. AAMA 2605-98: Voluntary Specification, Performance Requirements and Test Producedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels.

b. AAMA 611-98: Voluntary Specification for Anodized Architectural Aluminum.

3. UBC26-3: Room Fire Test Standard for Interior of Foam Plastic Systems.

1.5 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of metal wall panel and accessory.

B. Shop Drawings:

1. Show fabrication and installation layouts of metal wall panels; details of edge conditions, joints, corners, and accessories; and special details. Distinguish among factory, shop, and field-assembled work.
2. Coordination Drawings: Elevations, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

a. Soffit panels.
b. Wall-mounted items.
c. Penetrations of wall by utilities.

C. Samples: Samples for Verification: For type of exposed finish required, prepared on 6" x 6" sample of actual material.

D. Maintenance Data: For metal wall panels to include in maintenance manuals.

E. Preconstruction field adhesion test reports.

F. Warranties: Sample of Manufacturers standard warranty.

1.6 WARRANTY

A. Manufacturer's Warranty: Furnish panel manufacturer's standard warranty document executed by authorized company official. Manufacturer's warranty is in addition to and not a limitation of other rights Owner may have under the Contract Documents.

B. Panel Lamination Warranty: Five (5) years commencing on Date of Substantial Completion.

C. Installing Contractor shall warranty the system for 2 years from substantial completion.

D. Finish Warranty: Kynar 500®: Twenty (20) years.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver components, metal wall panels, and other manufactured items so as not to be damaged or deformed. Package panels for protection during transportation and handling.

B. Store and handle in strict compliance with manufacturers instructions and recommendations. Protect from damage from weather, excessive temperatures and construction operations.

C. Store covered with suitable weather tight and ventilated covering. Store panels to ensure dryness, with positive slope for drainage of water. Do not store panels in contact with other materials that might cause staining, denting, or other surface damage.

PART 2 - PRODUCTS

2.1 ACCEPTABLE TYPES & MANUFACTURERS

A. Metal Composite Material Soffit Panel Systems: Provide factory-formed and assembled, metal composite material wall panels fabricated from two metal facings that are bonded to a solid, extruded thermoset Phenolic Resin core; formed into profile for installation method indicated. Include attachment assembly components, panel stiffeners and accessories required for a watertight condition. Basis of Design - "Envelope 2000 - Reveal (R)" by Citadel or comparable products by Alucobond, Reynobond or Formabond Wall System or approved equal.

1. Materials:

a. Panel Composition(Panel 20 by Citadel):

1) Face Skin: .024" (minimum) prefinished smooth aluminum, in custom color as selected by Architect.
2) Core: .075" thermoset phenolic resin.
3) Back Skin: .024" primed smooth aluminum backer.
4) Panel thickness: 1/8"

b. Panel Tolerances:

1) Thickness: ±1/32".
2) Length and Width: +0, -1/16".
3) Squareness: 1/64" per lineal foot.

c. Attachment System: R System.

d. Finish: Exposed finish of Kynar 500 for both panels, trims and reveals. Color for canopies to be a clear anodized color to match the existing canopy fascias as selected by Architect. Color for the roof fascia to be selected from the manufacturer's standard colors.

e. Accessories:

1) Fasteners and moldings as required for panel system's design by panel system manufacturer. Fasteners shall be coated or stainless steel.
2) Weather Seals: Shall be Tremco® Spectrem® 2 or Dow Corning 795™, applied per the sealant manufacturer's instructions.

2.2 FABRICATION

A. Panels shall be factory fabricated and finished by manufacturer. Comply with indicated profiles and with dimensions as detailed and noted on drawings.

B. Form exposed work true to line and level, with accurate angles and surfaces and straight, sharp smooth edges.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine and verify substrate surfaces to receive composite metal panel system and associated work and condition which work will be installed.

B. Maximum deviation from vertical and horizontal alignment of substrate shall be no more than 1/4" in 20'-0".

C. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to installer. Starting work within a particular area will be construed as installer's acceptance of surface conditions.

3.2 COORDINATION

A. Coordinate with other trades for any items which may be attached to or require penetrations to the panel.

3.3 INSTALLATION

A. Erect panels level and true to intended plane.

B. Anchor panels securely in place in accordance with manufacturer's/fabricator's approved Shop Drawings.

C. Maximum deviation from vertical and horizontal alignment of erected panels shall be no more than 1/4" in 20'-0".

D. Maximum deviation in panel flatness shall be 0.6% of the assembled units.

E. Conform to panel manufacturer's instructions for attachment systems.

F. Weather seal all joints as required using methods and materials as recommended by the panel manufacturer/fabricator.

3.4 CLEANING/REPAIR/REPLACEMENTS AND PROTECTIOON

A. Weather seal all joints as required using methods and materials as recommended by the panel manufacturer/fabricator.

B. Repair or replace damaged installed products.

C. Clean installed products in accordance with manufacturer's instructions prior to Owner's acceptance.

D. Remove and legally dispose of construction debris from project site.

END OF SECTION 079200

SECTION 075320
ADHERED TPO ROOFING

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. Fully adhered TPO sheet roofing systems.
2. Board insulation.
3. Membrane roof flashings, base flashings and parapet flashings.
4. Elastomeric flashing boots at pipe penetrations.
5. Fasteners and adhesives.
6. Sealants.
7. Walkway pads.
8. Expansion joints.

B. Related Work Specified In Other Sections:

1. Section 013300 “Submittal Procedures” for submittal of required items.
2. Section 070150 “ Preparation for Re-Roofing” for preparation of existing roofing for installation of new roofing.
3. Section 076200 “ Sheet Metal Work” Sheet metal work and roof trim.

1.3 QUALITY ASSURANCE

A. Roofing Contractor: Illinois licensed, specializing for at least 5 years in the type of membrane system involved, who is approved by Architect and is certified/licensed by new roofing membrane system producer and who can furnish for this installation a foreman factory trained by the roof membrane system producer.

B. Source of Supply: Membrane system materials shall be obtained from a single source of supply except as authorized otherwise by membrane producer.

C. Standards of Installation: All components of roof system shall be furnished and installed to meet the wind 72 mph wind warranty.

D. Scheduling and Coordination:

1. Coordinate roofing installation with mechanical and electrical work associated with roof penetrations.
2. No phased construction will be considered or approved.

E. Wet and Damaged Materials: Shall not be installed.

1.4 SUBMITTALS

A. Process all submittals as required in Section 01300 – Submittals.

B. Product Data: Submit 3 copies of roofing materials producer's specifications, material characteristics and installation instructions for each product required including fasteners.

C. Shop Drawings: Indicate:

1. Outline of roof and dimensions.
2. Typical and special details for flashings, roof curbs, penetrations, perimeter conditions, termination details, etc. Reference the locations of details on the roof outline.
3. Number and mark of each factory prepared roofing sheet and flashing.
4. Layout of tapered insulation saddle areas.
5. Provide fastener locations and spacing for insulation installation.

1.5 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Packaging: Deliver materials to the job site in their original containers or packages, sealed, with legible labels intact, brand name, lot number, warning labels and reference standards clearly shown.

B. Temperatures Prior to Use: Store materials in the dry and in accordance with membrane producer's instructions. Other than roof membrane, all materials furnished by membrane producer shall be stored between 60°F and 80°F. If exposed to lower temperatures, restore to 60 - 80°F prior to use.

C. Warped or Broken Insulation Boards: Shall be removed from site.

1.6 JOB CONDITIONS

A. Ambient Conditions: Do not apply adhesives below adhesive manufacturers' recommended ambient temperature ranges.

B. Cold Weather: Follow membrane producer's special recommendations when cold weather retards free flow of adhesives and sealants. Do not apply adhesives below adhesive manufacturers' recommended ambient temperature ranges.

C. Fire Prevention: Take every precaution to prevent fire.

1. Maintain at least 2 portable fire extinguishers, rated 10-B:C-20 pounds, near area where adhesives are being used and train applicators in their proper use.
2. Do not use open flames to heat adhesives. Allow solvents to air-dry.
3. Use only grounded spray equipment.

D. Coordinate with Owner to shut off or block vents which may allow solvents or adhesives vapors to be drawn inside the building.

1.7 WARRANTIES

A. New Roofing: Shall be provided with a non-prorated, No-Dollar-Limit, full system warranty to Owner, including tapered insulation saddles, against leaks or defects of any kind due to faulty materials or workmanship, and to sustain a 72 mph maximum wind speed as follows:

1. Roofing membrane system producer's 20 year warranty for materials and workmanship.
2. Roofing Contractor's 2 year warranty for workmanship.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

A. System Fire Rating: Provide a fire-resistant membrane and insulation assembly which has been tested and listed by Underwriter's Laboratories, Inc. (UL) as Class A, for the roof deck and slopes to be used on this project.

B. System Wind Rating:

1. Roof to be warranted for a 72 mph maximum wind speed.

C. System Types:

1. Reinforced TPO membrane fully adhered to the top layer of insulation units.

D. Membrane Joint System: Membrane system producer's splice tape system.

E. Approved Products: Use one of the following systems:

1. TPO Membrane System:

a. Carlisle **"**Sure-Weld**"**
b. Firestone "Ultra Ply TPO".
c. Versico "VersiWeld."

F. Membrane Joint System: Membrane system producer's splice tape system.

2.2 MATERIALS

A. Membrane: TPO Roof Membrane: White, Thermoplastic Polyolefin, .060" (60 mil) thick, reinforced.

1. Roof Insulation: High Density Rigid board insulation of foamed isocyanurate core with manufacturer's standard glass fiber reinforced mat facers or organic/inorganic facers integrally laminated to both sides; minimum R=5.7 per 1" of thickness. All insulation directly below the roofing membrane to be 25psi, All other insulation can be 20 psi. Insulation furnished shall be as approved by membrane manufacturer.

a. Thickness: As shown on the drawings.

b. Tapered Insulation for Field: Isocyanurate units by same manufacturer as typical roof insulation; taper as required to achieve slopes indicated.
c. Tapered Insulation for Saddle & and Crickets: Isocyanurate units by same manufacturer as typical roof insulation; taper as required to achieve slopes indicated, or, if not indicated, not less than 1/4" per foot after roof deflection under full design load.
d. Tapered Insulation for Sump: Basis of Design "Hinged Target Sump" by Versico or equal, isocyanurate units by same manufacturer as typical roof insulation; with a 2" start and taper as required to achieve slopes indicated, or, if not indicated, not less than 1/4" per foot after roof deflection under full design load.

B. Base Sheet: Manufacturer's recommended base sheet.

C. Mechanical Anchors: Types recommended by roof system manufacturer including compression plates, for the kind of deck indicated and for wood nailers, featuring anti-corrosive materials and anti-blackout design. Anti-corrosion coating shall pass 30 cycles in Kesternich Cabinet DIN #50018 - 2 liter.

D. Base and Parapet Flashing: Same material as used for roof membrane.

E. Flashing To Cover Corners In Substrates: Same material as roof membrane; or roof membrane producer's unreinforced ethylene propylene-based flashing strips, .055" (55 mil) thick, of matching color.

F. Pipe Flashings: Premolded rubber boots approved by system producer for the membrane system, complete with stainless steel, screw tightened, pipe clamps.

G. Temporary Protection: Sheet polyethylene or fiber reinforced plastic. Provide weights to retain sheeting in position.

H. Auxiliary Materials: Prefabricated flashing units, bonding adhesives, sealants, splicing cements, mastics and other accessory materials shall be recommended by producer of roof membrane for the system installed.

I. Roof Expansion Joints: See drawings for locations and detail1.

J. Walkway Pads:

1. Carlisle "Sure-Seal Roof Walkway Pads" 30" wide x 30" long, 3/8" thick.
2. Firestone " Walkway Pad", 30" wide x 30" long, .54" thick.
3. Or approved equal.

PART 3 - EXECUTION

3.1 GENERAL:

A. Install roofing membrane and flashing system in accordance with details, specifications and best practices recommended by membrane manufacturer.

1. Follow all recommendations and adhere to all precautions specified by roofing manufacturer except that where conflict occurs between manufacturer's

recommendations and these specifications, the more stringent requirement shall prevail.

2. No wet or damaged materials shall be installed.

3.3 TEMPORARY PROTECTION

A. Temporary Protective Sheeting: Provide over uncovered deck surfaces whenever precipitation is forecast.

1. Retain sheeting in position with weights or temporary fasteners.
2. Provide for surface drainage from sheeting to existing drainage facilities.

B. Traffic: Do not permit traffic over unprotected or repaired deck surface.

3.4 PREPARATION

A. Surfaces to Receive Roofing System: Prepare so that they will be clean**,** dry**,** and free of fins**,** sharp edges**,** loose**,** damaged and foreign materials**,** oil and grease.

B. Cleaning: Sweep roof surface clean of loose matter.

3.5 INSPECTION FOR ROOFING

A. Acceptance of Conditions Affecting Application: Proceeding with roof system application shall designate acceptance of conditions.

3.6 INSULATION INSTALLATION

A. Over Existing Concrete Decks:

1. Roof Area 1, 4, 5, 6, 7, 8, 9 and 10 - See drawings for insulation thicknesses and attachment requirements.

B. Over Existing Metal Decks:

1. Roof Area 2, 3 and 11 - See drawings for insulation thicknesses and attachment requirements.

C. Crickets and Saddles: Slopes shall be of 1/2 per foot. Assure positive drainage flow by installing crickets and saddles wherever flow to roof drain is obstructed, is inadequate or must be positively encouraged during storms to counter the forces of excessive runoff speeds or high winds. Take special care to correct flow patterns at rooftop equipment and where roofs have been modified. Fully adhere to insulation using adhesive as recommended by manufacturer.

3.8 ROOF MEMBRANE INSTALLATION

A. General: Install roofing membrane and flashings in accordance with details**,** specifications and best practices recommended by membrane producer. Follow all recommendations and comply with all precautions specified by roofing producer except

that where conflict occurs between producer's recommendations and these specifications, the more stringent requirement shall prevail.

1. Direction of Membrane Placement: Orient the membrane so that rainwater runs over rather than along lap joints.
2. Whole Sheets: Use whole, single sheets to the extent practicable.

B. Membrane Installation: Lay membrane in full bed of contact adhesive for 100% adhesion.

1. Relaxing: Roof membrane shall be set in place over substrate without stretching and allowed to relax 30 minutes before bonding.
2. Placement: Set sheets in final position, free of wrinkles and folds, overlapping adjacent sheets, with up-hill sheet on top of joint. Make overlap 5" on EPDM membranes. Then roll sheet back evenly onto itself. Sweep away bonding contaminants from mating surfaces using a stiff bristled broom.
3. Bonding Adhesive Application: Apply evenly to underside of sheet and to insulation at about the same time so as to allow matching drying times. Smooth out adhesive with nap roller. Hold bonding adhesive well back from edges to be spliced over other membrane.
4. Bonding to Insulation: When bonding adhesive is tacky and does not stick or string to touch of a dry finger, roll membrane into the coated substrate slowly and evenly so as not to cause wrinkles. Compress the bond with an approved roller. Do not bond surfaces before adhesive becomes tacky. Should adhesive loose its tackiness, reapply adhesive. Set the pace of work accordingly. When first half of a sheet is fully adhered, complete other half in same manner.
5. Contaminated Adhesive: Should adhesive become contaminated by dust, moisture, walking etc., re-apply adhesive, but only after contaminated adhesive is thoroughly dry, even if redoing entire field of adhesive is required. Remove contaminated adhesives when so recommended by membrane producer.

C. Lap Splices:

1. Cleaning: Sweep away excess talc and other bonding contaminants from mating surfaces using a stiff bristled broom.
2. Adhesive Application: Scrub on bonding adhesive to each surface to be mated, extending adhesive 1/2" to 3/4" beyond edge of the sheet that will be layed on top. Scrub harder where there is excess dusting agent or contamination. Time the application of adhesive to each surface so as to allow matching drying times when each side of splice tape is pressed into the adhesive.
3. Rolling: Roll the splice tape into the adhesive applied onto bottom sheet, leaving no edge of tape un-wet by the adhesive.
4. Trimming: Trim the top sheet as required to allow splice tape to be exposed 1/8" to 1/2" after top sheet is fixed.
5. Bonding: Fix the top sheet in place by allowing the sheet to carefully fall on to the freshly exposed top surface of the splice tape, making a joint free of wrinkles and fishmouths. Broom the entire length of the splice as the splice is made and then roll the splice tight with a silicone wheeled hand roller, working across the joint and then along its length.
6. Splices between Lengths of Splice Tape: Lap the splices at least 1" and cover such joints with a 6" x 6" patch of uncured membrane, sealed all around with lap edge sealant.

7. Sealing Exposed Scrim: Wherever the membrane reinforcement scrim is exposed, cover with continuous bead of lap edge sealant.
8. Sealant Application: Prime the surfaces before applying sealant and tool the sealant bead, as required by membrane manufacturer. Take caution to not disturb fresh lap sealant.

D. Edge Attachment: Mechanically attach edges of membrane all around roof edges and roof openings, anchoring into parapets and edge blocking, according to membrane producer's recommendations and approved details.

E. Flashing: Bond only to clean surfaces. Contour the membrane to fit substrate to which it is bonded so as not to allow bridging or gapping effect.

1. Roof Interruptions, Curbs and Edges: Flash with longest pieces practicable. Include intersections with other roofs. Terminate flashings a minimum of 8" above adjacent roof surface unless indicated otherwise.
2. Pipe Penetrations: Flash with prefabricated rubber boots. Seal the top of boots with stainless steel strap clamps and continuous bed of mastic sealant. Form all surfaces so as to provide positive drainage.
3. Pipe Penetrations: Seal according to Architect's approval using sealant pockets having proper metal flashings all around.
4. Base Flashings: Membrane flashings applied over upright surfaces shall be fully adhered to substrate, all across contact area, using techniques similar to those used to bond main roof membrane.
5. Joints In Membrane Flashings: Provide a minimum lap of 3" at joints and compress the bond with an approved roller. Round off membrane corners. Apply additional patches of flashing membrane over joints and seal all around edges, according to roof membrane system producer's recommendations.
6. Flashing Over Fasteners: Cover the fasteners with flashing membrane, providing a minimum lap of 3" beyond washers.

F. Expansion Joints:

1. Fill expansion voids with expansion joint insulation down to the level of the roof deck. Fill voids completely. Do not use any rigid materials.

    a. Wrap a vapor barrier membrane around fibrous insulations and seal joints between vapor membrane sections with vapor resistant construction tape and then seal the joint between vapor barrier and curb with approved mastic.

2. Top the expansion joint with an approved foam tube and secure the tube against dislodgement with strips of flashing membrane or as otherwise approved.

G. Temporary Closures: Install as needed to prevent water from flowing beneath roof system during inclement weather.

1. Extent: The roof membrane shall be extended at least 2 feet past edge of roof insulation and a continuous layer of sealer applied onto substrate 12" wide along the membrane edge.
2. Sealing Edge: Firmly embed roof membrane into sealer and provide continuous pressure over the length of the cut-off, using lumber and other ballast, so as to prevent blow-off.

H. Repairs:

1. Wrinkles: When within 18" of a splice or running towards a splice or positioned to interrupt proper drainage, cut out the wrinkle and repair with unspliced roof membrane to at least 3" beyond the wrinkle.
2. Cuts and Punctures: Patch over with roof membrane to at least 3" beyond the break.

3.9 INSTALLATION OF SHEET METAL WORK

A. Coordinate membrane installation with Section 076200 – Sheet Metal Work Contractor.

3.10 CLEAN UP

A. Smears and Droppings: Clean from all non-roofing surfaces.

B. Rubble**,** Debris**,** and Excess Materials: Remove roof construction rubble**,** debris**,** and excess roofing materials and containers.

END OF SECTION 075323

SECTION 076200
SHEET METAL WORK

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. Flashings and sheet metal work.
2. Metal coping, fascia and edge trim.
3. Scupper and conductorbox.
4. Metal downspouts.
5. Joint sealants.

B. Related Requirements:

1. Section 061000 "Rough Carpentry" for treated blocking and nailers.
2. Section 075323"TPO Roofing" for materials and installation of new roofing.

1.3 COORDINATION

A. Coordinate sheet metal flashing and trim layout and seams with sizes and locations of penetrations to be flashed, and joints and seams in adjacent materials.

B. Coordinate sheet metal flashing and trim installation with adjoining wall materials, joints, and seams to provide leakproof, secure, and noncorrosive installation.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each manufactured product and accessory.

B. Shop Drawings: For sheet metal flashing and trim.

1. Include plans, elevations, sections, and attachment details.
2. Detail fabrication and installation layouts, expansion-joint locations, and keyed details. Distinguish between shop and field-assembled work.

3. Include identification of material, thickness, weight, and finish for each item and location in Project.
4. Include details for forming, including profiles, shapes, seams, and dimensions.
5. Include details for joining, supporting, and securing, including layout and spacing of fasteners, cleats, clips, and other attachments. Include pattern of seams.
6. Include details of termination points and assemblies.
7. Include details of expansion joints and expansion-joint covers, including showing direction of expansion and contraction from fixed points.
8. Include details of special conditions.
9. Include details of connections to adjoining work.
10. Detail formed flashing and trim at scale of not less than 1-1/2 inches per 12 inches.

C. Samples for Initial Selection: For each type of sheet metal and accessory indicated with factory-applied finishes.

D. Samples for Verification: For each type of exposed finish.

1. Sheet Metal Flashing: 12 inches long by actual width of unit, including finished seam and in required profile. Include fasteners, cleats, clips, closures, and other attachments.
2. Trim, Metal Closures, Expansion Joints, Joint Intersections, and Miscellaneous Fabrications: 12 inches long and in required profile. Include fasteners and other exposed accessories.
3. Accessories and Miscellaneous Materials: Full-size Sample.

E. Certifications: Submit roof membrane producer's certification that metal items to be furnished for roofing are acceptable for inclusion in roof system producer's warranty.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For sheet metal flashing panels and trim, and its accessories, to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Fabricator Qualifications: Employs skilled workers who custom fabricate sheet metal flashing and trim similar to that required for this Project and whose products have a record of successful in-service performance.

B. Applicator: A company specializing in sheet metal flashing work and approved by membrane roofing subcontractor; having 10 years' minimum experience.

C. Provide water and weather-tight work, with surfaces free from waves and buckles, and seams avoided as much as possible.

D. Comply with applicable recommendations and details of the latest editions of the SMACNA Architectural Sheet Metal Manual and the NRCA Roofing & Waterproofing Manual, including workmanship and installation.

E. Coordination:

1. Coordinate fabrication and installation of metal roof flashings with roof membrane system installers so as to meet requirements of roof warranty (specified in roofing specifications Section).

2. Coordinate metal flashings work with adjoining work for proper sequencing of each installation to ensure the best possible weather resistance and the protection of materials and finishes from damage.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver prefinished sheet metal components free of surface blemishes.

B. Do not store sheet metal flashing, panels and trim materials in contact with other materials that might cause staining, denting, or other surface damage. Store sheet metal flashing and trim materials away from uncured concrete and masonry.

C. Protect strippable protective covering on sheet metal flashing, panels and trim from exposure to sunlight and high humidity, except to extent necessary for period of sheet metal flashing and trim installation.

1.8 WARRANTY

A. Sheet metal flashings incorporated into membrane roofing shall be compatible with the requirements of the roof system producer for inclusion into the roofing warranty.

B. Special Warranty on Finishes: Manufacturer agrees to repair finish or replace sheet metal flashing, panels and trim that shows evidence of deterioration of factory-applied finishes within specified warranty period.

1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:

a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General: Sheet metal flashing, panels and trim assemblies shall withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.

B. Sheet Metal Standard for Flashing, panels and Trim: Comply with SMACNA's "Architectural Sheet Metal Manual" requirements for dimensions and profiles shown unless more stringent requirements are indicated.

2.2 FABRICATED SHEET METAL COMPONENTS

A. General: Protect mechanical and other finishes on exposed surfaces from damage by applying strippable, temporary protective film before shipping.

B. Counterflashings: Made from 0.050" aluminum, with 3" end laps. Corners to be mitered and solder sealed. Fabricate with punched nail hole slots 12" o.c. to allow for expansion.

C. Coping and Fascia: Made from 0.050" aluminum, with corners formed by butting adjacent fascia pieces over backer splice unit that has been mitered and welded.

D. Roof Edge Trim: .050" thick mill finished aluminum strips, formed to profiles indicated. to provide 1-1/2" nailing flange and 1-1/2 downturn terminated by a 1/2" 45° drip.

E. Scuppers/Conductorbox: Made from .050” aluminum; Include all accessories required.

1. Corners: Welded or spliced over a welded corner unit. Exposed welds shall be factory painted to remove all welding blemishes.

F. Downspouts:

1. Made from .050” aluminum. Provide smooth rectangular profile in sizes shown on the drawings.
2. Include anchor straps for anchorage to wall at 4'-0" intervals.

G. Finish (All Fabricated Sheet Metal Components except as otherwise noted): Factory applied fluoropolymer coating containing a minimum of 70%, by weight, Kynar 500, Kynar 500 VLD or Hylar 5000 resin; color as selected by Architect from manufacturer’s full range of standard options.

2.3 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and as recommended by manufacturer of primary sheet metal or manufactured item unless otherwise indicated.

B. Flashing Cement: Asphalt mastic cement formulated for weathering and flow resistance, meeting requirements of Fed. Spec. SS-C-153.

C. Adhesives for sheet metal flashings in contact with EPDM roofing shall be type recommended by flashing sheet manufacturer and approved by roofing system manufacturer to provide a waterproof/weather-resistant seaming and adhesive application compatible with roofing system materials.

D. Dissimilar Metal Protection: Bituminous coating conforming to Fed. Spec. TT-C-494 or SSPC-Paint 12, or plastic separators, or insulating tape, subject to Architect's approval.

1. For metal flashing in contact with roofing, use separation materials or methods compatible with roofing system materials as approved by roofing system manufacturer.

E. Sealant Tape for Surface Mounted Flashings: Protective Treatments, Inc., "Product #606 Architectural Sealant Tape," 3/16" x 3/4" minimum size.

F. Sealant for Metal Flashing Joints: Use one of the following, color as best blends with color of flashing material:

1. Dap, Inc. "Butyl - Flex".
2. Pecora Corp. "BC 158".
3. Protective Treatments, Inc. (PTI) "757 Butyl Sealant".
4. Tremco "Butyl Sealant".
5. Sonneborn Bldg. Products "Butakauk".

G. Fasteners: Fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal or manufactured item.

1. For Fastening Aluminum Flashings: Aluminum or stainless steel nails with annular threads, of sufficient length to penetrate wood blocking at least 7/8".
2. For Cleats to Nailers: Use ring-shank or screw-shank nails long enough to penetrate the wood nailer at least 1-3/4" or use #8 screws long enough to penetrate the wood nailer 3/4".
3. For Exposed Fastening: Fasteners as recommended by panel manufacturer or as specified above or screws, with soft neoprene washers.

2.4 FABRICATION, GENERAL

A. General: Custom fabricate sheet metal flashing and trim to comply with details shown and recommendations in cited sheet metal standard that apply to design, dimensions, geometry, metal thickness, and other characteristics of item required. Fabricate sheet metal flashing and trim in shop to greatest extent possible.

1. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.
2. Obtain field measurements for accurate fit before shop fabrication.
3. Form sheet metal flashing and trim to fit substrates without excessive oil canning, buckling, and tool marks; true to line, levels, and slopes; and with exposed edges folded back to form hems.
4. Conceal fasteners and expansion provisions where possible. Do not use exposed fasteners on faces exposed to view.

B. Expansion Provisions: Form metal for thermal expansion of exposed flashing and trim.

1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with butyl sealant concealed within joints.
2. Use lapped expansion joints only where indicated on Drawings.

C. Sealant Joints: Where movable, nonexpansion-type joints are required, form metal to provide for proper installation of elastomeric sealant according to cited sheet metal standard.

D. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.

E. Fabricate cleats and attachment devices of sizes as recommended by cited sheet metal standard for application, but not less than thickness of metal being secured.

F. Drip Edges: All exposed edges of flashing shall have 1/2" projecting hemmed edge.

G. Seams: Fabricate nonmoving seams with flat-lock seams. Tin edges to be seamed, form seams, and solder.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, substrate, and other conditions affecting performance of the Work.

1. Verify compliance with requirements for installation tolerances of substrates.
2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.

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

3.2 INSTALLATION, GENERAL

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

1. Install sheet metal flashing fascia panels and trim true to line, levels, and slopes. Provide uniform, neat seams with minimum exposure of welds, and sealant.
2. Install sheet metal flashing and fascia panels and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
3. Space cleats not more than 12 inches apart. Attach each cleat with at least two fasteners. Bend tabs over fasteners.

4. Install exposed sheet metal flashing and trim with limited oil canning, and free of buckling and tool marks.
5. Torch cutting of sheet metal flashing and trim is not permitted.

B. Metal Protection: Where dissimilar metals contact each other, or where metal contacts pressure-treated wood or other corrosive substrates, protect against galvanic action or corrosion by painting contact surfaces with bituminous coating or by other permanent separation as recommended by sheet metal manufacturer or cited sheet metal standard.

1. Coat concealed side of sheet metal flashing and trim with bituminous coating where flashing and trim contact wood, ferrous metal, or cementitious construction.
2. Underlayment: Where installing sheet metal flashing and trim directly on cementitious or wood substrates, install underlayment and cover with slip sheet.

C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at maximum of 10 feet with no joints within 24 inches of corner or intersection.

1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with sealant concealed within joints.

D. Fasteners: Use fastener sizes that penetrate substrate not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.

E. Conceal fasteners and expansion provisions where possible in exposed work and locate to minimize possibility of leakage. Cover and seal fasteners and anchors as required for a tight installation.

F. Seal joints as required for watertight construction.

1. Use sealant-filled joints unless otherwise indicated. Embed hooked flanges of joint members not less than 1 inch into sealant. Form joints to completely conceal sealant. When ambient temperature at time of installation is between 40 and 70 deg F, set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures. Do not install sealant-type joints at temperatures below 40 deg F.
2. Prepare joints and apply sealants to comply with requirements in Section 079200 "Joint Sealants."

3.3 INSTALLATION

A. General:

1. Install sheet metal wall flashing to intercept and exclude penetrating moisture according to cited sheet metal standard unless otherwise indicated. Coordinate installation of wall flashing with installation of wall-opening components such as windows, doors, and louvers.
2. Secure flashings in place using concealed fasteners. Use no exposed fasteners except as detailed. Install work watertight, making allowances for expansion and contraction. Install fasteners snug; do not over-tighten. Finished work shall be free of waves, warps, buckles, fastening stress, and distortions.

B. Metal Fascia & Roof Edgings: Install in coordination with roofing, as required to maintain roofing warranties. Engage drip hem around the anchor cleat to the full depth of the drip hem. Metal flanges under roof membranes shall be attached to blocking at 4" o.c., with nails placed 1" from back edge of roof flange.

C. Scupper and Conductorbox: See drawings.

D. Downspouts:

1. Keep metal downspouts separated from walls to avoid staining and corrosion.
2. Install downspouts visually plumb and anchor to building at top and bottom and at 4 ft (maximum) intervals in between. Protect building surfaces from damage from hanger and strap connectors.

3.4 CLEANING AND PROTECTION

A. Clean off excess sealants.

B. On completion of sheet metal flashing and trim installation, remove unused materials and clean finished surfaces as recommended by sheet metal flashing and trim manufacturer. Maintain sheet metal flashing and trim in clean condition during construction.

C. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 076200

SECTION 077100
ROOF HATCH

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 flashings and sheet metal work not specifically included with other Sections of the Specifications but required to prevent penetration of water through exterior shell of the building:

1. Roof access hatch.

B. Related Requirements:

1. Section 055000 "Metal Fabrications" for roof ladder.
2. Section 075423 "Adhered TPO Roofing" for roof flashings.

1.3 SUBMITTALS

A. Shop Drawings: Coordinate with Roof Installer as required. Indicate details for flashings, roof curbs, penetrations, perimeter conditions, etc. Shop Drawings for prefabricated roof hatch shall show exact dimensions, anchorages and relationships to other materials.

B. Product Data: Submit manufacturer’s specifications, material descriptions and installation instructions for each product required, including fasteners.

C. Warranties.

1.4 WARRANTY

A. Roof hatch manufacturer shall warrant that units will be free of defects in materials and workmanship for 5 years.

PART 2 - PRODUCTS

2.1 ROOF ACCESS HATCH

A. Type and Size: 2'-6" x 3'-0" ladder access type, with hatch cover lid controlled hydraulically or by counterbalancing spring, such as “Model S-20” manufactured by Bilco Co. as Basis-of-Design, or comparable products of Milcor or Babcock-Davis. Field verify exact size of roof hatch in the field prior to submitting shop drawing.

B. Cover Lid: Minimum 14-gauge steel galvanized with G-90 coating, factory primed. Lid shall be formed and reinforced to bear live load of at least 40 psf. Any joints required shall be welded or sealed continuously. Welded joints in galvanized steel shall be coated with zinc-rich galvanizing repair paint.

C. Curb: Minimum 14-gauge steel galvanized with G-90 coating. Curb shall be at least 8" higher than adjacent roof surface with an attachment flange at least 3" wide. Joints shall be welded continuously. Joints in galvanized steel shall be coated with zinc-rich galvanizing repair paint.

D. Insulation For Cover Lid and Curb: Glass fiber or mineral fiber insulation or rigid foamed plastic insulation, 1" thick, covered on the inside with 22-gauge steel, factory primed.

E. Counterflashings and Seals: Unit shall provide positive exclusion of wind blown moisture and cold air using neoprene or EPDM gaskets and counterflashing flanges of metal. Metal shall be same type as it is attached to, at least 22-gauge steel galvanized with G-90 coating.

F. Lock: Furnish with provisions for padlock on interior side.

G. Ladder Extension: Furnish with Bilco LadderUP extension, or equivalent, shop enamel finished.

PART 3 - EXECUTION

3.1 INSPECTION AND PREPARATION

A. Verify that surfaces to receive roof accessories roof hatches are suitable for application of the materials and that wood nailers have been properly installed.

B. Proceeding with installation of roof accessories, roof hatch shall designate acceptance of conditions.

C. Flash in existing roofing system watertight.

3.2 INSTALLATION

A. Install unit in accordance with manufacturer’s instructions according to the type of roof deck provided. Locate units accurately. Install roof curbs furnished under this Section.

B. Set flange in a continuous bed of roofing cement. Anchor only to the top of solid, treated wood blocking or through to structural framing members as detailed. Ensure that flange lays flat all around.

C. Securely fasten unit curbs to roof deck so as to resist all stresses induced by temperature changes in the roof system and induced through icing.

3.3 PROTECTION

A. Provide temporary coverings as necessary to protect against roofing operations.

END OF SECTION 077100

SECTION 079200
JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes joint sealants for interior and exterior applications:

B. Related Requirements:

1. Section 079200 "Joint Sealants.
2. Section 084113 "Aluminum Framed Entrances" for perimeter sealing of aluminum entrance frames to exterior walls.
3. Section 085113 "Aluminum Storefront Windows" for perimeter sealing of aluminum windows to exterior walls

1.3 PERFORMANCE REQUIREMENTS

A. Provide elastomeric joint sealants that establish and maintain watertight and airtight continuous joint seals without staining or deteriorating joint substrates.

B. Provide joint sealants for interior applications that establish watertight and airtight continuous seals without staining or deteriorating joint substrates.

1.4 SUBMITTALS

A. Product Data: For each type of joint sealant product.

B. Samples: For each kind and color of joint sealant required.

C. Joint Sealant Schedule: Include the following information:

1. Joint sealant application, joint location and designation.
2. Joint sealant manufacture and product line.
3. Joint sealant formulation.
4. Joint sealant color.

D. Product Test Reports.

E. Preconstruction compatibility and adhesive test reports.

F. Preconstruction field adhesion test reports.

G. Field adhesion test reports.

H. Warranties.

1.5 QUALITY ASSURANCE

A. Preinstallation Conference: Conduct conference at Project site.

1.6 WARRANTY

A. Special Installer's Warranty: Manufacturer's standard form in which Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

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

PART 2 - PRODUCTS

2.1 MAUFACTURERS

A. Products: Subject to compliance with requirements, provide one of, the products listed herein.

2.2 JOINT SEALANTS

A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.

B. VOC Content of Interior Sealants: Sealants and sealant primers used inside the weatherproofing system shall comply with the following limits for VOC content when calculated in accordance with 40 CFR 59, Part 59, Subpart D (EPA Method 24):

1. Architectural sealants shall have a VOC content of 250 g/L or less.
2. Sealants and sealant primers for nonporous substrates shall have a VOC content of 250 g/L or less.
3. Sealants and sealant primers for porous substrates shall have a VOC content of 775 g/L or less.

C. Liquid Applied Sealants: Sealants and sealant primers shall comply with ASTM C 920 and other requirements for each liquid applied joint sealant specified including those referencing ASTM C 920 classifications for type, grade, class and uses related to exposure and joint substrates.

1. Suitability for Immersion in Liquids: Where sealants are indicated of Use I for joints that will be continuously immersed in liquids, provide products that have undergone testing in accordance with ASTM C 1247. Liquid used for testing is deionized water unless otherwise indicated.

D. Stain Test Response Characteristics: Where sealants are specified to be non-staining to porous substrates, provide products that have undergone testing in accordance with ASTM C 1248 and have not stained porous joint substrates indicated for the project.

E. Suitability for Contact with Food: Where sealants are indicated for joints that will come in repeated contact with food, provide products that comply with CFR 177.2600.

F. Colors of Exposed Joint Sealants: Custom color to match window frame color.

2.3 SEALANT TYPES

A. Sealant: Low-modulus, single component, polyurethane hybrid sealant. Aluminum color to match the window frame color. Provide the following:

1. Tremco "Dymonic FC" is the Basis-of-Design or Owner Approved Equal by Sonneborn or Dow.

2.4 JOINT FILLER

A. Joint Filler: Backer rod for elastomeric sealants. Extruded closed cell polyethylene foam or polyethylene jacketed polyurethane foam, non-bleeding, non-staining, oversized 30 to 50 percent; provide one of the following:

1. Dow: Ethafoam.
2. Meadows: backer Rod.
3. Sonneborn: Sonofoam backer Rod.

2.5 JOINT-SEALANT BACKING

A. Sealant Backing Material, General: Non-staining; compatible with joint substrates, sealants, primers, and other joint fillers; and approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

B. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin**)**, and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.

C. Elastomeric Tubing Sealant Backings: Neoprene, butyl, EPDM or silicone tubing complying with ASTM D 1056, nonabsorbent to water and gas and capable of remaining resilient at temperatures down to minum26 deg. F (minimum 32 deg. C). Provide product with low compression set of size and shape to provide a secondary seal, to control sealant depth and otherwise contribute to optimum sealant performance.

D. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.

2.6 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.

C. Masking Tape: Non-staining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting performance of the Work.

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

3.2 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:

1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant.
2. Clean porous joint substrate surfaces by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:

3. Remove laitance and form-release agents from concrete.
4. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:

B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF JOINT SEALANTS

A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

1. Do not leave gaps between ends of sealant backings.
2. Do not stretch, twist, puncture, or tear sealant backings.
3. Remove absorbent sealant backings that have become wet before sealant application, and replace them with dry materials.

D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.

E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:

1. Place sealants so they directly contact and fully wet joint substrates.
2. Completely fill recesses in each joint configuration.
3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

F. Tooling of Non-sag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.

1. Remove excess sealant from surfaces adjacent to joints.
2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
3. Provide concave joint profile per Figure 8A in ASTM C 1193 unless otherwise indicated.

3.4 CLEANING

A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.5 PROTECTION

A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out, remove, and repair damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

END OF SECTION 079200

SECTION 084113
ALUMINUM FRAMED ENTRANCES

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: Under Alternate #1

1. Thermally broken aluminum entrance doors and frames.
2. Seals around frame perimeters.
3. Weatherstripping.
4. Installation of hardware furnished for aluminum entrances by hardware supplier as specified in Section 087100 - Finish Hardware.
5. Perimeter sealant installation in accordance with requirements of Section 079200 - Joint Sealants.

B. Related Requirements:

1. Section 079200 "Joint Sealants" for sealing at aluminum door frames
2. Section 087100 "Finish Hardware" for new aluminum doors and frames finish hardware.
3. Section 088000 "Glazing" for new glass.

1.3 QUALITY ASSURANCE

A. Installer's Qualifications: Company specializing in installation of systems of the type specified for 5 years, and approved by system manufacturer.

B. Fabrication Tolerances: Fabricate aluminum storefront in accordance with framing manufacturer's prescribed tolerances.

C. Thermal Break Components: Manufactured to meet the following standards:

1. AAMA QAG 1–98**, "**Quality Assurance Processing Guide for Poured and Debridged Polyurethane Thermal Barriers.**"**
2. AAMA TIR A8–90**, "**Structural Performance of Poured and Debridged Framing Systems.**"**
3. AAMA 505-98**, "**Dry Shrinkage and Composite Performance Thermal Cycling Test Procedure.**"**

D. Coordination:

1. Installer of aluminum entrance doors and frames shall be responsible for installing each complete with glass and perimeter sealant.
2. Coordinate with Finish Hardware Supplier as required to assure proper fitting of hardware items furnished under Section 087100.

    a. Hardware Installation: According to templates approved by hardware item manufacturers.
    b. Hardware Templates: Report to Architect in writing should templates not be delivered by Hardware Supplier in sufficient time to meet construction schedules.

3. Glazing: Installer of aluminum entrance doors shall be responsible for installing them complete with glass.

1.4 SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, and finishes.

B. Shop Drawings: Show elevations and details**,** including gaskets**,** weatherstripping**,** methods of anchoring**,** type of alloy**,** finishes; size and thickness of individual parts**,** dissimilar metal protection.

1. Shop drawings for the window systems shall bear the seal and signature of a Structural Engineer licensed in the State of Illinois and contain:

    a. Anchor locations - If anchors other than thru-jamb type are used, contractor to provide required interior trim as required to conceal fasteners whether shown on the drawings or not.
    b. Structural integrity.
    c. Wind loading.
    d. Structural loading.
    e. All installations shall be based on the 2009 IBC.

C. Samples: Submit for Architect**'**s review:

1. 2 samples 6" long of each color available for each type of glazing sealant and gasket exposed to view.
2. Full size samples of each framing system.

D. Certificates: Submit manufacturer's certification that Installer is approved by manufacturer.

1.5 PRODUCT STORAGE, AND HANDLING

A. Uncrate doors, frames and related accessories and store in strict compliance with the manufacturer**'**s instructions. Remove all padding and packing in contact with aluminum immediately upon arrival in order to prevent staining.

1.6 WARRANTIES

A. Manufacturer shall agree to repair or replace units whose components fail due to inferior materials or workmanship within 10 years of installation. Failures shall include but are not be limited to:

1. Structural failures including excessive deflection**,** leakage or air infiltration.
2. Failure of insulating glass, including interpane dusting or misting and internal dew point rising above -50°F.

B. Warranty Period:

1. Window Manufacturer: 10 years from date of Substantial Completion.
2. Window Installer: 5 years from date of Substantial Completion
3. Finish: Manufacturer's standard warranty.

PART 2 - PRODUCTS

2.1 MANUFACTURER AND TYPE

A. Acceptable Products:

1. Thermally Broke Aluminum Door Frame: TriFab "VG 451T" as manufactured by Kawneer as the Basis-of-Design or comparable products by Efco, Tubelite, Manko or YKK AP or Owner Approved Equal.

    a. Frames shall have with a nominal profile of 2" x 4 1/2".

2. Thermally Broke Aluminum Entrance Doors: Doors shall be heavy duty swing type, "Insulclad 560" as manufactured by Kawneer as the Basis-of-Design or comparable products by Efco, Tubelite, Manko or YKK AP or Owner Approved Equal.

    a. Door thickness of 2 1/4".
    b. Hardware and Lock Cylinders: As furnished under Section 087100 – Finish Hardware.

2.2 MATERIALS AND CONSTRUCTION

A. Aluminum (Framing and Components):

1. Material Standard: ASTM B 221; 6063-T6 alloy and temper.
2. Wall Thickness: minimum wall thickness of 3/16."
3. 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.
4. Thermal Breaks: Manufacturer's standard type. Poured-in-place polyurethane type shall have maximum tensile strength of 4,300 psi.

B. Accessories:

1. Fasteners: Where exposed, shall be Stainless Steel.
2. Gaskets: Glazing gaskets shall be extruded EPDM rubber.
3. Perimeter Anchors: Aluminum. When steel anchors are used, provide insulation between steel material and aluminum material to prevent galvanic action.
4. Dissimilar Metal Protection: Alkali resistant bituminous paint conforming to AN-P 31**,** plastic separators**,** insulating tapes or manufacturer**'**s standard**,** subject to Architect**'**s approval.

C. Weatherstripping: Thermoplastic elastomer weatherstrip system on all sides of exterior doors and/or frames**,** meeting AAMA 702 requirements. Provide surface applied bottom weatherstrip with flexible blade gasket at bottoms of doors.

D. Internal Joint Sealant: Polyisobutylene non-hardening thin-joint sealant **"**Presstite #579**"** or equal.

E. Sealants: See Section 079200 - Joint Sealants.

F. Glass: See Section 088000 - Glazing.

G. Material Separation: Provide a coating or material between dissimilar materials as recommended by aluminum door manufacturer to protect against corrosion of aluminum materials.

2.3 FABRICATIONS

A. Fabricate components per manufacturer's installation instructions and with minimum clearances and shim spacing around perimeter of assembly, yet enabling installation and dynamic movement of perimeter seal.

B. Accurately fit and secure joints and corners. Make joints flush, hairline and weatherproof.

C. Prepare components to receive anchor devices. Fabricate anchors.

D. Arrange fasteners and attachments to conceal from view.

2.4 FINISH

A. Exposed Metal Surfaces: Factory applied fluoropolymer coating containing a minimum of 70%, by weight, Kynar 500, Kynar 500 VLD or Hylar 5000 resin; color as selected by Architect from manufacturer's full range of standard options.

B. Unexposed metal surfaces may remain uncoated.

2.5 FABRICATION

A. General: Fabricate and assemble in as large sections in shop as consistent with shipping and field requirements.

B. Joints: Shall be flush, hairline. Field splices and joints between sections shall produce strength to resist misalignment and deformations imposed by handling and live loads. Keep fasteners concealed.

C. Doors: Corners: Dual moment construction consisting of mechanical fastening using extruded aluminum channel clips and bolt fasteners and SIGMA deep penetration plug welds and fillet welds.

D. Reinforce doors and frames for hardware with backing plates of non-magnetic steel or hot-dip galvanized steel complying with ASTM A 36.

1. Reinforce for butt hinges with 1/4" steel plates 10" long welded to aluminum with 6 welds, each 1/2" long.
2. Reinforce for closers with 10-gauge plate, 12-gauge plate for other hardware.
3. Reinforce for all other cutouts and mortises similarly.

E. Provide positive means to drain to the outside any water entering the system.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

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

3.2 PREPARATION

A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.

B. Drill and tap frames to receive nontemplated, mortised, and surface-mounted hardware.

C. All surfaces that may contact steel**,** concrete or masonry construction shall be prepared with dissimilar protection materials hereinbefore specified. Aluminum surfaces to remain exposed shall be protected from bituminous paint application.

3.3 INSTALLATION

A. Set frames in locations shown**,** level**,** plumb and in line. Seal joints between framing members and mullions. Where moldings are jointed**,** accurately cut and fit members to result in tightly closed joints.

B. Do not use exposed fasteners except as approved by Architect.

C. Internal Drainage: Cut**,** join and seal members to form positive paths of drainage within the framing in order to prevent any water that may enter the system from leaking through to interior of building.

D. Frame Anchors: Unless indicated or approved otherwise, space anchors all around opening at not more than 24" o.c. Powder-actuated fasteners will not be allowed.

E. Glazing Application:

1. Front plane.
2. Outside glazed.

F. Glazing Beads: Make corners square, butted and tightly fit.

G. Glazing Seals: Furnish seals to glass installer, ready for installation of glazing.

H. Apply sealant to both sides of perimeter of frames**,** using materials and methods specified in Section 079200 - Joint Sealants**,** including submissions.

I. Install Material Separation: Provide a coating or material between dissimilar materials as recommended by aluminum door system's manufacturer to protect against corrosion of aluminum materials.

J. Contractor is allowed to install head receptors. No jamb receptors will be allowed.

K. Finish Hardware: Install finish hardware as specified in Section 087100.

3.4 ADJUSTING, CLEANING AND PROTECTION

A. Hardware Adjustment: Adjust and check each operating item, to ensure proper operation and function.

B. Hardware Lubrication: Lubricate moving parts with lubricant recommended by manufacturer. Use graphite-type lubricant if none other recommended.

C. Hardware Replacement: Replace units that cannot be adjusted and lubricated to operate freely and smoothly as intended.

D. Cleaning: Clean aluminum surfaces promptly after installation of frames and doors**,** exercising care to clean corners and to avoid damage of the protective coating (if any). Remove excess glazing and sealant compounds**,** dirt and other substances. Final cleaning will be done by General Contractor just prior to time of acceptance.

E. Touch-Up: Scratches and abrasions shall be touched-up with finish manufacturer's recommended coating**,** to satisfaction of Architect.

F. Protection:

1. General Contractor shall provide protective measures and other precautions as required through remainder of construction period**,** according to recommendations of Installer**,** to ensure that doors and frames will be without damage or deterioration (other than normal weathering) at time of acceptance.
2. Plastic films applied for protection during shipment shall not be used for protection after installation of aluminum.

END OF SECTION 084113

SECTION 085113
ALUMINUM STOREFRONT WINDOWS

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. Fixed aluminum storefront windows.
2. Operable windows installed in storefront windows.

B. Related Requirements:

1. Section 079200 "Joint Sealants" for perimeter sealing of aluminum windows to exterior walls.
2. Section 084113 "Aluminum Framed Entrances" for aluminum doors and frames.
3. Section 088000 "Glazing" for glass.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Washington Academy.

1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
2. Review, discuss, and coordinate the interrelationship of aluminum windows with other exterior wall components. Include provisions for anchorage, flashing, sealing perimeters, and protecting finishes.
3. Review and discuss the sequence of work required to construct a watertight and weathertight exterior building envelope.
4. Inspect and discuss the condition of substrate and other preparatory work performed by other trades.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, glazing and fabrication methods, dimensions of individual components and profiles, hardware, and finishes for aluminum windows.

B. Shop Drawings: Include plans, elevations, sections, hardware, accessories, insect screens, operational clearances, and details of installation, including anchor, flashing, and sealant installation.

1. Submit shop drawings by date shown on drawings.

a. Shop drawings must be prepared wholly by the window manufacturer, or a qualified engineering services firm under the direction of the manufacturer.
b. After mockups are field tested and approved, window manufacturer shall complete the shop drawings for the remaining windows.

2. Shop drawings for the window systems shall bear the seal and signature of a Structural Engineer licensed in the State of Illinois and contain:

a. Anchor locations - If anchors other than thru-jamb type are used, contractor to provide required interior trim as required to conceal fasteners whether shown on the drawings or not.
b. Structural integrity.
c. Wind loading.
d. Structural loading.
e. All window installations shall be based on the 2009 IBC.

C. Samples: For each exposed product and for each color specified, 2 by 4 inches (50 by 100 mm) in size.

D. Samples for Initial Selection: For units with factory-applied color finishes.

1. Include similar Samples of hardware and accessories involving color selection.

E. Samples for Verification: For aluminum windows and components required, showing full range of color variations for finishes, and prepared on Samples of size indicated below:

1. Exposed Finishes: 2 by 4 inches (50 by 100 mm).
2. Exposed Hardware: Full-size units.

F. Product Schedule: For aluminum windows. Use same designations indicated on Drawings.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer and Installer.

B. Product Test Reports: For each type of aluminum window, for tests performed by a qualified testing agency.

C. Field quality-control reports.

D. Sample Warranties: For manufacturer's warranties.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: A manufacturer capable of fabricating aluminum windows that meet or exceed performance requirements indicated and of documenting this performance by test reports, and calculations.

B. Installer Qualifications: An installer acceptable to aluminum window manufacturer for installation of units required for this Project, who has a minimum of 5 years experience in similar window installation projects.

C. Mockups: Erect one mockup in location shown on the drawings to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution. These mockups will be field tested for air infiltration and water resistance in accord with paragraph 3.3.

1. Install the mockup window at the one wall opening location as shown on Drawings.
2. Test mockups per par. 3.3 Field Quality Control per schedule on drawings.
3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

1.7 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace aluminum windows that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Failure to meet performance requirements.
b. Structural failures including excessive deflection, water leakage, condensation, and air infiltration.
c. Faulty operation of movable sash and hardware.
d. Deterioration of materials and finishes beyond normal weathering.

2. Warranty Period:

a. Window Manufacturer: 10 years from date of Substantial Completion.
b. Window Installer: 5 years from date of Substantial Completion.
c. Finish: 20 year Manufacturer’s standard warranty.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Acceptable Products:

1. Basis-of-Design is Kawneer Window System or comparable products by Efco, Tubelite, Manko or YKK AP or Owner Approved Equal:

a. Fixed: 451 TVG, 2” x 4 ½”.
b. Projected: 8225 TL, 2 ¼” depth.

B. Source Limitations: Obtain aluminum windows from single source from single manufacturer.

2.2 MATERIALS

A. All aluminum members, frames, sash bars, glazing beads, muntins and mullions shall be extruded from 6063T alloy of suitable temper and have a minimum tensile strength of 28,000 psi.

1. No main member shall have a wall thickness less than .070"
2. Aluminum glazing beads shall be snap-in type with a minimum wall thickness of .050".
3. Sills/subsills shall have a minimum wall thickness of .090".

B. Aluminum Glazing Beads: Extruded snap-in type with glazing legs no less than 3/4".

C. Thermal Barrier: Poured in place polyurethane with max. tensile strength of 4300 psi.

1. Thermally Improved Construction: Fabricate frames, sashes, and muntins with an integral, concealed, low-conductance thermal barrier located between exterior materials and window members exposed on interior side in a manner that eliminates direct metal-to-metal contact.

D. Weatherstripping: Two rows of jacketed foam or neoprene fin gaskets or polypropylene pile installed in dovetailed grooves extruded in sash members and secured to prevent movement, shrinkage or loss. Jacketed type shall conform to AAMA 701.2.

E. Glazing Seals: As furnished by window manufacturer; color as selected by Architect from manufacturer's standard color options. Any of the following types may be used:

1. Extruded EPDM dry gasket seals with impervious skins.
2. Extruded vinyl dry gasket seals with impervious skins, meeting ASTM D 2287.
3. Extruded neoprene dry gasket seals with impervious skins, meeting ASTM D 2000, type 2BC415 to 3BC415.
4. Extruded silicone dry gasket seals with impervious skins.
5. Expanded neoprene gaskets with impervious skins meeting ASTM C 509, Grade 4.
6. Butyl tape and silicone wet seals as standard to window manufacturer.

F. Anchors: Aluminum or steel. When anchors are steel they must be primed with shop coat of approved zinc chromate primer and insulated from the aluminum members or must be cadmium or zinc plated to meet ASTM A 165 or A 164 requirements.

G. Fasteners:

1. Frame Assembly Fasteners: Non-magnetic stainless steel.
2. Miscellaneous Fasteners: Aluminum or non-magnetic stainless steel, with finish color to match frames where exposed to view.
3. Frame Anchor Clip Fasteners: Expansion bolts, toggle bolts or lag screws, as required by building construction material, not less than 1/4" dia., cadmium or zinc plated steel in accordance with ASTM A 164 and A 165.
4. No plastic expansion anchors allowed.

H. Sills/Subsills:

1. Extruded aluminum sections shall assure that any water entering the glazing channels will be positively weeped to the exterior. Furnish sills with sub-structural components**,** such as legs and/or blocking**,** so as to assure complete support of the sill across the window opening.
2. Subsills: Thermally broken, extruded-aluminum subsills in configurations indicated on Drawings.

I. Receptors: Head receptors are allowed. Jamb receptors are not allowed.

J. Dissimilar Metal Protection: Alkali resistant bituminous paint conforming to AN-P 31**,** plastic separators**,** insulating tapes or manufacturer**'**s standard**,** subject to Architect**'**s approval.

K. Applied muntins shall be finished to match the color of the window frames. Munitins can be installed with 3m tape designed for exterior use. See drawings for size and location of applied muntins.

2.3 COMPONENTS

A. Hardware:

1. All steel components including attachment fasteners to be stainless steel except as otherwise noted.
2. Extruded aluminum components 6063-T5 or T6.
3. Locking handles, bases and strikes to be die cast, white bronze or stainless steel.
4. Thermo-plastic or thermo-set plastic caps, housings and other components to be injection-molded nylon, extruded PVC pr other suitable compound.

B. Sealants:

1. All sealants shall comply with applicable provisions of AAMA 800 and/or Federal Specifications FS-TT-001 and 002 Series.
2. Frame joinery sealants shall be suitable for application specified and as tested and approved by window manufacturer.

2.4 WINDOW PERFORMANCE REQUIREMENTS

A. Design Wind Loads:

1. The design wind pressure for the project shall be per the IBC 2009 code and should be determined by the Structural Engineer licensed in the State of Illinois obtained by the manufacturer.

2. All structural components, including meeting rails, mullions, anchors and added reinforcing shall be designed accordingly, by a Structural Engineer licensed in the State of Illinois, complying with deflection and stress requirements as listed herein.

B. Air Test: Air infiltration maximum 0.1 cfm per square foot at 6.24 psf pressure differential when tested in accord with ASTM E283.

C. Water Test: No uncontrolled water leakage at 12.00 psf static pressure differential, with Water application rate of 5 gallons/hr/sq ft when tested in accord with SASTM E331 and ASTM E547.

2.5 GLAZING

A. See Specification Section 088000 "Glazing".

2.6 HARDWARE

A. General: Provide manufacturer's standard hardware fabricated from aluminum, stainless steel, carbon steel complying with AAMA 907, or other corrosion-resistant material compatible with adjacent materials; designed to smoothly operate, tightly close, and securely lock windows, and sized to accommodate sash weight and dimensions.

B. Exposed Hardware Color and Finish: As selected by Architect from manufacturer's full range of colors.

C. Projected Window Hardware:

1. Gear-Type Rotary Operators: Complying with AAMA 901 when tested according to ASTM E 405, Method A.

    a. Type and Style: As selected by Architect from manufacturer's full range of types and styles.

    b. All operable windows shall have a rotary operator.

2. Hinges: Stainless steel 4 – bar non-friction type, not less than two per sash.
3. Lock: Lever handle and cam-action lock with keeper.
4. Limit Devices: Concealed support arms with adjustable, limited, hold-open limit devices designed to restrict sash opening.

    a. Allow windows to be opened as far as possible. Prior to fabrication of windows, some windows maybe changed to only allow a 4" opening.

D. Weather Stripping: Provide full-perimeter weather stripping for each operable sash unless otherwise indicated.

E. Fasteners: Noncorrosive and compatible with window members, trim, hardware, anchors, and other components.

1. Exposed Fasteners and Anchors: Do not use exposed fasteners or anchors to the greatest extent possible. For application of hardware, use fasteners that match finish hardware being fastened.
2. Exposed fasteners or anchors shall be covered by trim which matches the finish and colors of the window frame.

2.7 INSECT SCREENS

A. General: Fabricate insect screens to integrate with window frame. Provide screen for each operable exterior sash. Screen wickets are not permitted.

1. Provide screen anchors at 6 locations typical. Two on each side and two at the bottom..

B. Aluminum Frames: Manufacturer's standard aluminum alloy complying with SMA 1004 or SMA 1201. Fabricate frames with mitered or coped joints or corner extrusions, concealed fasteners, and removable PVC spline/anchor concealing edge of frame.

1. Tubular Framing Sections and Cross Braces: Roll formed from aluminum sheet with color to match window frames.

C. Aluminum Wire Fabric: 18-by-16 (1.1-by-1.3-mm) mesh of 0.011-inch- (0.28-mm-) diameter, coated aluminum wire, Charcoal gray finish

2.8 FABRICATION

A. Fabricate aluminum windows in sizes indicated. Include a complete system for assembling components and anchoring windows.

B. Weather strip each operable sash to provide weathertight installation.

C. Weep Holes: Provide weep holes and internal passages to conduct infiltrating water to exterior.

2.9 ALUMINUM FINISHES

A. Natural Anodized Finish, AA-C22A41, Class 1 (min. 0.7 mils thickness and sealed), natural aluminum color.

B. Under Alternate Bid #6: Factory applied fluoropolymer coating containing a minimum of 70%, by weight, Kynar 500, Kynar 500 VLD or Hylar 5000 resin; color as selected by Architect from manufacturer’s full range of standard.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Verify rough opening dimensions, levelness of sill plate, and operational clearances.

C. Examine wall flashings, vapor retarders, water and weather barriers, and other built-in components to ensure weathertight window installation.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with manufacturer's written instructions for installing windows, hardware, accessories, and other components. For installation procedures and requirements not addressed in manufacturer's written instructions, comply with installation requirements in ASTM E 2112.

B. Install windows level, plumb, square, true to line, without distortion or impeding thermal movement, anchored securely in place to structural support, and in proper relation to wall flashing and other adjacent construction to produce weathertight construction.

C. Install windows and components to drain condensation, water penetrating joints, and moisture migrating within windows to the exterior.

D. Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials.

E. Glazing Application:

1. Front plane.
2. Outside glazed except where otherwise noted on drawings.

3.3 FIELD QUALITY CONTROL

A. Testing Agency:

1. Owner will engage and pay a qualified testing agency to perform tests and inspections

2. Testing and inspecting agency will interpret tests and state in each report whether tested work complies with or deviates from requirements.

B. Testing Services: Testing and inspecting of installed windows shall take place as follows:

1. Testing Methodology: Testing of windows for air infiltration and water resistance shall be performed according to AAMA 502.

2. Air-Infiltration Testing:

   a. Test Pressure: That required to determine compliance with AAMA/WDMA/CSA 101/I.S.2/A440 performance class indicated.
   b. Allowable Air-Leakage Rate: 1.5 times the applicable AAMA/WDMA/CSA 101/I.S.2/A440 rate for product type and performance class rounded down to one decimal place.

3. Water-Resistance Testing:

   a. Test Pressure: Eight (8) lbs/psf to determine compliance with AAMA/WDMA/CSA 101/I.S.2/A440 performance grade indicated.

b. Allowable Water Infiltration: No water penetration.

4. Testing Extent: One window (one W12) in location as shown on the drawings. Window shall be tested after perimeter sealants have cured.

5. Test Reports: Prepared according to AAMA 502.

C. Remove and replace noncomplying windows and retest as specified above.

D. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

E. Prepare test and inspection reports.

F. Owner may have other random windows tested after they are completed in order to verify compliance with the above air and water resistant testing. Any windows that fail the tests will need to be corrected and retested at the Contractors expense.

3.4 ADJUSTING, CLEANING, AND PROTECTION

A. Adjust operating sashes and hardware for a tight fit at contact points and weather stripping for smooth operation and weathertight closure.

B. Clean exposed surfaces immediately after installing windows. Avoid damaging protective coatings and finishes. Remove excess sealants, glazing materials, dirt, and other substances.

1. Keep protective films and coverings in place until final cleaning.

C. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.

D. Protect window surfaces from contact with contaminating substances resulting from construction operations. If contaminating substances do contact window surfaces, remove contaminants immediately according to manufacturer's written instructions.

END OF SECTION 085113

SECTION 086200
UNIT SKYLIGHTS

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. Prefabricated deck mounted impact modified plastic double domed skylights.

B. Coordinate installation of skylights with installation of roofing and related metal flashings.

C. Related Requirements:

1. Section 024119 “Selective Demolition” for removal of existing skylights.
2. Wood framing
3. Section 075423 "Adhered TPO Roofing"

1.3 SUBMITTALS

A. Product Data Sheet: For each type of skylight specified, include details of construction and installation, relative to applicable roofing materials

B. Samples for Selection: Manufacturer’s color charts showing a full range of colors available for each type of skylight glazing and Aluminum Finish.

1.4 PERFORMANCE REQUIREMENTS

A. General: Provide unit skylights capable of withstanding loads indicated without failure.

B. Units shall be tested to compliance with AAMA\WDMA\CSA\101\I.S.2\A440 as required by the International Building Code.

C. Units shall be impact tested to 775 ft-lbs to comply with the intent of OSHA fall protection regulation 29 CFR 1910.23 (e)(8)*.

1.5 WARRANTY

A. General: Warranties specified in this section shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to and run concurrent with other warranties made by the Contractor under requirements of the Contract Documents.

B. Skylight Warranty: Provide written warranty signed by manufacturer, agreeing to repair or replace work that exhibits defects in materials or workmanship and guaranteeing weather-tight and leak-free performance. “Defects” is defined as uncontrolled leakage of water and abnormal aging or deterioration.

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

C. Plastic Warranty: Provide written warranty signed by manufacturer agreeing to repair or replace work that has or develops defects in the plastic. “Defects” is defined as abnormal aging or deterioration.

1. Warranty Period for Impact Glazing: 2 years from date of Substantial.

D. Finish Warranty: Provide written warranty signed by manufacturer agreeing to repair or replace work with finish defects. “Defects” is defined as peeling, chipping, chalking, fading, abnormal aging or deterioration, and failure to perform as required.

1. Warranty Period for Anodized Finish: 2 year from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 ACCEPTABLE TYPES & MANUFACTURERS

1. Single Skylight - Model #3636 double dome by Daylite Company is the basis-of-design or approved equal.

2. Triple Skylight - Model #712C double dome by Daylite Company is the basis-of-design or approved equal. Provide integral gutters between skylights.

2.2 MATERIALS

A. General: Factory-assembled, deck-mounted unit consisting of impact plastic glazing, gasketing, inner frame that is incorporated into the curb, and integral curb with self-contained roof flashing flanges.

B. Condensation Control: Fabricate skylight units with integral internal gutters and weeps to collect and dispose of condensation.

C. Shapes: Double domed (refer to drawings for locations of each type).

D. Sizes:

1. Single Square Unit: 3’ x 3’ (verify in field).
2. 3 Domed Unit: 7’ x 12’ (verify in field).

E. Outer Dome Glazing: Dome thermoformed as indicated on drawings with clear acrylic glazing.

F. Inner Dome Glazing: Dome or pyramid thermoformed as indicated on drawings with white acrylic glazing.

G. Fall Protection: Provide 0.162" diameter galvanized wire mesh at 4" o.c. in both directions to meet OSHA standards.

2.3 FABRICATION

A. Framing Components: As follows:

1. Factory fit and assemble components.
2. Fabricate components that, when assembled, will have accurately fitted joints with ends coped or mitered to produce hairline joints free of burrs and distortion.
3. Fabricate components to drain water passing joints and condensation the exterior.
4. Fabricate components to accommodate expansion, contraction, and field adjustment, and to provide for minimum clearance and shimming at skylight perimeter.
5. Fabricate components to ensure that glazing is thermally and physically isolated from framing members.
6. Form shapes with sharp profiles, straight and free of defects or deformations, before finishing.

2.4 ALUMINUM FINISHES

A. General: Comply with NAAMM "Metal Finishes Manual" recommendations for application and designations of finish.

B. Finish designations prefixed by AA conform to the system for designations of aluminum finishes established by the Aluminum Association.

1. Clear-Anodized Finish, Class I: AA-C22A41 complying with AAMA 611.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with installer present, for compliance with requirements for installation tolerances and other conditions affecting skylight performance.

1. Insure that existing wood curbs have been raised by adding additional preserved wood nailers being added by the Carpenter.

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

3.2 PREPARATION

A. Metal Protection: As follows.

1. Where aluminum will contact dissimilar metals, protect against galvanic action by paining contact surfaces with primer or by applying sealant or tape recommended by manufacturer for this purpose.
2. Where aluminum will contact pressure-treated wood, separate dissimilar materials by methods recommended by manufacturer.

3.3 INSTALLATION

A. General: Comply with manufacturer's written instructions for protecting, handling, and installing skylight components.

B. Coordinate with installation of roofing and other substrates to receive skylight units.

C. Coordinate with installation of vapor barriers, roof insulation, roofing, and flashing as required to assure that each element of the work performs properly and that combined elements are waterproof and weathertight. Anchor units securely to supporting structural substrates, adequate to withstand lateral and thermal stresses as well as inward and outward loading pressures.

D. Counter Flashing: Where counter flashing is required as component of the skylight, install to provide an adequate waterproof overlap with roofing or roof flashing (as counter flashing). Seal with thick bead of mastic sealant, except where overlap is indicated to be left open for ventilation.

3.4 CLEANING AND PROTECTION

A. Clean exposed metal and plastic surfaces according to manufacturer's instructions. Touch up damaged metal coatings.

END OF SECTION 086200

SECTION 087100
FINISH 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.

B. SUMMARY

1. Mechanical door hardware for exterior swinging doors for Alternate Bid #1.

C. Related Sections:

1. Section 012300 "Alternates" for doors and hardware provided under Alternate No. 1.

1.2 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. 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: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule." Double space entries, and number and date each page.
c. Content: Include the following information:

1) Identification number, location, hand, 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) Fastenings and other pertinent information.
5) Explanation of abbreviations, symbols, and codes contained in schedule.
6) Mounting locations for door hardware.
7) 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.

1.3 INFORMATIONAL SUBMITTALS

A. Warranty: Special warranty specified in this Section.

1.4 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.

B. Source Limitations: Obtain each type of door hardware from a single manufacturer.

C. Means of Egress Doors: Latches do not require more than 15 lbf (67 N) to release the latch. Locks do not require use of a key, tool, or special knowledge for operation.

D. Accessibility Requirements: Comply with applicable provisions in the DOJ's 2010 ADA Standards for Accessible Design and ICC 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 (22.2 N).
2. Bevel raised thresholds with a slope of not more than 1:2. Provide thresholds not more than 1/2 inch (13 mm) high.
3. Closers: Adjust door and gate closer sweep periods so that, from an open position of 90 degrees, the time required to move the door to a position of 12 degrees from the latch is 5 seconds minimum.

1.5 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 to manufacturer of key control system for subsequent delivery to Owner.

1.6 COORDINATION

A. 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.

B. Security: Coordinate installation of door hardware, keying, and access control with Owner's security consultant.

C. 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.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including excessive deflection, cracking, or breakage.
b. Faulty operation of doors and door hardware.
c. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.

2. Warranty Period: Two years from date of Substantial Completion, unless otherwise indicated.

a. Exit Devices: Three years from date of Substantial Completion.
b. Manual Closers: 10 years from date of Substantial Completion.
c. Bored Locksets: 7 years from date of Substantial Completion.
d. Hinges: Life of Building from date of Substantial Completion.

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 as follows:

1. Keyed Removal Mullion: As specified or Owner approved equal.
2. Panic Hardware: As specified or Owner approved equal.
3. Cylinders: As specified or Owner approved equal.
4. Closers: As specified or Owner approved equal.
5. All Other Hardware: As specified or Owner approved equal.

2.2 FABRICATION

A. Manufacturer's Nameplate: Do not provide products that have manufacturer's name or trade name displayed in a visible location except as otherwise approved by Architect.

1. Manufacturer's identification is permitted on rim of lock cylinders only.

B. 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.

C. 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. Spacers or Sex Bolts: For through bolting of hollow-metal doors.
3. Gasketing Fasteners: Provide noncorrosive fasteners for exterior applications and elsewhere as indicated.

2.3 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. 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.

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.

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 type quantities indicated in door hardware schedule.

D. Thresholds: Set threshold in full bed of sealant.

E. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.

F. Door Bottoms: Apply to bottom of door, forming seal with threshold when door is closed.

3.4 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. Door Closers: Adjust sweep period to comply with accessibility requirements and requirements of authorities having jurisdiction.

3.5 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.

3.6 DOOR HARDWARE SCHEDULE

HARDWARE SET # 01
FOR USE ON DOOR #(S):

101

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	CONT. HINGE	112HD	313	IVE
1	EA	PANIC HARDWARE	CD-99-NL-697NL-SNB	612	VON
1	EA	MORTISE CYLINDER	LC-R	612	SAR
1	EA	RIM CYLINDER	LC-R	612	SAR
1	EA	ELECTRIC STRIKE	6111 FSE	612	VON
1	EA	OH STOP	104S	630	GLY
1	EA	CLOSER	UNI-7500	691	NOR
1	EA	DOOR SWEEP	323A	AL	REE
1	EA	APPLIED STOP	4N	719	NGP
1	EA	THRESHOLD	813	AL	NGP
1	EA	POWER SUPPLY	PS902 900-BBK	LGR	VON
1	EA		WEATHERSTRIP BY DOOR/FRAME MANUFACTURER		

*REUSE EXISTING CARD READER
*CARD READER AND ELECTRIC STRIKE NEED TO BE CONNECTED TO POWER

HARDWARE SET # 02
FOR USE ON DOOR #(S):

102 103

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	CONT. HINGE	112HD	313	IVE
1	EA	PANIC HARDWARE	CD-99-DT-697DT	612	VON
1	EA	MORTISE CYLINDER	LC-R	612	SAR
1	EA	OH STOP	104S	630	GLY
1	EA	CLOSER	UNI-7500	691	NOR
1	EA	DOOR SWEEP	323A	AL	REE
1	EA	APPLIED STOP	4N	719	NGP
1	EA	THRESHOLD	813	AL	NGP
1	EA		WEATHERSTRIP BY DOOR/FRAME MANUFACTURER		

END OF SECTION 087100

SECTION 088000
GLAZING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes:

1. Glazing of exterior aluminum storefront windows.
2. Glazing of exterior aluminum entrance framing.
3. Glazing of exterior aluminum entrance doors.

B. Related Requirements:

1. Section 084113 "Aluminum Framed Entrances" for glazing of new aluminum entrances.
2. Section 085113 "Aluminum Storefront Windows" for glazing of new aluminum windows.

1.3 QUALITY ASSURANCE

A. Comply with all pertinent codes and regulations, including the Consumer Product Safety Commission Safety Standard for Architectural Glazing Materials (16 CFR 1201) and the State of Illinois Safety Glazing Materials Act.

B. Comply with all pertinent recommendations in the Glazing Manual of the Flat Glass Marketing Association.

C. All glass shall bear glass manufacturer's label stating variety and grade.

1.4 SUBMITTALS

A. Product Data: Submit manufacturers' product data describing each type of glass and glazing item specified herein.

B. Samples: Submit for Architect's review 2 samples, 6" square, of each type of glass required.

C. Manufacturer's Instructions: Submit glazing gasket manufacturer's recommendations for each installation situation.

1.5 WARRANTIES

A. Installer shall guarantee installed work to be waterproof for a period of 5 years.

B. Insulating glass units shall be warranted for 10 years against failure**,** including interpane dusting or misting and internal dew point rising above -50°F. Warranty shall provide for replacement of glass and glazing**,** including labor.

1.6 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Deliver glazing materials to job site in sealed containers with manufacturer's original labels attached to each piece of glass. Provide UL labels for fire rated glass. Provide cushions at edges to prevent impact damage.

B. Store glass on edge, under cover and protect from staining.

C. Avoid deformation of units. Protect faces from scratches and abrasion.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURER

A. Insulating-Glass Units: ASTM E 2190, certified through IGCC as complying with requirements of IGCC. Glass Types Gl-1, Gl-2 and Gl-4 listed are PPG products as the Basis-of-Design or comparable products of Guardian and Pilkington or Owner approved equal. Glass types shall be as follows:

1. GL 1: PPG 1” Insulated Solarban R100-Tempered:

   a. ¼” tempered on clear neutral reflective Low-E #2 surface.
   b. ½” airspace with argon.
   c. ¼” clear tempered.

2. GL 2: PPG 1” Insulated Solarban R100-Tempered Obscure Glass:

   a. ¼” tempered on clear neutral reflective Low-E #2 surface.
   b. ½” airspace with argon.
   c. ¼” velour tempered on #3.

3. GL-3: Insulated Metal Spandrel Infill Panels: 1" thick insulated sandwich panels consisting of an isocyanurate core laminated to 1/8" tempered hardboard substrates with smooth aluminum skins.

   a. “R” Value of Core: At least 6.

   b. Finish: On both sides of panels shall be smooth aluminum with a Kynar 500 finish in a custom color selected by Architect. Color maybe different on the interior and exterior.

   c. Lamination: With thermo-plastic, moisture and fungus resistant adhesive, subjected to direct heat before assembly closure in order to drive off excess solvents.

d. Acceptable Manufacturer: Mapes Industries, Citadel Architectural Products or Owner approved equal.

2.2 Glazing Materials:

A. Approved Manufacturers: Use products of the following:

1. Tremco Manufacturing Co.
2. G.E.
3. Dap, Inc.
4. Pecora Corp.
5. Protective Treatments, Inc. (PTI).
6. Vetrotech (Saint-Gobain).

B. Setting Blocks: Neoprene, 70-90 durometer hardness, having proven compatibility with sealants used, width of rabbet less 1/16" by lengths sufficient for weight of glass supported.

C. Spacers: Neoprene, 40-50 durometer hardness, having proven compatibility with sealants used.

D. Compressible Filler Rod: Closed-cell or waterproof-jacketed rod stock of synthetic rubber or plastic foam, proven to be compatible with sealants used, flexible and resilient, with 5-10 psi compression strength for 25% deflection.

E. Cleaners, Primers and Sealers: Type recommended by sealant or gasket manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

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

3.2 PREPARATION

A. Clean the glazing channel, or other framing members to receive glass, immediately before glazing. Remove coatings that are not firmly bonded to the substrate. Remove lacquer from metal surfaces wherever elastomeric sealants are used. Verify that weep holes are free of obstructions.

B. Apply primer or sealer to joint surfaces wherever recommended by sealant manufacturer.

C. Cut glass with smooth straight edges to full sizes required by openings. Do not attempt to cut, seam, nip or abrade glass that is tempered, heat strengthened, or coated.

3.3 INSTALLATION

A. Glass:

1. Set glass on setting blocks at quarter points, and fix without springing or inducing bowing. Install with proper bite and clearances all around.
2. Glass having waviness shall be set with waves placed horizontally unless Architect directs otherwise. Lites viewed in series or as a group shall have uniform draw, bow and similar characteristics.
3. Tempered glass having tong marks shall be installed so that tong marks are within rabbets at top of opening.

3.4 CLEANING

A. All glass shall be left whole, free from checks or other defects, and cleanly washed inside and out and the building left ready for occupancy when directed by the Architect.

B. Any defective glass that may appear after cleaning shall be removed and replaced with perfect glass.

END OF SECTION 088000

SECTION 092216
NON-STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes non-load-bearing steel framing members for the following applications:

1. Interior framing systems (e.g., supports for partition walls, framed soffits, furring, etc.).

1.2 SUBMITTALS

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

PART 2 - PRODUCTS

2.1 DESCRIPTION

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

B. Framing Members, General: Comply with ASTM C 754 for conditions indicated.

1. Design Values:

a. Deflection Limit:

1) L/240 unless otherwise noted.
2) L/360 where Level 5 gypsum board finish is indicated, at tile backing panels, and elsewhere as indicated.

b. Lateral Pressure:

1) 5.0 psf (240 Pa) unless otherwise noted.
2) 10 psf (480 Pa) at stair enclosures.

2. Steel Sheet Components: Comply with ASTM C 645 requirements for metal, unless otherwise indicated.
3. Protective Coating: ASTM A 653/A 653M, G60 (Z180), hot-dip galvanized,

unless otherwise indicated.

2.2 SUSPENSION SYSTEM COMPONENTS

A. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.0625-inch- (1.59-mm-) diameter wire, or double strand of 0.0475-inch- (1.21-mm-) diameter wire.

B. Hanger Attachments to Concrete:

1. Anchors: Fabricated from corrosion-resistant materials with holes or loops for attaching wire hangers and capable of sustaining, without failure, a load equal to 5 times that imposed by construction as determined by testing according to ASTM E 488 by an independent testing agency.

   a. Type: Postinstalled, chemical anchor Postinstalled, expansion anchor.

2. Powder-Actuated Fasteners: Suitable for application indicated, fabricated from corrosion-resistant materials with clips or other devices for attaching hangers of type indicated, and capable of sustaining, without failure, a load equal to 10 times that imposed by construction as determined by testing according to ASTM E 1190 by an independent testing agency.

C. Wire Hangers: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.162-inch (4.12-mm) diameter.

D. Flat Hangers: Steel sheet, 1 by 3/16 inch (25.4 by 4.76 mm) by length indicated, unless otherwise indicated.

E. Furring Channels (Furring Members):

1. Steel Studs: ASTM C 645.

   a. Minimum Base-Metal Thickness: 0.0179 inch (0.45 mm).
   b. Depth: 3-5/8 inches (92.1 mm).

2. Hat-Shaped, Rigid Furring Channels: ASTM C 645, 7/8 inch (22.2 mm) deep.

   a. Minimum Base Metal Thickness: 0.0179 inch (0.45 mm).

2.3 STEEL FRAMING FOR FRAMED ASSEMBLIES

A. Steel Studs and Runners: ASTM C 645.

1. Minimum Base-Metal Thickness: 0.033 inch (0.84 mm).
2. Depth: As indicated on Drawings.

3. Type of Studs and Runners: Use one of the following types:

   a. Plain steel studs and runners.
   b. Dimpled steel studs and runners. c. Embossed steel studs and runner.

4. Manufacturer Certification: If either dimpled steel studs and runners or embossed steel studs and runners are used, submit written certification from stud and runner manufacturer stating that the proposed stud meets or exceeds the span limitations indicated in ASTM C 754 with signature and seal of a structural engineer licensed in the state where the project is located.

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

1. Single Long-Leg Runner System: ASTM C 645 top runner with 2-inch- (50.8-mm-) deep flanges in thickness not less than indicated for studs, installed with studs friction fit into top runner and with continuous bridging located within 12 inches (305 mm) of the top of studs to provide lateral bracing.
2. Double-Runner System: ASTM C 645 top runners, inside runner with 2-inch- (50.8-mm-) deep flanges in thickness not less than indicated for studs and fastened to studs, and outer runner sized to friction fit inside runner.
3. Deflection Track or Angle System: Steel sheet top runner or slotted angle system manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above; in thickness not less than indicated for studs and in width to accommodate depth of studs.

   a. Products: Subject to compliance with requirements, provide one of the following:

      1) Steel Network Inc. (The); VertiClip SLD Series.
      2) Metal-Lite, Inc.: Slotted Top Angle System.

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

1. Products: Subject to compliance with requirements, provide one of the following:

   a. Fire Trak Corp.; Fire Trak attached to studs with Fire Trak Slip Clip.
   b. Metal-Lite, Inc.; The System.

D. Metal Back-up Plates: Minimum thickness of 0.0538 inch (1.37 mm) galvanized steel plates of sizes and configurations detailed, or if not detailed, as required to accommodate the wall hung casework, millwork, railings or other items mounted to metal stud and wallboard walls and partitions.

1. Provide plates designed, and certified, to support an imposed load of 250 lbs. per linear foot (113 kg per 30 cm) for handrails, grab bars and other ADA-compliant items. Provide plates designed, and certified, to support an imposed load of 144 lbs. per linear

foot (65kg per 30 cm) for all other items. All loads required above are in addition to the weight of the item supported by the back-up plate.

2. Provide plates designed for screw-attachment to steel studs with back-up plate faces flush with face of studs or overlapping face of studs with pre-cut notches matching stud spacing.
3. Products: Subject to compliance with requirements, provide the following product or an acceptable equivalent product:

    a. Metal-Lite. Inc.; Flush Mount or Notch-Tite.

2.4 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards.

1. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

B. Isolation Strip at Exterior Walls: Provide one of the following:

1. Asphalt-Saturated Organic Felt: ASTM D 226, Type I (No. 15 asphalt felt), non-perforated.
2. Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8 inch (3.2 mm) thick, in width to suit steel stud size.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Installation Standard: ASTM C 754, except comply with framing sizes and spacing indicated.

1. Gypsum Board Assemblies: Also comply with requirements in ASTM C 840 that apply to framing installation.

B. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.

1. Comply with details indicated. Install metal back-up plates in accordance with plate manufacturer's written instructions using self-tapping pan-head screws of type and in quantity required by manufacturer to achieve full load capacity.

3.3 INSTALLING SUSPENSION SYSTEMS

A. Install suspension system components in sizes and spacings indicated on Drawings, but not less than those required by referenced installation standards for assembly types and other assembly components indicated.

B. Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.

C. Suspend hangers from building structure as follows:

1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or suspension system.

    a. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.

2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with locations of hangers required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.

    a. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced installation standards.

3. Wire Hangers: Secure by looping and wire tying, either directly to structures or to inserts, eye screws, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause hangers to deteriorate or otherwise fail.
4. Flat Hangers: Secure to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices and fasteners that are secure and appropriate for structure and hanger, and in a manner that will not cause hangers to deteriorate or otherwise fail.
5. Do not attach hangers to permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.
6. Do not attach hangers to rolled-in hanger tabs of composite steel floor deck.
7. Do not connect or suspend steel framing from ducts, pipes, or conduit.

D. Fire-Resistance-Rated Assemblies: Wire tie furring channels to supports.

E. Installation Tolerances: Install suspension systems that are level to within 1/8 inch in 12 feet (3 mm in 3.6 m) measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

3.4 INSTALLING FRAMED ASSEMBLIES

A. Install studs so flanges within framing system point in same direction.

1. Space studs as follows:

a. Single-Layer Application: 16 inches (406 mm) o.c., unless otherwise indicated.
b. Multi-Layer Application: 16 inches (406 mm) o.c., unless otherwise indicated.

B. Install tracks (runners) at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings, except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts penetrating partitions above ceiling.

1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.

a. Install two studs at each jamb, unless otherwise indicated.
b. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch (12.7-mm) clearance from jamb stud to allow for installation of control joint in finished assembly.
c. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.

3. Fire-Resistance-Rated Partitions: Install framing to comply with fire-resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.

a. Firestop Track: Where indicated, install to maintain continuity of fire-resistance-rated assembly indicated.

C. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch (3 mm) from the plane formed by faces of adjacent framing.

END OF SECTION 092216

SECTION 092900
GYPSUM BOARD SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Provide and install gypsum board partition on metal studs with acoustical insulation.

B. Related Requirements: Section includes surface preparation and the application of paint systems

1. Section 099113 "Painting" for finish painting of gypsum board surfaces.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.4 DELIVERY, STORAGE AND HANDLING

A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

1.5 FIELD CONDITIONS

A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written instructions, whichever are more stringent.

B. Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned.

C. Do not install panels that are wet, moisture damaged, and mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 FRAMING MATERIALS

A. Metal Studs: Zinc coated steel channel studs**,** 20-gauge**,** 3-5/8" size except as required otherwise**,** conforming to ANSI/ASTM C 645 or GA 201 or GA 216.

B. Runner Tracks:

1. 20-gauge metal**,** matching stud width. Use tracks with minimum 1-1/4" leg when indicated or directed.
2. Deflection Track: Provide for deck deflection by using "VertiTrack" manufactured by The Steel Network, Inc., tel: 888-474-4876 or approved equal, complete with manufacturer's patented fasteners having step bushings sized to the gauge of the studs.

C. Reinforcing Strips: Electro-galvanized 20-gauge sheet steel meeting ASTM A 525, 8" wide.

D. Angle Connectors: Galvanized 20-gauge sheet steel meeting ASTM A 525, formed into angle with 1-1/2" legs.

2.2 GYPSUM BOARD, GENERAL

A. Size: Provide maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

2.3 INTERIOR GYPSUM BOARD

A. Gypsum Board,: ASTM C 1396/C 1396M, Fire rated**,** tapered edge**,** conforming to ANSI/ASTM C 36 & C 1396**,** 5/8" thick from floor to minimum 8'-0" above floor except behind lockers:

1. "Tough Rock Fireguard X Abuse Resistant Gypsum Board" by Georgia Pacific.
2. "Gold Bond Hi-Abuse XP Gypsum Board" by National Gypsum Company.
3. **"**Fiberock Abuse Resistant Interior Panels" by USG.
4. Or approved equal

B. Gypsum Board,: ASTM C 1396/C 1396M, Fire rated**,** tapered edge**,** conforming to ANSI/ASTM C 36 & C 1396**,** 5/8" thick from 8'-0" above floor and above and behind lockers:

1. "Tough Rock Fireguard X Gypsum Board" by Georgia Pacific.
2. "Gold Bond Fireshield Gypsum Board" by National Gypsum Company.
3. **"**Sheetrock Brand Firecode X Gypsum Panels" by USG
4. Or approved equal

2.4 FINISH MATERIALS

A. Edge and Corner Reinforcement: Manufacturer's standard trim beads made of hot-dip galvanized steel with either knurled and perforated or expanded flanges, and beaded for concealment of flanges in joint compound. Vinyl trimNOT allowed.

1. Corner Beads: Paper-faced heavy gauge metal or plastic with extra wide flanges, equal to USG “B1XW EL” or No-Coat “Ultracorner**”**.
2. Edge Beads: Paper-faced heavy gauge metal or plastic “L” type with extra wide flanges, equal to USG “B4 (1")” or No-Coat “L Trim.
3. Control Joint Beads: Flexible expansion channel**,** such as USG #093 or Gold Bond **“**.093 Zinc Control Joint.**”**

2.5 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C 475/C 475M.

B. Reinforcing Tape: Perforated joint reinforcing tape, paper or fiberglass, asbestos free.

C. Joint Compound: Ready mixed all-purpose drywall joint compound**,** type and mix as required for conditions of humidity and temperature. Use topping type compound for finishing coats.

2.6 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written instructions.

B. Fasteners: Screws meeting ASTM **C 954** and the following:

1. For metal to metal framing: 1/2" long**,** Type S**,** shallow pan-head screws.
2. For gypsum board: 1-1/4" Type S bugle-head screws.
3. For tracks to concrete: Powder-actuated stud pins sized to penetrate concrete at least 1/2".
4. For moving (deflection) joints: “VertiClip Step Bushing Fasteners” sized to match gauge of studs.

C. Acoustical Sealant: One of the following:

1. USG “Acoustical Sealant”
2. W.W. Henry Co. “313 Sound Control Sealant”
3. Tremco “Acoustical Sealant”
4. Pecora “Acoustical Sealant BA-98”
5. Norton “Norseal V730 and V740FR Acoustical Foam Tape”

D. Acoustical Insulation: Sound attenuation blanket of thickness to produce an STC rating of not less than 48 in the constructions indicated, as manufactured by Johns Manville (Schuller), USG or Zonolite Grace.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates including welded hollow-metal frames and support framing, with Installer present, for compliance with requirements and other conditions

affecting performance of the Work.

B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 FRAMING INSTALLATION

A. Partitions:

1. Base Tracks: Install continuous tracks, straight and true, accurately aligned to the layout at base and at tops of studs. Set floor tracks in a continuous bead of acoustical sealant. Secure tracks at each end and a maximum of 24" o.c. in between. Use powder actuated pin anchors for anchoring to concrete.
2. Studs: Set studs plumb, not more than 16" o.c. and not more than 2" from abutting walls. In each line of studs, face flanges all in the same direction.
3. Partition Heights: All studs shall extend to heights as noted on Drawings.
4. Stud Securement: Studs shall engage both floor and top runners. Secure studs to tracks with 2 screws at top and 2 screws at bottom, one each at both inside and outside flanges.
5. Top Track: Provide multiple runner track installation, at top of wall to accommodate deck deflection.
6. Stud Flanges: Do not cut to accommodate pipes, conduit, etc. without Architect's specific approval for each case.

B. Control Joints:

1. Placement: As indicated, consistent with lines of building spaces. Provide additional control joints in locations approved by General Contractor so that no expanse of wall exceeds 30 feet.
2. Framing: Frame each control joint in walls with 2 nearly abutting studs set back to back. Seal each side of space between studs with bead of sealant.

3.3 APPLYING AND FINISHING PANELS, GENERAL

A. Comply with ASTM C 840.

B. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.

C. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.

D. Form control and expansion joints with space between edges of adjoining gypsum panels.

E. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.

1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. in area.
2. Fit gypsum panels around ducts, pipes, and conduits.
3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch wide joints to install sealant.

F. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

3.4 APPLYING INTERIOR GYPSUM BOARD

A. Install interior gypsum board in the following locations:

1. Type X: Vertical surfaces unless otherwise indicated.

B. Single-Layer Application:

1. On partitions/walls, apply gypsum panels vertically (parallel to framing) unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.

a. Stagger abutting end joints not less than one framing member in alternate courses of panels.

2. Fastening Methods: Apply gypsum panels to supports with steel drill screws.

3.5 INSTALLING TRIM ACCESSORIES

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

B. Acoustical Insulation: Install acoustical blanket insulation in all interior partition stud spaces. Insulation shall extend to ceiling level unless noted otherwise and fill all voids. Place insulation behind and around electrical and mechanical items within partitions and tight to items passing through partitions.

C. Acoustical Sealant: Apply sealant continuously to joint between gypsum board and bottom track at partitions filled with acoustical insulation. Also, seal any untaped edges or corner joints butting into other wall materials at insulated partitions.

D. Control Joints: Install control joints according to ASTM C 840 and in specific locations approved by Architect for visual effect.

E. Interior Trim: Install cornerbeads at outside corners.

3.6 FINISHING GYPSUM BOARD

A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.

B. Prefill open joints or beveled edges, and damaged surface areas.

C. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.

D. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C 840:

1. Level 4: At panel surfaces that will be covered by finish painting.

3.7 PROTECTION

A. Protect adjacent surfaces from drywall compound and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.

B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

C. Remove and replace panels that are wet, moisture damaged, and mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 092900

SECTION 098433
SOUND ABSORBING WALL UNITS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes shop-fabricated, fabric-wrapped panel units tested for acoustical performance, including:

1. Sound-absorbing wall panels.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of fabric facing, panel edge, core material, and mounting indicated.

B. Shop Drawings: For sound-absorbing wall units. Include mounting devices and details; details at panel head, base, joints, and corners; and details at ceiling, floor base, and wall intersections. Indicate panel edge and core materials.

1. Include elevations showing panel sizes and direction of fabric weave and pattern matching.

C. Samples for Verification: For the following products, prepared on Samples of size indicated below:

1. Fabric: Full-width by approximately 36-inch- (900-mm-) long Sample, but not smaller than required to show complete pattern repeat, from dye lot to be used for the Work, and with specified treatments applied. Mark top and face of fabric.
2. Panel Edge: 12-inch- (300-mm-) long Sample(s) showing each edge profile, corner, and finish.
3. Core Material: 12-inch- (300-mm-) square Sample at corner.
4. Mounting Devices: Full-size Samples.
5. Assembled Panels: Approximately 36 by 36 inches (900 by 900 mm), including joints and mounting methods.

1.3 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Elevations and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Electrical outlets, switches, and thermostats

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For sound-absorbing wall units to include in maintenance manuals. Include fabric manufacturers' written cleaning and stain-removal recommendations.

1.5 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: Provide sound-absorbing wall units meeting the following as determined by testing identical products by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:

1. Surface-Burning Characteristics: As determined by testing per ASTM E 84:

a. Flame-Spread Index: 25 or less.
b. Smoke-Developed Index: 450 or less.

2. Fire Growth Contribution: Meeting acceptance criteria of local code and authorities having jurisdiction when tested according to [NFPA 265] [NFPA 286].

B. Preinstallation Conference: Conduct conference at Project site.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Comply with fabric and sound-absorbing wall unit manufacturers' written instructions for minimum and maximum temperature and humidity requirements for shipment, storage, and handling.

B. Deliver materials and units in unopened bundles and store in a temperature-controlled dry place with adequate air circulation.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not install sound-absorbing wall units until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work at and above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

B. Lighting: Do not install sound-absorbing wall units until a permanent level of lighting is provided on surfaces to receive the units.

C. Air-Quality Limitations: Protect sound-absorbing wall units from exposure to airborne odors, such as tobacco smoke, and install units under conditions free from odor contamination of ambient air.

D. Field Measurements: Verify locations of sound-absorbing wall units and actual dimensions of openings and penetrations by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 SOUND-ABSORBING WALL UNITS

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

1. Acoustical Solutions, Inc.
2. Conwed Designscape; an Owens Corning company.
3. Decoustics Limited; a CertainTeed Ceilings company.
4. Kinetics Noise Control, Inc.
5. Lamvin, Inc.
6. Wall Technology, Inc.; an Owens Corning company.

B. Sound-Absorbing Wall Panel : Manufacturer's standard panel construction consisting of facing material laminated to front face, edges, and back edge border of core.

1. Basis-of-Design Product: Indicated on Drawings.
2. Mounting: Back mounted with manufacturer's standard metal clips or bar hangers, secured to substrate.
3. Core: Manufacturer's standard.

    a. Core-Face Layer: Manufacturer's standard impact-resistant, acoustically transparent, copolymer sheet.

4. Edge Construction: Manufacturer's standard chemically hardened core with no frame.
5. Edge Profile: Eased (small radius).
6. Corner Detail in Elevation: Square with continuous edge profile indicated.
7. Facing Material: Fabric, as indicated on Drawings.
8. Acoustical Performance: Sound absorption NRC, Minimum of 0.90 according to ASTM C 423 for Type A mounting according to ASTM E 795.
9. Nominal Core Thickness: 3/4 inch (19 mm) 1 inch (25 mm) 2 inches (51 mm).
10. Panel Width: As indicated on Drawings.
11. Panel Height: As indicated on Drawings.

2.2 MATERIALS

A. Core Materials: Manufacturer's standard.

1. Glass-Fiber Board: ASTM C 612, Type standard with manufacturer; nominal density of 6 to 7 lb/cu. ft. (96 to 112 kg/cu. m), unfaced, and dimensionally stable, molded rigid board; and with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively.
2. Particleboard: Panels complying with ANSI A208.1, Grade M-2.

    a. Made with binder containing no urea formaldehyde.

B. Facing Material : Fabric from same dye lot; color and pattern as indicated on Drawings.

C. Mounting Devices: Concealed on back of unit, recommended by manufacturer to support weight of unit, and as follows:

1. Metal Clips or Bar Hangers: Manufacturer's standard two-part metal "Z" clips, with one part of each clip mechanically attached to back of unit and the other part to substrate, designed to permit unit removal.

2.3 FABRICATION

A. General: Use manufacturer's standard construction except as otherwise indicated; with facing material applied to face, edges, and back border of dimensionally stable core; and with rigid edges to reinforce panel perimeter against warpage and damage.

1. Glass-Fiber Board Cores: Chemically harden core edges and areas of core where mounting devices are attached.

B. Facing Material: Apply fabric facing fully covering visible surfaces of unit; with material stretched straight, on the grain, tight, square, and free from puckers, ripples, wrinkles, sags, blisters, seams, adhesive, or other visible distortions or foreign matter.

1. Square Corners: Tailor corners.
2. Fabrics with Directional or Repeating Patterns or Directional Weave: Mark fabric top and attach fabric in same direction so pattern or weave matches in adjacent units.

C. Dimensional Tolerances of Finished Units: Plus or minus 1/16 inch (1.6 mm) for the following:

1. Thickness.
2. Edge straightness.
3. Overall length and width.
4. Squareness from corner to corner.
5. Chords, radii, and diameters.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine fabric, fabricated units, substrates, areas, and conditions, for compliance with requirements, installation tolerances, and other conditions affecting performance of sound-absorbing wall units.

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

3.2 INSTALLATION

A. Install sound-absorbing wall units in locations indicated with vertical surfaces and edges plumb, top edges level and in alignment with other units, faces flush, and scribed to fit adjoining work accurately at borders and at penetrations.

B. Comply with sound-absorbing wall unit manufacturer's written instructions for installation of units using type of mounting devices indicated. Mount units securely to supporting substrate.

C. Align and level fabric pattern and grain among adjacent units.

3.3 INSTALLATION TOLERANCES

A. Variation from Plumb and Level: Plus or minus 1/16 inch (1.6 mm).

B. Variation of Panel Joints from Hairline: Not more than 1/16 inch (1.6 mm) wide.

3.4 CLEANING

A. Clip loose threads; remove pills and extraneous materials.

B. Clean panels on completion of installation to remove dust and other foreign materials according to manufacturer's written instructions.

END OF SECTION 098433

SECTION 099110
ELECTROSTATICALLY APPLIED COATING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, as provided by the Owner, apply to this Section.

B. Extent of electrostatically applied coating is indicated on Drawings, schedules and by provisions of this section.

C. Type of electrostatically applied coating includes field application of electrostatically charged, spray paint coating, over existing metal casework as provided for and specified in this section and within the Construction Documents.

D. Colors: Colors selections are included in the color schedule noted within the Construction Documents.

1.2 SUMMARY

A. Section includes surface preparation and the application of paint systems on interior substrates:

1. Steel.
2. Galvanized metal.

1.3 DEFINITIONS

A. Gloss Level 1: Not more than 5 units at 60 degrees and 10 units at 85 degrees, according to ASTM D 523, a matte flat finish.

B. Gloss Level 2: Not more than 10 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523, a high-side sheen flat, velvet-like finish.

C. Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523, an eggshell finish.

D. Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D 523, a satin-like finish.

E. Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D 523, a semi-gloss finish.

F. Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D 523, a gloss finish.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product. Include preparation requirements and application instructions.

B. Samples for Verification: For each type of paint system and in each color and gloss of topcoat.

1. Submit Samples on rigid backing, 8 inches (200 mm) square.
2. Step coats on Samples to show each coat required for system.
3. Label each coat of each Sample.
4. Label each Sample for location and application area.

C. Product List: For each product indicated, include the following:

1. Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.
2. VOC content.
3. Certification: Provide written certification attesting that applicators have been factory trained, and that application equipment used complies with manufacturer's requirements.

1.5 CLOSEOUT SUBMITTALS

A. Coating Maintenance Manual: Provide coating maintenance manual including area summary with finish schedule, area detail designating location where each product/color/finish was used, product data pages, material safety data sheets, care and cleaning instructions, touch-up procedures, and color samples of each color and finish used. Use same designations indicated on drawings / schedules.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are new, unopened product packaged with protective covering for storage and identified with labels describing contents. Use same designations indicated on drawings / schedules.

1. Paint: For each facility where work is performed, Provide 1 gal. (3.8 L) of each coating type in each color applied.

1.7 QUALITY ASSURANCE

A. Mockups: Apply mockups of each paint system indicated and each color and finish selected to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Owner will select one surface to represent surfaces and conditions for application of each paint system specified in Part 3.

a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft. (9 sq.m).
b. Other Items: Architect will designate items or areas required.

2. Final approval of color selections will be based on mockups.

   a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.

3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion and accepted by Owner.

B. Workers performing application of electrostatic finishes shall have satisfactorily completed factory training by the manufacturer for the specific products being used.

C. Equipment used for application of electrostatic finishes shall be as recommended or approved by the product manufacturer and used in compliance with the equipment operating instructions.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Delivery and Handling: Deliver products to Project site in an undamaged condition in manufacturer's original unopened and sealed containers, complete with labels and instructions for handling, storing, unpacking, protecting, and installing. Packaging shall bear the manufacturer’s label with the following information:

1. Product name and type (description).
2. Batch date.
3. Color number.
4. VOC content.
5. Environmental handling requirements.
6. Surface preparation requirements.
7. Application instructions.

B. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F (7 deg C).

1. Maintain containers in clean condition, free of foreign materials and residue.
2. Remove rags and waste from storage and work areas daily.

1.9 FIELD CONDITIONS

A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 70 and 77 deg F or per manufacturer’s instructions, if stricter. Painted surfaces and ambient air temperature shall remain greater than 55 deg F prior to application and for at least two hours after finishing coating application.

B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.

C. Lead Paint: It is not expected that lead paint will be encountered in the Work.

1. If suspected lead paint is encountered, do not disturb; immediately notify Owner.

D. Lead Paint: Lead paint **may be** present in buildings and structures to be painted. A report on the presence of lead paint is on file for review and use. Examine report to become aware of locations where lead paint is present.

1. Do not disturb lead paint or items suspected of containing hazardous materials except under procedures specified.

1.10 Where applicable, perform preparation for painting of substrates known to include lead paint in accordance with EPA Renovation, Repair and Painting Rule and additional requirements of authorities having jurisdiction.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: ACCESSA Coatings Solutions, Perfection Electrostatic Paint INVIRAnamel, semi-gloss finish. Subject to compliance with requirements, provide products indicated in construction documents or Owner-approved equal from one of the following:
1. Accessa Coatings Solutions
2. Sherwin-Williams Company
3. Benjamin Moore & Co.
4. Glidden Professional, Division of PPG Architectural Finishes, Inc.
5. PPG Architectural Finishes, Inc.
6. Pratt & Lambert.

B. Basis-of-Design Product: ACCESSA Coatings Solutions, INVIRAprime primer for surface preparation as compatible and recommended by manufacturer of final coating. Subject to compliance with requirements, provide products indicated in construction documents or Owner-approved equal from one of the following:
1. Accessa Coatings Solutions
2. Sherwin-Williams Company
3. Benjamin Moore & Co.
4. Glidden Professional, Division of PPG Architectural Finishes, Inc.
5. PPG Architectural Finishes, Inc.
6. Pratt & Lambert.

C. Source Limitations: Obtain paint materials from single source from single listed manufacturer.

1. Manufacturer's designations listed on a separate color schedule are for color reference only and do not indicate prior approval.

2.2 PAINT, GENERAL

A. Material Compatibility:

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

B. VOC Content: Comply with current State of Illinois Regulations regarding VOC (Volatile Organic Compounds).

C. Colors: Match Owner's final approved samples with colors as indicated in construction documents.

2.3 SOURCE QUALITY CONTROL

A. Testing of Paint Materials: Owner reserves the right to invoke the following procedure:

1. Owner will engage the services of a qualified testing agency to sample paint materials. Contractor will be notified in advance and may be present when samples are taken. If paint materials have already been delivered to Project site, samples may be taken at Project site. Samples will be identified, sealed, and certified by testing agency.
2. Testing agency will perform tests for compliance with product requirements.
3. Owner may direct Contractor to stop applying coatings if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying paint materials from Project site, pay for testing, and repaint surfaces painted with rejected materials. Contractor will be required to remove rejected materials from previously painted surfaces if, on repainting with complying materials, the two paints are incompatible. Contractor responsible for substrate damage identified, resulting from removal of rejected materials based on compliance testing.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers. Where acceptability of substrate conditions is in question, apply samples and perform in-situ testing to verify compatibility, adhesion, and film integrity of new paint application.

1. Applicator to report, in writing, conditions that may affect application, appearance, or performance of paint.

B. Substrate Conditions:
1. Existing finished surfaces: Verify existing finish is adequate or made ready to receive new finish.
2. Metal surfaces shall be free of any loose paint or other finish materials that would impede full adherence of new coating to existing surface.

C. Proceed with coating application only after unsatisfactory conditions have been corrected; application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations for a like-new final finish.

B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.

C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, tape and incompatible paints and encapsulants.

1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated. Bare metal scratches or surface shall be covered with primer prior to any coating application.

2. Sand or chemically clean as appropriate, all abraded surfaces, corroded areas and other imperfections in surfaces to be coated. Fill or feather edges of sanded areas to produce a smooth transition to bare metal.

D. Steel Substrates: Remove rust, loose mill scale, and shop primer, if any. Clean using methods recommended in writing by coating manufacturer but not less than the following:

1. SSPC-SP 2, "Hand Tool Cleaning."
2. SSPC-SP 3, "Power Tool Cleaning."
3. SSPC-SP 7/NACE No. 4, "Brush-off Blast Cleaning."
4. SSPC-SP 11, "Power Tool Cleaning to Bare Metal."

E. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.

F. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal fabricated from coil stock by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints. Notify if a chromate passivated or “bonderized” primer is present.

3.3 APPLICATION

A. Apply paints according to manufacturer's written instructions.

1. Apply prime and finish materials in accordance with manufacturer’s directions. Apply each material in not less than the manufacturer’s recommended spreading rate. Use special equipment, applicators, and techniques recommended by the manufacturer as best suited for the particular purpose.
2. Apply additional coats beyond scheduled requirements when undercoating, stains or other conditions show through final paint coat until the special coating is of uniform finish, color and appearance.
3. Paint exposed edges at kerfs, reveals, cut-outs and bends so that all exposed surfaces have an even color matching the main finished surface when final coat is complete. Edges of casework doors and openings that are visible when closed shall have an even color matching the main finished surface when final coat is complete. All operable parts must be in full operable condition when painting is complete and dry.
4. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates. Protect as necessary.
5. Primers may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.

B. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

3.4 FIELD QUALITY CONTROL

A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.

1. Contractor shall touch up and restore painted surfaces damaged by testing.
2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

3.5 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

3.6 INTERIOR PAINTING SCHEDULE

A. Paint metal lockers as directed in Construction Documents and with the colors as selected in the painting schedule.

END OF SECTION 099110

SECTION 099113
PAINTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. See below for painting requirements.

1. Base Bid:

a. Paint existing steel lintels of window openings as noted on drawings.

b. Paint new interior ladder, exterior ladder and interior security window guards.

2. Alternate Bid No. 3:

a. Paint existing exterior decorative grilles.

3. Alternate Bid No. 4:

a. Paint metal stringers, stairs and risers.

4. Work by Owner:

a. Interior painting as called for in the drawings.

B. Related Requirements: Section includes surface preparation and the application of paint systems

1. Section 012300 "Alternates".

1.3 SUBMITTALS

A. Product Data: Submit for Architect's review on all products to be used. List each material and cross-reference it to the specified paint and finish system and application. Identify by manufacturer's catalog number and general classification.

B. Color Samples: When so requested, submit samples of each finish and topcoat color for Architect's review. Also, submit samples on portions of work at the site as directed by Architect, not less than 4ft x 4ft size.

1. Samples of Non-Transparent Finishes: If requested, submit for Architect's review 3 panels of non-transparent finishes, not less than 8" x 8" for each finish and color required, using proposed paint on materials resembling surfaces to be painted.

1.4 MAINTENANCE MATERIAL SUBMITTALS

A. Maintenance Supply: Deliver to Owner in unused containers 1 gallon of each type and color of paint used on the Project. Mark each container with color and room names/numbers where paint was used, without obscuring manufacturer's label. Deliver these containers to place on site designated by Owner.

1.5 QUALITY ASSURANCE

A. Comply with State of Illinois Regulations (effective date July 1, 2009) regarding VOC (Volatile Organic Compounds).

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F (7 deg C).

1. Maintain containers in clean condition, free of foreign materials and residue.
2. Remove rags and waste from storage areas daily.

1.7 FIELD CONDITIONS

A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F (10 and 35 deg C).

B. Do not apply paints in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Approved Manufacturers: Paint materials shall be manufactured by Pratt & Lambert, I.C.I. Glidden, Pittsburgh Paints (PPG), Sherwin-Williams, Benjamin Moore, Zinsser or other manufacturer's as approved by Architect.

B. Approved Products: Manufacturer's products listed hereinafter in the Painting Schedule represent types and grades required. Comparable products of other manufacturers listed in preceding paragraph will also be acceptable.

C. Grades: Materials not displaying manufacturer's identification as a best-grade product will not be acceptable.

D. Thinners: Paint manufacturer's preferred solvent.

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

PART 3 - EXECUTION

3.1 EXAMINATION

A. Conditions: Applicator must examine areas and conditions under which painting work is to be done and shall notify Contractor in writing of conditions detrimental to proper and timely completion of work.

B. Moisture Contents: Do not apply coatings to surfaces where electronic moisture meter indicates values above 12%, except that for wood, moisture content may be not exceed 15%.

C. Proceed with coating application only after unsatisfactory conditions have been corrected.

1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and paint systems indicated.

B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection.

C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.

1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.

D. Steel Substrates: Remove rust, loose mill scale, and shop primer if any. Clean using methods recommended in writing by paint manufacturer.

E. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and areas where shop paint is abraded. Paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.

F. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.

G. Wood Substrates:

1. Scrape and clean knots. Before applying primer, apply coat of knot sealer recommended in writing by topcoat manufacturer for exterior use in paint system indicated.
2. Sand surfaces that will be exposed to view, and dust off.
3. Prime edges, ends, faces, undersides, and backsides of wood using Benjamin Moore Fresh Start 100% Acrylic Superior Primer (046) or equal by approved manufacturers.
4. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.

3.3 REPAINTING EXISTING PAINTED SURFACES

A. Surface Preparation:

1. Do not paint existing surfaces until any items attached to existing surfaces and not scheduled for painting (e.g. door hardware) have been removed. (The trade removing the attachments shall replace them to their original positions after painting is complete.).
2. Wash surfaces to be repainted.
3. Remove all loose**,** blistered**,** cracked or otherwise defective paint and varnish. Sand surfaces smooth**,** free of depressions. Cut out and fill cracks or other defects to match adjoining surfaces.

3.4 APPLICATION

A. Apply paints according to manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual."

1. Use applicators and techniques suited for paint and substrate indicated.
2. Paint surfaces behind movable items same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed items with prime coat only.
3. Paint both sides and edges of exterior doors and entire exposed surface of exterior door frames.
4. Paint entire exposed surface of existing window lintels.
5. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
6. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.

B. Tint undercoats same color as topcoat, but tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Provide sufficient difference in shade of undercoats to distinguish each separate coat.

C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

3.5 FIELD QUALITY CONTROL

A. Architect's Inspection: All work where a coat of material has been applied must be inspected and approved by Architect before application of succeeding specified coat**;** otherwise no credit for the coat applied will be given and the work in question shall be recoated.

1. Contractor shall touch up and restore painted surfaces damaged by testing.
2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

3.6 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.7 PAINTING SCHEDULE

A. Existing Window Lintels.

2 coats - P & L Pro-Hide Gold Ext. Latex Semi-Gloss Paint**,**
S-W Metalatex Acrylic Semi-Gloss, B42 Series
ICI 2406 Dulux Professional Semi-Gloss Finish, or
Benjamin Moore Super Spec HP® D.T.M. Acrylic Low Lustre P25 or

PPG SpeedHide Exterior House & Trim Semi-Gloss, Acrylic Latex**,** 6-900 Series

B. Exterior Ladder, Interior Ladder, Interior Security Screens and Decorative Grilles:

2 Coats - Shop epoxy paint in accordance with Society for Protective Coatings (SSPC) System Guide No. 7.00.

Extent: Shop paint all miscellaneous and ornamental metal work, except surfaces and edges to be field welded, and galvanized surfaces, unless otherwise specified.

Surface Preparation: Remove scale, rust, grease, oils and other deleterious materials before applying shop coat of paint

END OF SECTION 099113

SECTION 122413
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.

1.2 SUMMARY

A. Section includes manually operated sunscreen roller shades.

B. Related Requirements:

1. Section 061000 "Miscellaneous Rough Carpentry" for wood blocking and grounds for mounting roller shades and accessories.

1.3 REFERENCES

A. ASTM G31 – Standard practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.

B. NFPA 70 - National Electrical Code.

C. NFPA 701 – fire Tests for Flame resistant textiles and Films.

1.4 SUBMITTALS

A. Submit under provisions of Section 013300.

B. Manufacturer’s Product Data: For each type of product including:

1. Preparation instructions and recommendations.
2. Styles, material description, dimensions of individual components, profiles, features, finishes and operating instructions.
3. Storage and handling requirements and recommendations.
4. Mounting details and installation methods.

C. Shop drawings: Plans, elevations, sections, product details. Installation details, operational clearances and relationship to adjacent work.

1. Submit shop drawings on AutoCad.

2. Field Verify Measurements as required.

D. Window treatment Schedule: use same room designation as noted on construction drawings for all roller shades.

E. Selection Samples: For each finish product specified, provide one set of shade cloth options and aluminum finish color samples representing manufacturer's full range of available colors and patterns.

F. Maintenance Data: methods for maintaining roller shade, cleaning materials and method precautions, instructions for operating hardware and controls.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Obtain roller shades through on source from a single manufacturer with a minimum twenty years experience in manufacturing products comparable to those specified herein.

B. Installer Qualifications: Installer trained and certified by the manufacturer with a minimum of ten years experience in installing products comparable to those specified herein.

C. Fire Test Response Characteristics: Passes NFPA 701 small and large scale vertical burn. Materials tested shall be identical to products proposed for use.

D. Anti-Microbial Characteristics: "No-growth" per ASTM G 21 results for fungi ATCC 9642, ATCC 9644 and ATCC 9645.

E. Mockup: Build mockup of one roller shade assembly for evaluation of mounting, appearance and accessories.

1. Locate mock-up in window designated by Architect.
2. Do not proceed with remaining work until mock-up is approved by Architect.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver roller shades in factory packages, marked with manufacturer, product name, and location of installation using same room designations indicated on Drawings.

1.7 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.

1.8 WARRANTY

A. Roller Shade Hardware and Chain warranty: Manufacturer's standard non-depreciating twenty- five year limited warranty.

B. Standard Shade cloth: Manufacturer's standard twenty-five year warranty.

C. Roller shade Installation: One year from date of Substantial Completion, not including scaffolding, lifts or other means to reach inaccessible areas.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. Products:
MechoShade Systems, Inc., located at: 42-03 - 35th St.; Long Island City, NY 11101; Tel: 718-729- 2020; Web: www.mechoshade.com. Or Owner approved equal.

2.2 ROLLER SHADE TYPES

A. Manually Operated Shades:

1. Mounting: Surface mounted with fascia.
2. Configuration: Single solar shadecloth.
3. Solar Shadecloths: See plans for locations of 2 types below.

a. Type 1 - Light Filtering Fabric: ThermoVeil 0900 or 3000 series Vertical Privacy Weave Fabric. 3000 Series is Reversible Satin/Diamond Weave at 1-2% Openness. 0900 Series is Translucent Linear Weave at 0-1% Openness. One Color and Fabric Series to be selected by Owner/Architect.

b. Type 2 (Auditorium only) - Room Darkening Shades. Fabric Equinox Blackout 0100 Series or Midnight Blackout 0200 Series. Both are 0% Opaque Transparency. One Color and Fabric Series to be selected by Owner/Architect.

2.3 SHADE CLOTH

A. Visually Transparent Shadecloth: MechoShade Systems, Inc., ThermoVeil series, single thickness non-raveling 0.024-inch thick vinyl fabric, woven from 0.018-inch (0.457 mm) diameter extruded vinyl yarn comprising of 15 percent polyester and 85 percent vinyl on polyester.

2.4 SHADE BAND

A. Shade Bands: Construction of shade band includes the fabric, the hem weight, hem-pocket, shade roller tube, and the attachment of the shade band to the roller tube. Sewn hems and open hem pockets are not acceptable.

1. Hem Pockets and Hem Weights: Fabric hem pocket with RF-welded seams (including welded ends) and concealed hem weights. Hem weights shall be of appropriate size and weight for shade band. Hem weight shall be continuous inside a sealed hem pocket. Hem pocket construction and hem weights shall be similar, for all shades within one room.
2. Shade Band and Shade Roller Attachment:

a. Use extruded aluminum shade roller tube of a diameter and wall thickness required to support shade fabric without excessive deflection. Provide for positive mechanical engagement with drive / brake mechanism.
b. Provide for positive mechanical attachment of shade band to roller tube; shade band shall be made removable / replaceable with a "snap-on" snap-off" spline mounting, without having to remove shade roller from shade brackets.
c. Mounting spline shall not require use of adhesives, adhesive tapes, staples, and/or rivets.
d. Any method of attaching shade band to roller tube that requires the use of: adhesive, adhesive tapes, staples, and/or rivets are not acceptable.

2.5 SHADE FABRICATION

A. Fabricate units to completely fill existing openings from head to sill and jamb-to-jamb, unless specifically indicated otherwise.

B. Provide battens in standard shades as required to assure proper tracking and uniform rolling of the shadebands. Contractor shall be responsible for assuring the width-to-height (W:H) ratios shall not exceed manufacturer's standards or, in absence of such standards, shall be responsible for establishing appropriate standards to assure proper tracking and rolling of the shadecloth within specified standards. Battens shall be roll-formed stainless steel or tempered steel, as required.

2.6 COMPONENTS

A. Access and Material Requirements:

1. Provide shade hardware allowing for the removal of shade roller tube from brackets without removing hardware from opening and without requiring end or center supports to be removed.
2. Provide shade hardware that allows for removal and re-mounting of the shade bands without having to remove the shade tube, drive or operating support brackets.
3. Use only Delrin engineered plastics by DuPont for all plastic components of shade hardware. Styrene based plastics, and /or polyester, or reinforced polyester will not be acceptable.

B. Manual Operated Chain Drive Hardware and Brackets:

1. Provide for universal, regular and offset drive capacity, allowing drive chain to fall at front, rear or non-offset for all shade drive end brackets. Universal offset shall be adjustable for future change.
2. Provide hardware capable for installation of a removable fascia, for both regular and/or reverse roll, which shall be installed without exposed fastening devices of any kind.
3. Provide shade hardware system that allows for removable regular and/or reverse roll fascias to be mounted continuously across two or more shade bands without requiring exposed fasteners of any kind.
4. Provide shade hardware system that allows for operation of multiple shade bands (multi-banded shades) by a single chain operator, subject to manufacturer's design

criteria. Connectors shall be offset to assure alignment from the first to the last shade band.

5. Provide positive mechanical engagement of drive mechanism to shade roller tube. Friction fit connectors for drive mechanism connection to shade roller tube are not acceptable.
6. Provide shade hardware constructed of minimum 1/8-inch (3.18 mm) thick plated steel or heavier as required to support 150 percent of the full weight of each shade.
7. Drive Bracket / Brake Assembly:

    a. MechoShade Drive Bracket model M5 shall be fully integrated with all MechoShade accessories, including, but not limited to: SnapLoc fascia, center supports, wall mount angles, and connectors for multi-banded shades.
    b. M5 drive sprocket and brake assembly shall rotate and be supported on a welded 3/8 inch (9.525 mm) steel pin.
    c. The brake shall be an over-running clutch design which disengages to 90 percent during the raising and lowering of a shade. The brake shall withstand a pull force of 50 lbs. (22 kg) in the stopped position..
    d. The braking mechanism shall be applied to an oil-impregnated hub on to which the brake system is mounted. The oil impregnated hub design includes an articulated brake assembly, which assures a smooth, non-jerky operation in raising and lowering the shades. The assembly shall be permanently lubricated. Products that require externally applied lubrication and or not permanently lubricated are not acceptable.
    e. The entire M5 assembly shall be fully mounted on the steel support bracket, and fully independent of the shade tube assembly, which may be removed and reinstalled without effecting the roller shade limit adjustments.
    f. Drive Chain: #10 qualified stainless steel chain rated to 90 lb. (41 kg) minimum breaking strength. Nickel plate chain shall not be accepted.

2.7 ACCESSORIES

A. Fascia:

1. Continuous removable extruded aluminum fascia that attaches to shade mounting brackets without the use of adhesives, magnetic strips, or exposed fasteners.
2. Fascia shall be able to be installed across two or more shade bands in one piece.
3. Fascia shall fully conceal brackets, shade roller and fabric on the tube.
4. Provide bracket/fascia end caps where mounting conditions expose outside of roller shade brackets.
5. Notching of Fascia for manual chain shall not be acceptable.
6. Color of Fascia shall be selected from full range of options. Provide Chainset.

B. Chain Retainer: Provide and install chain retainer on all manually operated shades.

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 roller shades level, plumb, square, and true according to manufacturers written instructions, and located so shade band is not closer than 2 inches (50 mm) to interior face of glass. Allow proper clearances for window operation hardware.

B. Adjust and balance roller shades to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.

C. Clean roller shade surfaces after installation, according to manufacturer's written instructions.

D. Engage Installer to train Owner's maintenance personnel to adjust, operate and maintain roller/shade systems.

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 122413

SECTION 144200
CHAIR LIFT

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: All labor and incidental materials necessary for the delivery, set-up, installation, adjusting, inspecting, testing and delivery to the Owner of complete lift systems at location in the building as designated on the drawings for the inclined stairway chairlift

B. Related Requirements:

1. Division 26 - Electrical for electrical service and devices.

1.3 REFERENCES

A. Lift shall be designed, manufactured and installed in accordance with the following standards:

1. American National Standards Institute (ANSI): ICC/ANSI A117.1 - Accessible and Usable Buildings and Facilities.
2. American Society of Mechanical Engineers (ASME): ASME A18.1 - Safety Standard for Platform Lifts and Stairway Chairlifts.
3. Underwriters Laboratories (UL).
4. International Building Code (IBC 2009).
5. National Fire Protection Agency (NFPA): NFPA 70 - National Electric Code.
6. American Society for Testing Materials (ASTM).
7. American Welding Society (AWS).

1.4 SUBMITTALS

A. 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.

B. Shop Drawings:

1. Show typical details of assembly, erection and anchorage.
2. Show complete layout and location of equipment, including required clearances.
3. Samples for Initial Selection: For each finished product specified, two complete sets of color chips representing manufacturer's full range of available colors and patterns.
4. Samples for Verification: For each finished product specified, two samples, representing actual product, color, and patterns.

C. Closeout Submittals:

1. Operation and Maintenance Data: For each type of lift to include in operation and maintenance manuals.
2. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:

   a. Parts list with sources indicated.
   b. Recommended parts inventory list.

3. Inspection and Acceptance Certificates and Operating Permits: As required by authorities having jurisdiction for normal, unrestricted use of lifts.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Firm with minimum 10 years documented experience in manufacturing of inclined wheelchair platform lifts of installations of type specified.

B. Installer Qualifications: Firm licensed to install equipment of this scope, with evidence of experience with specified equipment. Installer shall maintain an adequate stock of replacement parts and have qualified people available to ensure timely maintenance and callback service at the project site.

1.6 REGULATORY REQUIREMENTS

A. Provide platform lifts in compliance with:

1. ASME A18.1 - Safety Standard for Platform Lifts and Stairway Chairlifts.
2. ASME A17.5 - Elevator and Escalator Electrical Equipment.
3. NFPA 70 - National Electric Code.

B. Sample Warranty: For special warranty.

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 covering replacement of defective parts and excluding labor. Preventive maintenance agreement required.

B. Labor Warranty: One year.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Basis-Of-Design is Garaventa or equal by Savaria or approved equal.

2.2 INCLINED STAIRWAY CHAIRLIFT

A. Type: Basis-Of-Design, Garaventa Stair-Lift Model XPRESS II to serve one flight of straight stairs, with two landings and two stops. Lift consists of an extruded aluminum guide rail, a folding platform that is moved along the guide rail by an integrated rack and pinion drive system, overspeed safety system and call stations at each landing. Conform to the following design requirements or equal by Savaria. Conform to the following design requirements and components to be included:

1. Application: Indoor.
2. Platform Load Rating: 495 lbs (225 kg), with minimum safety factor of 5.
3. Travel Speed: 13 fpm (4 m/min) traveling up; 16 fpm (5 m/min) traveling down.
4. Platform Deck: Surface shall be slip resistant with the following features:

    a. Platform Size A (ADA Compliant): 31-1/2 inches (800 mm) wide by 49-1/4 inches (1250 mm) long.

5. Platform Operation:

    a. Automatic Fold: Folded and unfolded electrically from the call station.
    b. Emergency Manual Fold: When left in the open position, platform may be manually folded and retained in the closed position.

6. Under Platform Obstruction Sensing:

    a. Provide under-platform sensing device to stop platform from traveling in the downward direction when encountering 4 lb/f (20 N) of pressure.
    b. Platform is permitted to travel in the opposite direction of the obstruction to allow clearing.

7. Passenger Restraining Arms:

    a. Platform equipped with retractable passenger restraining arms in compliance with ASME A18.1a.
    b. Arms stop moving when an obstruction causing 4 lb/f (20 N) of pressure is encountered and immediately retract when signal is removed.
    c. Arms folded and unfolded electrically from the call stations or platform controls.
    d. Provide with means to manually unlock and open the restraining arms for passenger emergency evacuation.
    e. Top of arms mounted 32 inches (800 mm) to 38 inches (1000 mm) above platform deck. When in guarding position arms are located above the perimeter of the platform.
    f. Gaps between ends of the arms shall not exceed 4 inches (100 mm).

8. Boarding Ramps:

    a. Provide boarding sides of platform with retractable ramps positioned for travel at a height of 6 inches (150 mm) measured vertically above platform deck.
    b. Lock ramps in guarding positions during travel. When platform is at the landing, only the retractable ramp servicing the landing shall be operable.
    c. Ramps folded and unfolded electrically.
    d. Retractable ramps, in the guarded position, shall withstand a force of 125 lb/f (550 N) applied on any 4 inches (100 mm) by 4 inches (100 mm) area. This force shall not cause the height of the ramp, at any point in its length, to be less than 6 inches (150 mm) measured vertically above the platform deck.
    e. Provide a means to manually unlock the ramps for emergency evacuation when platform is located at landing.
    f. Provide with a bi-directional obstruction sensitive device on the travel direction side end of the platform to stop the lift when 4 lb/f (20 N) of pressure is encountered. Platform is permitted to travel in the opposite direction of obstruction to allow clearing.

9. Platform Sidewall:

    a. Provide on the non-boarding and non-guide rail side of the platform a sidewall of not less 6 inches (150 mm) in height, measured vertically from the platform deck.
    b. When the platform is folded sidewall shall cover the platform controls, providing protection from vandalism.

10. Hand Grips: Equip platform with a 1-1/4 inch (32 mm) tubular steel hand grip or grab bar at the top of the platform. Hand grip is to cover the entire width of the platform.

11. Clearances Dimensions:

    a. Platform shall not protrude more than 12 13/16 inches (260 mm) from the mounting surface when folded and stored.
    b. Platform shall not protrude more than 42 11/16 inches (1020 mm) from the mounting surface when unfolded and in use.

12. Controls:

    a. Controls: 24 VDC Low Voltage type.
    b. Platform equipped with emergency stop switch located within reach of passenger. Emergency stop button shall cause electric power to be removed from the drive system stopping lift immediately.
    c. Platform operating controls shall be two separate 1-1/2 inch (36 mm) diameter round illuminated constant pressure buttons with directional arrows, mounted on the front surface of the platform control panel.
    d. When the platform arrives at landing and the user releases the directional control button, the passenger restraining arms and boarding ramp shall unfold automatically allowing passenger to disembark.
    e. Platform control panel includes a receptacle for an optional plug-in hand-held attendant pendant control.
    f. Platform equipped for keyless operation.

13. Passenger Seat: Fold-down type with safety belt. Minimum rated load of 250 lbs (115 kg).
14. Platform Security Lock: Provide to prevent unauthorized unfolding of the platform.
15. Attendant Hand-Held Pendant Control: Provide lift with a plug-in pendant control for attendant operation.
16. Platform on-Board Emergency Alarm: Provide platform with an on-board alarm that sounds when emergency stop button is pushed. The alarm shall have a battery back-up so that it will continue to function if lift power is lost.

B. Drive and Guide Rail System:

1. Operation:

   a. Motor: 3/4 HP (0.6 kW) electric motor with an integrated brake.
   b. Required power: 208-240 VAC, single phase, 50/60 Hz. on a dedicated 15 amp circuit.
   c. Power Transmission: Worm gear reduction to a pinion moving on a fixed gear rack.
   d. Provide a frequency inverter to smoothly start and stop the platform motion.
   e. Locate drive carriage and associated control devices within the platform conveyance.
   f. Provide an upper final limit switch to stop the lift in the event of a failure of the primary limit switch.
   g. Equip drive system with an hour counter.

2. Guide Rail System:

   a. Two-part guide rail system consisting of:

      1) Main Upper Rail: Anodized aluminum extrusion weighing 8 lb/ft (11.9 kg/m) with integrally mounted zinc plated gear rack.
      2) Lower Rail: 1-1/2 inches (38 mm) by 2-1/2 inches (64 mm) anodized aluminum extrusion.

   b. Rail Mounting: Mount rails to steel support posts secured to the lower landing floor and stair treads. Support posts shall be 2-1/2 inches (64 mm) by 2-1/2 inches (64 mm) hollow structural steel.
   c. Provide a mechanical stop at the upper landing to prevent over-travel of the drive carriage in the event of a switch failure.

3. Provide overspeed governor and brake on upper carriage drive, containing mechanical overspeed sensor and lock, with electrical drive cut-out protection.
4. Provide with manual handwheel for emergency operation.

C. Pedestrian Grabrail Integrated with Guide Rail:

1. Provide a pedestrian grabrail to be mounted to the top of the upper rail.
2. The top of the grabrail gripping surface shall be between 31 inches (785 mm) and 50 inches (1270 mm) above the stair nosing and have a smooth gripping surface 1-1/2 inch (38 mm) in diameter.
3. Grabrail will be on the same plane as the upper rail of the lift.

4. Grabrail shall meet local code requirements for height above stair noses depending on stair angle and platform size.

D. Call Stations:

1. Provide surface mounted call stations at both landings.
2. Call station operating voltage 24V.
3. Call stations shall be provided with directional control buttons for call and send.
4. A one-touch control system shall be used to automatically fold/unfold the platform, boarding ramps and passenger restraining arms.
5. Call stations shall be equipped for keyed operation.

E. Finish: Design and fabricate lift to manufacturer's standard design for indoor and outdoor locations.

1. Aluminum guide rails and ramps to be anodized aluminum. Steel components shall be painted with electrostatically applied and baked powder coat with a Fine Textured Satin Grey (RAL 7030) finish.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. Verify required supports are correct

C. Verify electrical rough-in is at correct locations.

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 platform lifts in accordance with in compliance with regulatory requirements specified 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 regulatory requirements specified and as required by authorities having jurisdiction.

B. Schedule tests with agencies and Architect, Owner, and Contractor present.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain lifts. Include a review of emergency systems and emergency procedures to be followed at time of operational failure and other building emergencies.

B. Check operation of lifts with Owner's personnel present and before date of Substantial Completion. Determine that operating systems and devices are functioning properly.

C. Check operation of lift with Owner's personnel present not more than one month before end of warranty period. Determine that operating systems and devices are functioning properly.

3.6 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION 144200

SECTION 22 00 00
PLUMBING, GENERAL PURPOSE

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AIR-CONDITIONING, HEATING AND REFRIGERATION INSTITUTE (AHRI)

AHRI 1010	(2002) Self-Contained, Mechanically Refrigerated Drinking-Water Coolers

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI Z21.10.3/CSA 4.3	(2011) Gas Water Heaters Vol.III, Storage Water Heaters With Input Ratings Above 75,000 Btu Per Hour, Circulating and Instantaneous
ANSI Z21.22/CSA 4.4	(1999; Addenda A 2000, Addenda B 2001; R 2004) Relief Valves for Hot Water Supply Systems

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS (ASHRAE)

ASHRAE 90.1 - IP	(2010; Errata 1-3 2011; INT 1-12 2011; Addenda A, B, C, G, H, J, K, O, P, S, Y, Z, BZ, CG, CI and DS 2012; Errata 4-8 2012; INT 13-16 2012; Errata 9-12 2013; INT 17 2013) Energy Standard for Buildings Except Low-Rise Residential Buildings

AMERICAN SOCIETY OF SANITARY ENGINEERING (ASSE)

ASSE 1001	(2008) Performance Requirements for Atmospheric Type Vacuum Breakers (ANSI approved 2009)
ASSE 1010	(2004) Performance Requirements for Water Hammer Arresters (ANSI approved 2004)
ASSE 1011	(2004; Errata 2004) Performance Requirements for Hose Connection Vacuum Breakers (ANSI approved 2004)
ASSE 1012	(2009) Performance Requirements for Backflow Preventer with an Intermediate Atmospheric Vent - (ANSI approved 2009)
ASSE 1013	(2011) Performance Requirements for Reduced Pressure Principle Backflow Preventers and Reduced Pressure Fire Protection Principle Backflow Preventers - (ANSI approved 2010)

ASSE 1018	(2001) Performance Requirements for Trap Seal Primer Valves - Potable Water Supplied (ANSI Approved 2002
ASSE 1019	(2011) Performance Requirements for Vacuum Breaker Wall Hydrants, Freeze Resistant, Automatic Draining Type (ANSI Approved 2004)
ASSE 1020	(2004; Errata 2004; Errata 2004) Performance Requirements for Pressure Vacuum Breaker Assembly (ANSI Approved 2004)

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA 10084	(2005) Standard Methods for the Examination of Water and Wastewater
AWWA B300	(2010; Addenda 2011) Hypochlorites
AWWA B301	(2010) Liquid Chlorine
AWWA C606	(2011) Grooved and Shouldered Joints
AWWA C651	(2005; Errata 2005) Standard for Disinfecting Water Mains

AMERICAN WELDING SOCIETY (AWS)

AWS A5.8/A5.8M	(2011; Amendment 2012) Specification for Filler Metals for Brazing and Braze Welding
AWS B2.2/B2.2M	(2010) Specification for Brazing Procedure and Performance Qualification

ASME INTERNATIONAL (ASME)

ASME A112.1.2	(2012) Standard for Air Gaps in Plumbing Systems (For Plumbing Fixtures and Water-Connected Receptors)
ASME A112.14.1	(2003; R 2012) Backwater Valves
ASME A112.19.1/CSA B45.2	(2008; Update 1 2008; Update 2 2011) Enameled Cast Iron and Enameled Steel Plumbing Fixtures
ASME A112.19.2/CSA B45.1	(2008; Update 1 2009; Update 2 2011) Standard for Vitreous China Plumbing Fixtures and Hydraulic Requirements for Water Closets and Urinals
ASME A112.19.5	(2011) Trim for Water-Closet Bowls, Tanks and Urinals
ASME A112.36.2M	(1991; R 2012) Cleanouts
ASME A112.6.1M	(1997; R 2012) Floor Affixed Supports for Off-the-Floor Plumbing Fixtures for Public Use
ASME A112.6.3	(2001; R 2007) Standard for Floor and Trench Drains

ASME B1.20.1	(1983; R 2006) Pipe Threads, General Purpose (Inch)
ASME B16.12	(2009) Cast Iron Threaded Drainage Fittings
ASME B16.15	(2011; INT thru June 2011) Cast Copper Alloy Threaded Fittings Classes 125 and 250
ASME B16.18	(2012) Cast Copper Alloy Solder Joint Pressure Fittings
ASME B16.21	(2011) Nonmetallic Flat Gaskets for Pipe Flanges
ASME B16.22	(2012) Standard for Wrought Copper and Copper Alloy Solder Joint Pressure Fittings
ASME B16.23	(2011) Cast Copper Alloy Solder Joint Drainage Fittings - DWV
ASME B16.24	(2011) Cast Copper Alloy Pipe Flanges and Flanged Fittings: Classes 150, 300, 600, 900, 1500, and 2500
ASME B16.29	(2012) Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings - DWV
ASME B16.3	(2011) Malleable Iron Threaded Fittings, Classes 150 and 300
ASME B16.34	(2013) Valves - Flanged, Threaded and Welding End
ASME B16.4	(2011) Standard for Gray Iron Threaded Fittings; Classes 125 and 250
ASME B16.5	(2013) Pipe Flanges and Flanged Fittings: NPS 1/2 Through NPS 24 Metric/Inch Standard
ASME B16.50	(2001; R 2008) Wrought Copper and Copper Alloy Braze-Joint Pressure Fittings
ASME BPVC SEC IX	(2010) BPVC Section IX-Welding and Brazing Qualifications

ASTM INTERNATIONAL (ASTM)

ASTM A536	(1984; R 2009) Standard Specification for Ductile Iron Castings
ASTM A74	(2013) Standard Specification for Cast Iron Soil Pipe and Fittings
ASTM A888	(2013) Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications
ASTM B111/B111M	(2011) Standard Specification for Copper and Copper-Alloy Seamless Condenser Tubes and Ferrule Stock
ASTM B117	(2011) Standard Practice for Operating Salt Spray (Fog) Apparatus

ASTM B152/B152M	(2013) Standard Specification for Copper Sheet, Strip, Plate, and Rolled Bar
ASTM B306	(2013) Standard Specification for Copper Drainage Tube (DWV)
ASTM B32	(2008) Standard Specification for Solder Metal
ASTM B370	(2012) Standard Specification for Copper Sheet and Strip for Building Construction
ASTM B42	(2010) Standard Specification for Seamless Copper Pipe, Standard Sizes
ASTM B43	(2009) Standard Specification for Seamless Red Brass Pipe, Standard Sizes
ASTM B584	(2013) Standard Specification for Copper Alloy Sand Castings for General Applications
ASTM B75/B75M	(2011) Standard Specification for Seamless Copper Tube
ASTM B813	(2010) Standard Specification for Liquid and Paste Fluxes for Soldering of Copper and Copper Alloy Tube
ASTM B88	(2009) Standard Specification for Seamless Copper Water Tube
ASTM C1053	(2000; R 2010) Standard Specification for Borosilicate Glass Pipe and Fittings for Drain, Waste, and Vent (DWV) Applications
ASTM C564	(2012) Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings
ASTM C920	(2011) Standard Specification for Elastomeric Joint Sealants
ASTM D1004	(2013) Initial Tear Resistance of Plastic Film and Sheeting
ASTM D1248	(2012) Standard Specification for Polyethylene Plastics Extrusion Materials for Wire and Cable
ASTM D2000	(2012) Standard Classification System for Rubber Products in Automotive Applications
ASTM D2564	(2012) Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems
ASTM D2657	(2007) Heat Fusion Joining Polyolefin Pipe and Fittings
ASTM D2665	(2012) Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings
ASTM D2822/D2822M	(2005; E 2011; R 2011) Asphalt Roof Cement

ASTM D2855	(1996; R 2010) Standard Practice for Making Solvent-Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings
ASTM D3139	(1998; R 2011) Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals
ASTM D3212	(2007; R 2013) Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals
ASTM D3311	(2011) Drain, Waste, and Vent (DWV) Plastic Fittings Patterns
ASTM D4101	(2011) Standard Specification for Polypropylene Injection and Extrusion Materials
ASTM D4551	(2012) Poly(Vinyl Chloride) (PVC) Plastic Flexible Concealed Water-Containment Membrane
ASTM D638	(2010) Standard Test Method for Tensile Properties of Plastics
ASTM E1	(2007) Standard Specification for ASTM Liquid-in-Glass Thermometers
ASTM E96/E96M	(2012) Standard Test Methods for Water Vapor Transmission of Materials
ASTM F1290	(1998a; R 2011) Electrofusion Joining Polyolefin Pipe and Fittings
ASTM F1760	(2001; R 2011) Coextruded Poly(Vinyl Chloride) (PVC) Non-Pressure Plastic Pipe Having Reprocessed-Recycled Content
ASTM F891	(2010) Coextruded Poly (Vinyl Chloride) (PVC) Plastic Pipe with a Cellular Core

CAST IRON SOIL PIPE INSTITUTE (CISPI)

CISPI 301	(2009) Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications
CISPI 310	(2011) Coupling for Use in Connection with Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications

COPPER DEVELOPMENT ASSOCIATION (CDA)

CDA A4015	(2010) Copper Tube Handbook

INTERNATIONAL ASSOCIATION OF PLUMBING AND MECHANICAL OFFICIALS (IAPMO)

IAPMO PS 117	(2005b) Press Type Or Plain End Rub Gasketed W/ Nail CU & CU Alloy Fittings 4 Install On CU Tubing

INTERNATIONAL CODE COUNCIL (ICC)

ICC A117.1	(2009) Accessible and Usable Buildings and Facilities

ILLINOIS DEPARTMENT OF PUBLIC HEALTH (IDPH)

ILPC	(2014) Illinois Plumbing Code

INTERNATIONAL SAFETY EQUIPMENT ASSOCIATION (ISEA)

ANSI/ISEA Z358.1	(2009) American National Standard for Emergency Eyewash and Shower Equipment

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)

MSS SP-110	(2010) Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends
MSS SP-25	(2008) Standard Marking System for Valves, Fittings, Flanges and Unions
MSS SP-58	(2009) Pipe Hangers and Supports - Materials, Design and Manufacture, Selection, Application, and Installation
MSS SP-67	(2011) Butterfly Valves
MSS SP-69	(2003; Notice 2012) Pipe Hangers and Supports - Selection and Application (ANSI Approved American National Standard)
MSS SP-72	(2010a) Ball Valves with Flanged or Butt-Welding Ends for General Service
MSS SP-80	(2013) Bronze Gate, Globe, Angle and Check Valves
MSS SP-85	(2011) Gray Iron Globe & Angle Valves Flanged and Threaded Ends

NACE INTERNATIONAL (NACE)

NACE SP0169	(1992; R 2007) Control of External Corrosion on Underground or Submerged Metallic Piping Systems

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA 250	(2008) Enclosures for Electrical Equipment (1000 Volts Maximum)
NEMA MG 1	(2011; Errata 2012) Motors and Generators
NEMA MG 11	(1977; R 2012) Energy Management Guide for Selection and Use of Single Phase Motors

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 31	(2011) Standard for the Installation of Oil-Burning Equipment
NFPA 54	(2012) National Fuel Gas Code
NFPA 90A	(2012) Standard for the Installation of Air Conditioning and Ventilating Systems

NSF INTERNATIONAL (NSF)

NSF 372	(2011) Drinking Water System Components - Lead Content
NSF/ANSI 14	(2013) Plastics Piping System Components and Related Materials
NSF/ANSI 61	(2012; Errata 1013; Addenda 2013) Drinking Water System Components - Health Effects

PLASTIC PIPE AND FITTINGS ASSOCIATION (PPFA)

PPFA Fire Man	(2010) Firestopping: Plastic Pipe in Fire Resistive Construction

PLUMBING AND DRAINAGE INSTITUTE (PDI)

PDI G 101	(2010) Testing and Rating Procedure for Hydro Mechanical Grease Interceptors with Appendix of Installation and Maintenance
PDI WH 201	(2010) Water Hammer Arresters Standard

SOCIETY OF AUTOMOTIVE ENGINEERS INTERNATIONAL (SAE)

SAE J1508	(2009) Hose Clamp Specifications

U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)

EPA SM 9223	(2004) Enzyme Substrate Coliform Test
Energy Star	(1992; R 2006) Energy Star Energy Efficiency Labeling System
PL 93-523	(1974; A 1999) Safe Drinking Water Act

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

10 CFR 430	Energy Conservation Program for Consumer Products
21 CFR 175	Indirect Food Additives: Adhesives and Components of Coatings
40 CFR 141.80	National Primary Drinking Water Regulations; Control of Lead and Copper; General Requirements
PL 109-58	Energy Policy Act of 2005 (EPAct05)

1.2 SUBMITTALS

The following shall be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

Shop Drawings

Product Data

Pipe
Valves
Insulaiton

Plumbing System

Diagrams, instructions, and other sheets proposed for posting.

Test Reports

Tests, Flushing and Disinfection

Test reports in booklet form showing all field tests performed to adjust each component and all field tests performed to prove compliance with the specified performance criteria, completion and testing of the installed system. Each test report shall indicate the final position of controls.

Operation and Maintenance Data

Plumbing System

Submit in accordance with Section 01 78 23 OPERATION AND MAINTENANCE DATA.

1.3 STANDARD PRODUCTS

Specified materials and equipment shall be standard products of a manufacturer regularly engaged in the manufacture of such products, and as listed on applicable schedules. Specified equipment shall essentially duplicate equipment that has performed satisfactorily at least two years prior to bid opening. Standard products shall have been in satisfactory commercial or industrial use for 2 years prior to bid opening. The 2-year use shall include applications of equipment and materials under similar circumstances and of similar size. The product shall have been for sale on the commercial market through advertisements, manufacturers' catalogs, or brochures during the 2 year period.

A. Alternative Qualifications

Products having less than a two-year field service record will be acceptable if a certified record of satisfactory field operation for not less than 6000 hours, exclusive of the manufacturer's factory or laboratory tests, can be shown.

B. Service Support

The equipment items shall be supported by service organizations. Submit a certified list of qualified permanent service organizations for support of the equipment which includes their addresses and qualifications. These service organizations shall be reasonably convenient to the equipment installation and able to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.

C. Manufacturer's Nameplate

Each item of equipment shall have a nameplate bearing the manufacturer's name, address, model number, and serial number securely affixed in a conspicuous place; the nameplate of the distributing agent will not be acceptable.

D. Modification of References

In each of the publications referred to herein, consider the advisory provisions to be mandatory, as though the word, "shall" had been substituted for "should" wherever it appears. Interpret references in these publications to the "authority having jurisdiction", or words of similar meaning, to mean the Architect.

1. Definitions

For the International Code Council (ICC) Codes referenced in the contract documents, advisory provisions shall be considered mandatory, the word "should" shall be interpreted as "shall." References to the "permit holder" shall be interpreted to mean the "Contractor."

1.4 DELIVERY, STORAGE, AND HANDLING

Handle, store, and protect equipment and materials to prevent damage before and during installation in accordance with the manufacturer's recommendations, and as approved by the Architect. Replace damaged or defective items.

1.5 PERFORMANCE REQUIREMENTS

A. Welding

Piping shall be welded in accordance with qualified procedures using performance-qualified welders and welding operators. Procedures and welders shall be qualified in accordance with ASME BPVC SEC IX. Welding procedures qualified by others, and welders and welding operators qualified by another employer, may be accepted as permitted by ASME B31.1. Welders or welding operators shall apply their assigned symbols near each weld they make as a permanent record.

1.6 REGULATORY REQUIREMENTS

Unless otherwise required herein, plumbing work shall be in accordance with IDPH 2014 IPC. Energy consuming products and systems shall be in accordance with PL 109-58 and ASHRAE 90.1 - IP

1.7 PROJECT/SITE CONDITIONS

The Contractor shall become familiar with details of the work, verify dimensions in the field, and advise the Architect of any discrepancy before performing any work.

1.8 INSTRUCTION TO OWNER PERSONNEL

When specified in other sections, furnish the services of competent instructors to give full instruction to the designated Owner personnel in the adjustment, operation, and maintenance, including pertinent safety requirements, of the specified equipment or system. Instructors shall be thoroughly familiar with all parts of the installation and shall be trained in operating theory as well as practical operation and maintenance work.

Instruction shall be given during the first regular work week after the equipment or system has been accepted and turned over to the Owner for regular operation. The number of man-days (8 hours per day) of instruction furnished shall be as specified in the individual section. When more than 4 man-days of instruction are specified, use approximately half of the time for classroom instruction. Use other time for instruction with the equipment or system.

When significant changes or modifications in the equipment or system are made under the terms of the contract, provide additional instruction to acquaint the operating personnel with the changes or modifications.

1.9 ACCESSIBILITY OF EQUIPMENT

Install all work so that parts requiring periodic inspection, operation, maintenance, and repair are readily accessible. Install concealed valves, expansion joints, controls, dampers, and equipment requiring access, in locations freely accessible through access doors.

PART 2 PRODUCTS

2.1 Materials

Materials for various services shall be in accordance with TABLES I and II. Pipe schedules shall be selected based on service requirements. Pipe fittings shall be compatible with the applicable pipe materials. Plastic pipe, fittings, and solvent cement shall meet NSF/ANSI 14 and shall be NSF listed for the service intended. Plastic pipe, fittings, and solvent cement used for potable hot and cold water service shall bear the NSF seal "NSF-PW." Polypropylene pipe and fittings shall conform to dimensional requirements of Schedule 40, Iron Pipe size and shall comply with NSF/ANSI 14, NSF/ANSI 61 and ASTM F2389. Polypropylene piping that will be exposed to UV light shall be provided with a Factory applied UV resistant coating. Pipe threads (except dry seal) shall conform to ASME B1.20.1. Grooved pipe couplings and fittings shall be from the same manufacturer. Material or equipment containing a weighted average of greater than 0.25 percent lead shall not be used in any potable water system intended for human consumption, and shall be certified in accordance with NSF/ANSI 61, Annex G or NSF 372. In line devices such as water meters, building valves, check valves, meter stops, valves, fittings and back flow preventers shall comply with PL 93-523 and

NSF/ANSI 61, Section 8. End point devices such as drinking water fountains, lavatory faucets, kitchen and bar faucets, residential ice makers, supply stops and end point control valves used to dispense water for drinking must meet the requirements of NSF/ANSI 61, Section 9. Hubless cast-iron soil pipe shall not be installed underground, under concrete floor slabs, or in crawl spaces below kitchen floors. Plastic pipe shall not be installed in air plenums. Plastic pipe shall not be installed in a pressure piping system in buildings greater than three stories including any basement levels.

A. Pipe Joint Materials

Grooved pipe and hubless cast-iron soil pipe shall not be used under ground. Solder containing lead shall not be used with copper pipe. Cast iron soil pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Institute. Joints and gasket materials shall conform to the following:

a. Coupling for Cast-Iron Pipe: for hub and spigot type ASTM A74, AWWA C606. For hubless type: CISPI 310

b. Coupling for Steel Pipe: AWWA C606.

c. Couplings for Grooved Pipe: Ductile Iron ASTM A536 (Grade 65-45-12), Copper ASTM A536.

d. Flange Gaskets: Gaskets shall be made of non-asbestos material in accordance with ASME B16.21. Gaskets shall be flat, 1/16 inch thick, and contain Aramid fibers bonded with Styrene Butadiene Rubber (SBR) or Nitro Butadiene Rubber (NBR). Gaskets shall be the full face or self centering flat ring type. Gaskets used for hydrocarbon service shall be bonded with NBR.

e. Brazing Material: Brazing material shall conform to AWS A5.8/A5.8M, BCuP-5.

f. Brazing Flux: Flux shall be in paste or liquid form appropriate for use with brazing material. Flux shall be as follows: lead-free; have a 100 percent flushable residue; contain slightly acidic reagents; contain potassium borides; and contain fluorides.

g. Solder Material: Solder metal shall conform to ASTM B32.

h. Solder Flux: Flux shall be liquid form, non-corrosive, and conform to ASTM B813, Standard Test 1.

i. PTFE Tape: PTFE Tape, for use with Threaded Metal or Plastic Pipe.

j. Rubber Gaskets for Cast-Iron Soil-Pipe and Fittings (hub and spigot type and hubless type): ASTM C564.

k. Rubber Gaskets for Grooved Pipe: ASTM D2000, maximum temperature 230 degrees F.

l. Flexible Elastomeric Seals: ASTM D3139, ASTM D3212 or ASTM F477.

m. Bolts and Nuts for Grooved Pipe Couplings: Heat-treated carbon steel, ASTM A183.

n. Solvent Cement for Transition Joints between ABS and PVC Nonpressure Piping Components: ASTM D3138.

o. Plastic Solvent Cement for PVC Plastic Pipe: ASTM D2564 and ASTM D2855.

p. Flanged fittings including flanges, bolts, nuts, bolt patterns, etc., shall be in accordance with ASME B16.5 class 150 and shall have the manufacturer's trademark affixed in accordance with MSS SP-25. Flange material shall conform to ASTM A105/A105M. Blind flange material shall conform to ASTM A516/A516M cold service and ASTM A515/A515M for hot service. Bolts shall be high strength or intermediate strength with material conforming to ASTM A193/A193M.

q. Plastic Solvent Cement for Styrene Rubber Plastic Pipe: ASTM D3122.

r. Press fittings for Copper Pipe and Tube: Copper press fittings shall conform to the material and sizing requirements of ASME B16.18 or ASME B16.22 and performance criteria of IAPMO PS 117. Sealing elements for copper press fittings shall be EPDM, FKM or HNBR. Sealing elements shall be factory installed or an alternative supplied fitting manufacturer. Sealing element shall be selected based on manufacturer's approved application guidelines.

s. Copper tubing shall conform to ASTM B88, Type K, L or M.

B. Miscellaneous Materials

Miscellaneous materials shall conform to the following:

a. Water Hammer Arrester: PDI WH 201. Water hammer arrester shall be diaphragm type.

b. Asphalt Roof Cement: ASTM D2822/D2822M.

c. Hose Clamps: SAE J1508.

d. Supports for Off-The-Floor Plumbing Fixtures: ASME A112.6.1M.

e. Metallic Cleanouts: ASME A112.36.2M.

f. Plumbing Fixture Setting Compound: A preformed flexible ring seal molded from hydrocarbon wax material. The seal material shall be nonvolatile nonasphaltic and contain germicide and provide watertight, gastight, odorproof and verminproof properties.

g. Coal-Tar Protective Coatings and Linings for Steel Water Pipelines: AWWA C203.

h. Hypochlorites: AWWA B300.

i. Liquid Chlorine: AWWA B301.

j. Gauges - Pressure and Vacuum Indicating Dial Type - Elastic Element: ASME B40.100.

k. Thermometers: ASTM E1. Mercury shall not be used in thermometers.

C. Pipe Insulation Material

Insulation shall be as specified in Section 23 07 00 THERMAL INSULATION.

2.2 PIPE HANGERS, INSERTS, AND SUPPORTS

Pipe hangers, inserts, and supports shall conform to MSS SP-58 and MSS SP-69.

2.3 VALVES

Valves shall be provided on supplies to equipment and fixtures. Valves 2-1/2 inches and smaller shall be bronze with threaded bodies for pipe and solder-type connections for tubing. Valves 3 inches and larger shall have flanged iron bodies and bronze trim. Pressure ratings shall be based upon the application. Grooved end valves may be provided if the manufacturer certifies that the valves meet the

performance requirements of applicable MSS standard. Valves shall conform to the following standards:

Description	Standard
Butterfly Valves	MSS SP-67
Cast-Iron Gate Valves, Flanged and Threaded Ends	MSS SP-70
Cast-Iron Swing Check Valves, Flanged and Threaded Ends	MSS SP-71
Ball Valves with Flanged Butt-Welding Ends for General Service	MSS SP-72
Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends	MSS SP-110
Cast-Iron Plug Valves, Flanged and Threaded Ends	MSS SP-78
Bronze Gate, Globe, Angle, and Check Valves	MSS SP-80
Steel Valves, Socket Welding and Threaded Ends	ASME B16.34
Cast-Iron Globe and Angle Valves, Flanged and Threaded Ends	MSS SP-85
Backwater Valves	ASME A112.14.1
Vacuum Relief Valves	ANSI Z21.22/CSA 4.4
Water Heater Drain Valves	ASME BPVC SEC IV, Part HLW-810: Requirements for Potable-Water Heaters Bottom Drain Valve
Trap Seal Primer Valves	ASSE 1018
Temperature and Pressure Relief Valves for Hot Water Supply Systems	ANSI Z21.22/CSA 4.4
Temperature and Pressure Relief Valves for Automatically Fired Hot Water Boilers	ASME CSD-1 Safety Code No., Part CW, Article 5

A. Backwater Valves

Backwater valves shall be either separate from the floor drain or a combination floor drain, P-trap, and backwater valve, as shown. Valves shall have cast-iron bodies with cleanouts large enough to permit removal of interior parts. Valves shall be of the flap type, hinged or pivoted, with revolving disks. Hinge pivots, disks, and seats shall be nonferrous metal. Disks shall be slightly open in a no-flow no-backwater condition. Cleanouts shall extend to finished floor and be fitted with threaded countersunk plugs.

B. Relief Valves

Water heaters and hot water storage tanks shall have a combination pressure and temperature (P&T) relief valve. The pressure relief element of a P&T relief valve shall have adequate capacity to prevent excessive pressure buildup in the system when the system is operating at the maximum rate of heat input. The temperature element of a P&T relief valve shall have a relieving capacity which is at least equal to the total input of the heaters when operating at their maximum capacity. Relief valves shall be rated according to ANSI Z21.22/CSA 4.4. Relief valves for systems where the maximum rate of heat input is less than 200,000 Btuh shall have 3/4 inch minimum inlets, and 3/4 inch outlets. Relief valves for systems where the maximum rate of heat input is greater than 200,000 Btuh shall have 1 inch minimum inlets, and 1 inch outlets. The discharge pipe from the relief valve shall be the size of the valve outlet.

C. Thermostatic Mixing Valves

Provide thermostatic mixing valve where indicated. Mixing valves, thermostatic type, pressure-balanced or combination thermostatic and pressure-balanced shall be line size and shall be constructed with rough or finish bodies either with or without plating. Each valve shall be constructed to control the mixing of hot and cold water and to deliver water at a desired temperature regardless of pressure or input temperature changes. The control element shall be of an approved type. The body shall be of heavy cast bronze, and interior parts shall be brass, bronze, corrosion-resisting steel or copper. The valve shall be equipped with necessary stops, check valves, unions, and sediment strainers on the inlets. Mixing valves shall maintain water temperature within 5 degrees F of any setting.

2.4 DRAINS

Area drains shall be plain pattern with polished stainless steel perforated or slotted grate and bottom outlet. The drain shall be circular or square with a 6 inch nominal overall width or diameter and 5 inch nominal overall depth. Drains shall be cast iron with manufacturer's standard coating. Grate shall be easily lifted out for cleaning. Outlet shall be suitable for inside caulked connection to drain pipe. Drains shall conform to ASME A112.6.3. Install drains flush with floor.

2.5 TRAPS

Unless otherwise specified, traps shall be copper-alloy adjustable tube type with slip joint inlet and swivel. Traps shall include a gasketed cleanout. Tubes shall be copper alloy with walls not less than 0.032 inch thick within commercial tolerances, except on the outside of bends where the thickness may be reduced slightly in manufacture by usual commercial methods. Inlets shall have rubber washer and copper alloy nuts for slip joints above the discharge level. Swivel joints shall be below the discharge level and shall be of metal-to-metal or metal-to-plastic type as required for the application. Nuts shall have flats for wrench grip. Outlets shall have internal pipe thread, except that when required for the application, the outlets shall have sockets for solder-joint connections. The depth of the water seal shall be not less than 2 inches. The interior diameter shall be not more than 1/8 inch over or under the

nominal size, and interior surfaces shall be reasonably smooth throughout. A copper alloy "P" trap assembly consisting of an adjustable "P" trap and threaded trap wall nipple with cast brass wall flange shall be provided for lavatories. The assembly shall be a standard manufactured unit and may have a rubber-gasketed swivel joint.

2.6 WATER HEATERS

The hydronic heating boiler(s) shall be an A. O. Smith Model HW-300 having an input rating of 300,000 BTU/hr., an output rating of 429,000 BTU/hr., when fired using Natural gas. The boiler(s) shall be design certified by an ANSI approved/accredited independent rating laboratory. The boiler shall bear the ASME "H" stamp and shall be National Board registered for 160 PSI working pressure. Boiler(s) shall be up flow type having all non-ferrous waterways, and employing a copper finned heat exchanger and a tightly wound copper coil combustion chamber. Boiler(s) shall be equipped with an electric gas valve of the step-opening type, an adjustable limit control which will break the electric circuit on temperature rise, intermittent ignition with one (1) second shutdown in the event of pilot flame failure, a gas pressure regulator properly set for the gas to be supplied, and a coil limit switch for shut off in event of excessive water temperature, a certified draft diverter and a fully illustrated instruction manual. Certified for combustible flooring. Outer jacket shall be of baked enamel finish. The coil, heat exchanger and burner shall have a ten year limited warranty as outlined in the written warranty.

2.7 WATER STORAGE TANKS

Jacketed or insulated models shall meet R12.5 minimum thermal insulation requirements of the U.S. Department of Energy and current edition of ASHRAE/IESNA 90.1. ASME storage tank to be A. O. Smith Custom-Line model TJV-350. Capacity to be 350 gallons with a diameter of 36 inches. Tank(s) shall be constructed and stamped according to ASME specifications. Manhole (11 x 15), handhole (4x6) or inspection openings (2-2˝) shall be installed in accordance with ASME code requirements and manufacturer(s) standard practice. Tank to be constructed of carbon steel. Lining shall be glass. Tanks with glass lining shall be equipped with the number and size of magnesium anode rod(s) sufficient to provide adequate protection for the tank lining.

2.8 ELECTRICAL WORK

Provide electrical motor driven equipment specified complete with motors, motor starters, and controls as specified herein and in Division 26. Provide internal wiring for components of packaged equipment as an integral part of the equipment. Controllers and contactors shall have auxiliary contacts for use with the controls provided. Manual or automatic control and protective or signal devices required for the operation specified and any control wiring required for controls and devices specified, but not shown, shall be provided. For packaged equipment, the manufacturer shall provide controllers, including the required monitors and timed restart. Power wiring and conduit for field installed equipment shall be provided under and conform to the requirements of Division 26.

2.9 MISCELLANEOUS PIPING ITEMS

A. Escutcheon Plates

Provide one piece or split hinge metal plates for piping entering floors, walls, and ceilings in exposed spaces. Provide chromium-plated on copper alloy plates or polished stainless steel finish in finished spaces. Provide paint finish on plates in unfinished spaces.

B. Pipe Sleeves

Provide where piping passes entirely through walls, ceilings, roofs, and floors. Sleeves are not required where [supply] drain, waste, and vent (DWV) piping passes through concrete floor slabs located on grade, except where penetrating a membrane waterproof floor.

1. Sleeves in Masonry and Concrete

Provide steel pipe sleeves or schedule 40 PVC plastic pipe sleeves. Sleeves are not required where drain, waste, and vent (DWV) piping passes through concrete floor slabs located on grade. Core drilling of masonry and concrete may be provided in lieu of pipe sleeves when cavities in the core-drilled hole are completely grouted smooth.

2. Sleeves Not in Masonry and Concrete

Provide 26 gage galvanized steel sheet or PVC plastic pipe sleeves.

C. Pipe Hangers (Supports)

Provide MSS SP-58 and MSS SP-69, Type 1 with adjustable type steel support rods, except as specified or indicated otherwise. Attach to steel joists with Type 19 or 23 clamps and retaining straps. Attach to Steel W or S beams with Type 21, 28, 29, or 30 clamps. Attach to steel angles and vertical web steel channels with Type 20 clamp with beam clamp channel adapter. Attach to horizontal web steel channel and wood with drilled hole on centerline and double nut and washer. Attach to concrete with Type 18 insert or drilled expansion anchor. Provide Type 40 insulation protection shield for insulated piping.

D. Nameplates

Provide 0.125 inch thick melamine laminated plastic nameplates, black matte finish with white center core, for equipment, gages, thermometers, and valves; valves in supplies to faucets will not require nameplates. Accurately align lettering and engrave minimum of 0.25 inch high normal block lettering into the white core. Minimum size of nameplates shall be 1.0 by 2.5 inches. Key nameplates to a chart and schedule for each system. Frame charts and schedules under glass and place where directed near each system. Furnish two copies of each chart and schedule.

E. Labels

Provide tags for all valves and labels for all piping conforming to ASME A13.1.

PART 3 EXECUTION

1.10 3.1 GENERAL INSTALLATION REQUIREMENTS

Piping located in air plenums shall conform to NFPA 90A requirements. Piping located in shafts that constitute air ducts or that enclose air ducts shall be noncombustible in accordance with NFPA 90A. Installation of plastic pipe where in compliance with NFPA may be installed in accordance with PPFA Fire Man. The plumbing system shall be installed complete with necessary fixtures, fittings, traps, valves, and accessories. Valves shall be installed with control no lower than the valve body.

A. Water Pipe, Fittings, and Connections

1. Utilities

The piping shall be extended to fixtures, outlets, and equipment. The hot-water and cold-water piping system shall be arranged and installed to permit draining. The supply line to each item of equipment or fixture, except faucets, flush valves, or other control valves which are supplied with integral stops, shall be equipped with a shutoff valve to enable isolation of the item for repair and maintenance without interfering with operation of other equipment or fixtures. Supply piping to fixtures, faucets, hydrants, shower heads, and flushing devices shall be anchored to prevent movement.

2. Cutting and Repairing

The work shall be carefully laid out in advance, and unnecessary cutting of construction shall be avoided. Damage to building, piping, wiring, or equipment as a result of cutting shall be repaired by mechanics skilled in the trade involved.

3. Protection of Fixtures, Materials, and Equipment

Pipe openings shall be closed with caps or plugs during installation. Fixtures and equipment shall be tightly covered and protected against dirt, water, chemicals, and mechanical injury. Upon completion of the work, the fixtures, materials, and equipment shall be thoroughly cleaned, adjusted, and operated. Safety guards shall be provided for exposed rotating equipment.

4. Mains, Branches, and Runouts

Piping shall be installed as indicated. Pipe shall be accurately cut and worked into place without springing or forcing. Structural portions of the building shall not be weakened. Aboveground piping shall run parallel with the lines of the building, unless otherwise indicated. Branch pipes from service lines may be taken from top, bottom, or side of main, using crossover fittings required by structural or installation conditions. Supply pipes, valves, and fittings shall be kept a sufficient distance from other work and other services to permit not less than 1/2 inch between finished covering on the different services. Bare and insulated water lines shall not bear directly against building structural elements so as to transmit sound to the structure or to prevent flexible movement of the lines. Water pipe shall not be buried in or under floors unless specifically indicated or approved. Changes in pipe sizes shall be made with reducing fittings. Use of bushings will not be permitted except for use in situations in which standard factory fabricated components are furnished to accommodate specific accepted installation practice. Change in direction shall be made with fittings, except that bending of pipe 4 inches and smaller will be permitted, provided a pipe bender is used and wide sweep bends are formed. The center-line radius of bends shall be not less than six diameters of the pipe. Bent pipe showing kinks, wrinkles, flattening, or other malformations will not be acceptable.

5. Pipe Drains

Pipe drains indicated shall consist of 3/4 inch hose bibb with renewable seat and ball valve ahead of hose bibb. At other low points, 3/4 inch brass plugs or caps shall be provided. Disconnection of the supply piping at the fixture is an acceptable drain.

6. Expansion and Contraction of Piping

Allowance shall be made throughout for expansion and contraction of water pipe. Each hot-water and hot-water circulation riser shall have expansion loops or other provisions such as offsets, changes in direction, etc., where indicated and/or required. Risers shall be securely anchored as required or where indicated to force expansion to loops. Branch connections from risers shall be made with ample swing or offset to avoid undue strain on fittings or short pipe lengths. Horizontal runs of pipe over 50 feet in length shall be anchored to the wall or the supporting construction about midway on the run to force expansion, evenly divided, toward the ends. Sufficient flexibility shall be provided on branch runouts from mains and risers to provide for expansion and contraction of piping. Flexibility shall be provided by installing one or more turns in the line so that piping will spring enough to allow for expansion without straining. If mechanical grooved pipe coupling systems are provided, the deviation from design requirements for expansion and contraction may be allowed pending approval of Architect.

7. Thrust Restraint

Plugs, caps, tees, valves and bends deflecting 11.25 degrees or more, either vertically or horizontally, in waterlines 4 inches in diameter or larger shall be provided with thrust blocks, where indicated, to prevent movement. Thrust blocking shall be concrete of a mix not leaner than: 1 cement, 2-1/2 sand, 5 gravel; and having a compressive strength of not less than 2000 psi after 28 days. Blocking shall be placed between solid ground and the fitting to be anchored. Unless otherwise indicated or directed, the base and thrust bearing sides of the thrust block shall be poured against undisturbed earth. The side of the thrust block not subject to thrust shall be poured against forms. The area of bearing will be as shown. Blocking shall be placed so that the joints of the fitting are accessible for repair. Steel rods and clamps, protected by galvanizing or by coating with bituminous paint, shall be used to anchor vertical down bends into gravity thrust blocks.

8. Commercial-Type Water Hammer Arresters

Commercial-type water hammer arresters shall be provided on hot- and cold-water supplies and shall be located as generally indicated, with precise location and sizing to be in accordance with PDI WH 201. Water hammer arresters, where concealed, shall be accessible by means of access doors or removable panels. Commercial-type water hammer arresters shall conform to ASSE 1010. Vertical capped pipe columns will not be permitted where flush valve outlets are used.

B. Joints

Installation of pipe and fittings shall be made in accordance with the manufacturer's recommendations. Mitering of joints for elbows and notching of straight runs of pipe for tees will not be permitted. Joints shall be made up with fittings of compatible material and made for the specific purpose intended.

1. Threaded

Threaded joints shall have American Standard taper pipe threads conforming to ASME B1.20.1. Only male pipe threads shall be coated with graphite or with an approved graphite compound, or with an inert filler and oil, or shall have a polytetrafluoroethylene tape applied.

2. Mechanical Couplings

Mechanical couplings may be used in conjunction with grooved pipe for aboveground, ferrous or non-ferrous, domestic hot and cold water systems, in lieu of unions, brazed, soldered, welded, flanged, or threaded joints.

Mechanical couplings are permitted in accessible locations including behind access plates. Flexible grooved joints will not be permitted, except as vibration isolators adjacent to mechanical equipment. Rigid grooved joints shall incorporate an angle bolt pad design which maintains metal-to-metal contact with equal amount of pad offset of housings upon installation to ensure positive rigid clamping of the pipe.

Designs which can only clamp on the bottom of the groove or which utilize gripping teeth or jaws, or which use misaligned housing bolt holes, or which require a torque wrench or torque specifications will not be permitted.

Rigid grooved pipe couplings shall be for use with grooved end pipes, fittings, valves and strainers. Rigid couplings shall be designed for not less than 125 psi service and appropriate for static head plus the pumping head, and shall provide a watertight joint.

Grooved fittings and couplings, and grooving tools shall be provided from the same manufacturer. Segmentally welded elbows shall not be used. Grooves shall be prepared in accordance with the coupling manufacturer's latest published standards. Grooving shall be performed by qualified grooving operators having demonstrated proper grooving procedures in accordance with the tool manufacturer's recommendations.

The owner shall be provided with a completed set of the required tools for repairing the systems, along with raining on maintenance and repair. The contractor shall demonstrate the ability to properly adjust the grooving tool, groove the pipe, and to verify the groove dimensions in accordance with the coupling manufacturer's specifications.

3. Unions and Flanges

Unions, flanges and mechanical couplings shall not be concealed in walls, ceilings, or partitions. Unions shall be used on pipe sizes 2-1/2 inches and smaller; flanges shall be used on pipe sizes 3 inches and larger.

4. Grooved Mechanical Joints

Grooves shall be prepared according to the coupling manufacturer's instructions. Grooved fittings, couplings, and grooving tools shall be products of the same manufacturer. Pipe and groove dimensions shall comply with the tolerances specified by the coupling manufacturer. The diameter of grooves made in the field shall be measured using a "go/no-go" gauge, vernier or dial caliper, narrow-land micrometer, or other method specifically approved by the coupling manufacturer for the intended application. Groove width and dimension of groove from end of pipe shall be measured and recorded for each change in grooving tool setup to verify compliance with coupling manufacturer's tolerances. Grooved joints shall not be used in concealed locations.

5. Cast Iron Soil, Waste and Vent Pipe

Bell and spigot compression and hubless gasketed clamp joints for soil, waste and vent piping shall be installed per the manufacturer's recommendations.

6. Copper Tube and Pipe

a. Brazed. Brazed joints shall be made in conformance with AWS B2.2/B2.2M, ASME B16.50, and CDA A4015 with flux and are acceptable for all pipe sizes. Copper to copper joints shall include the use of copper-phosphorus or copper-phosphorus-silver brazing metal without flux. Brazing of dissimilar metals (copper to bronze or brass) shall include the use of flux with either a copper-phosphorus, copper-phosphorus-silver or a silver brazing filler metal.

b. Soldered. Soldered joints shall be made with flux and are only acceptable for piping 2 inches and smaller. Soldered joints shall conform to ASME B31.5 and CDA A4015.

c. Copper Tube Extracted Joint. Mechanically extracted joints shall be made in accordance with ILPC and ICC IPC.

d. Press connection. Copper press connections shall be made in **strict** accordance with the manufacturer's installation instructions for manufactured rated size. The joints shall be pressed using the tool(s) approved by the manufacturer **of that joint**. Minimum distance between fittings shall be in accordance with the manufacturer's requirements. The owner shall be provided with a complete set of tools and training for the installed system.

7. Plastic Pipe

PVC and CPVC pipe shall have joints made with solvent cement elastomeric, threading, (threading of Schedule 80 Pipe is allowed only where required for disconnection and inspection; threading of Schedule 40 Pipe is not allowed), or mated flanged.

C. Dissimilar Pipe Materials

Connections between ferrous and non-ferrous copper water pipe shall be made with dielectric unions or flange waterways. Dielectric waterways shall have temperature and pressure rating equal to or greater than that specified for the connecting piping. Waterways shall have metal connections on both ends suited to match connecting piping. Dielectric waterways shall be internally lined with an insulator specifically designed to prevent current flow between dissimilar metals. Dielectric flanges shall meet the performance requirements described herein for dielectric waterways. Connecting joints between plastic and metallic pipe shall be made with transition fitting for the specific purpose.

D. Corrosion Protection for Buried Pipe and Fittings

Ductile iron, cast iron, and steel pipe, fittings, and joints shall have a protective coating. Additionally, ductile iron, cast iron, and steel pressure pipe shall have a cathodic protection system and joint bonding. Coatings shall be selected, applied, and inspected in accordance with NACE SP0169 and as otherwise specified. The pipe shall be cleaned and the coating system applied prior to pipe tightness testing. Joints and fittings shall be cleaned and the coating system applied after pipe tightness testing. For tape coating systems, the tape shall conform to AWWA C203 and shall be applied with a 50 percent overlap. Primer utilized with tape type coating systems shall be as recommended by the tape manufacturer.

E. Pipe Sleeves and Flashing

Pipe sleeves shall be furnished and set in their proper and permanent location.

1. Sleeve Requirements

Unless indicated otherwise, provide pipe sleeves meeting the following requirements:

Secure sleeves in position and location during construction. Provide sleeves of sufficient length to pass through entire thickness of walls, ceilings, roofs, and floors.

A modular mechanical type sealing assembly may be installed in lieu of a waterproofing clamping flange and caulking and sealing of annular space between pipe and sleeve. The seals shall consist of interlocking synthetic rubber links shaped to continuously fill the annular space between the pipe and sleeve using galvanized steel bolts, nuts, and pressure plates. The links shall be loosely assembled with bolts to form a continuous rubber belt around the pipe with a

pressure plate under each bolt head and each nut. After the seal assembly is properly positioned in the sleeve, tightening of the bolt shall cause the rubber sealing elements to expand and provide a watertight seal between the pipe and the sleeve. Each seal assembly shall be sized as recommended by the manufacturer to fit the pipe and sleeve involved.

Sleeves shall not be installed in structural members, except where indicated or approved. Rectangular and square openings shall be as detailed. Each sleeve shall extend through its respective floor, or roof, and shall be cut flush with each surface, except for special circumstances. Pipe sleeves passing through floors in wet areas such as mechanical equipment rooms, lavatories, kitchens, and other plumbing fixture areas shall extend a minimum of 4 inches above the finished floor.

Unless otherwise indicated, sleeves shall be of a size to provide a minimum of 1/4 inch clearance between bare pipe or insulation and inside of sleeve or between insulation and inside of sleeve. Sleeves in bearing walls and concrete slab on grade floors shall be steel pipe or cast-iron pipe. Sleeves in nonbearing walls or ceilings may be steel pipe, cast-iron pipe, galvanized sheet metal with lock-type longitudinal seam, or plastic.

Except as otherwise specified, the annular space between pipe and sleeve, or between jacket over insulation and sleeve, shall be sealed as indicated with sealants conforming to ASTM C920 and with a primer, backstop material and surface preparation. The annular space between pipe and sleeve, between bare insulation and sleeve or between jacket over insulation and sleeve shall not be sealed for interior walls which are not designated as fire rated.

Sleeves through below-grade walls in contact with earth shall be recessed 1/2 inch from wall surfaces on both sides. Annular space between pipe and sleeve shall be filled with backing material and sealants in the joint between the pipe and concrete/masonry wall as specified above. Sealant selected for the earth side of the wall shall be compatible with dampproofing/waterproofing materials that are to be applied over the joint sealant. Pipe sleeves in fire-rated walls shall conform to the requirements in Section FIRESTOPPING.

2. Flashing Requirements

Pipes passing through roof shall be installed through a 16 ounce copper flashing, each within an integral skirt or flange. Flashing shall be suitably formed, and the skirt or flange shall extend not less than 8 inches from the pipe and shall be set over the roof or floor membrane in a solid coating of bituminous cement. The flashing shall extend up the pipe a minimum of 10 inches. For cleanouts, the flashing shall be turned down into the hub and caulked after placing the ferrule. Pipes passing through pitched roofs shall be flashed, using lead or copper flashing, with an adjustable integral flange of adequate size to extend not less than 8 inches from the pipe in all directions and lapped into the roofing to provide a watertight seal. The annular space between the flashing and the bare pipe or between the flashing and the metal-jacket-covered insulation shall be sealed as indicated. Flashing for dry vents shall be turned down into the pipe to form a waterproof joint. Pipes, up to and including 10 inches in diameter, passing through roof or floor waterproofing membrane may be installed through a cast-iron sleeve with caulking recess, anchor lugs, flashing-clamp device, and pressure ring with brass bolts. Flashing shield shall be fitted into the sleeve clamping device. Pipes passing through wall waterproofing membrane shall be sleeved as described above. A waterproofing clamping flange shall be installed.

3. Waterproofing

Waterproofing at floor-mounted water closets shall be accomplished by forming a flashing guard from soft-tempered sheet copper. The center of the sheet shall be perforated and turned down approximately 1-1/2 inches to fit between the outside diameter of the drainpipe and the inside diameter of the cast-iron or steel pipe sleeve. The turned-down portion of the flashing guard shall

be embedded in sealant to a depth of approximately 1-1/2 inches; then the sealant shall be finished off flush to floor level between the flashing guard and drainpipe. The flashing guard of sheet copper shall extend not less than 8 inches from the drainpipe and shall be lapped between the floor membrane in a solid coating of bituminous cement. If cast-iron water closet floor flanges are used, the space between the pipe sleeve and drainpipe shall be sealed with sealant and the flashing guard shall be upturned approximately 1-1/2 inches to fit the outside diameter of the drainpipe and the inside diameter of the water closet floor flange. The upturned portion of the sheet fitted into the floor flange shall be sealed.

4. Optional Counterflashing

Instead of turning the flashing down into a dry vent pipe, or caulking and sealing the annular space between the pipe and flashing or metal-jacket-covered insulation and flashing, counterflashing may be accomplished by utilizing the following:

a. A standard roof coupling for threaded pipe up to 6 inches in diameter.

b. A tack-welded or banded-metal rain shield around the pipe.

5. Pipe Penetrations of Slab on Grade Floors

Where pipes, fixture drains, floor drains, cleanouts or similar items penetrate slab on grade floors, except at penetrations of floors with waterproofing membrane as specified in paragraphs Flashing Requirements and Waterproofing, a groove 1/4 to 1/2 inch wide by 1/4 to 3/8 inch deep shall be formed around the pipe, fitting or drain. The groove shall be filled with a sealant.

6. Pipe Penetrations

Provide sealants for all pipe penetrations. All pipe penetrations shall be sealed to prevent infiltration of air, insects, and vermin.

F. Fire Seal

Where pipes pass through fire walls, fire-partitions, fire-rated pipe chase walls or floors above grade, a fire seal shall be provided as specified in Section FIRESTOPPING.

G. Supports

1. General

Hangers used to support piping 2 inches and larger shall be fabricated to permit adequate adjustment after erection while still supporting the load. Pipe guides and anchors shall be installed to keep pipes in accurate alignment, to direct the expansion movement, and to prevent buckling, swaying, and undue strain. Piping subjected to vertical movement when operating temperatures exceed ambient temperatures shall be supported by variable spring hangers and supports or by constant support hangers. In the support of multiple pipe runs on a common base member, a clip or clamp shall be used where each pipe crosses the base support member. Spacing of the base support members shall not exceed the hanger and support spacing required for an individual pipe in the multiple pipe run. Threaded sections of rods shall not be formed or bent.

2. Pipe Hangers, Inserts, and Supports

Installation of pipe hangers, inserts and supports shall conform to MSS SP-58 and MSS SP-69, except as modified herein.

a. Types 5, 12, and 26 shall not be used.

b. Type 3 shall not be used on insulated pipe.

c. Type 18 inserts shall be secured to concrete forms before concrete is placed. Continuous inserts which allow more adjustment may be used if they otherwise meet the requirements for type 18 inserts.

d. Type 19 and 23 C-clamps shall be torqued per MSS SP-69 and shall have both locknuts and retaining devices furnished by the manufacturer. Field-fabricated C-clamp bodies or retaining devices are not acceptable.

e. Type 20 attachments used on angles and channels shall be furnished with an added malleable-iron heel plate or adapter.

f. Type 24 may be used only on trapeze hanger systems or on fabricated frames.

g. Type 39 saddles shall be used on insulated pipe 4 inches and larger when the temperature of the medium is 60 degrees F or higher. Type 39 saddles shall be welded to the pipe.

h. Type 40 shields shall:

(1) Be used on insulated pipe less than 4 inches.

(2) Be used on insulated pipe 4 inches and larger when the temperature of the medium is 60 degrees F or less.

(3) Have a high density insert for all pipe sizes. High density inserts shall have a density of 8 pcf or greater.

i. Horizontal pipe supports shall be spaced as specified in MSS SP-69 and a support shall be installed not over 1 foot from the pipe fitting joint at each change in direction of the piping. Pipe supports shall be spaced not over 5 feet apart at valves. Operating temperatures in determining hanger spacing for PVC or CPVC pipe shall be 120 degrees F for PVC and 180 degrees F for CPVC. Horizontal pipe runs shall include allowances for expansion and contraction.

j. Vertical pipe shall be supported at each floor, except at slab-on-grade, at intervals of not more than 15 feet nor more than 8 feet from end of risers, and at vent terminations. Vertical pipe risers shall include allowances for expansion and contraction.

k. Type 35 guides using steel, reinforced polytetrafluoroethylene (PTFE) or graphite slides shall be provided to allow longitudinal pipe movement. Slide materials shall be suitable for the system operating temperatures, atmospheric conditions, and bearing loads encountered. Lateral restraints shall be provided as needed. Where steel slides do not require provisions for lateral restraint the following may be used:

(1) On pipe 4 inches and larger when the temperature of the medium is 60 degrees F or higher, a Type 39 saddle, welded to the pipe, may freely rest on a steel plate.

(2) On pipe less than 4 inches a Type 40 shield, attached to the pipe or insulation, may freely rest on a steel plate.

(3) On pipe 4 inches and larger carrying medium less that 60 degrees F a Type 40 shield, attached to the pipe or insulation, may freely rest on a steel plate.

l. Pipe hangers on horizontal insulated pipe shall be the size of the outside diameter of the insulation. The insulation shall be continuous through the hanger on all pipe sizes and applications.

m. Where there are high system temperatures and welding to piping is not desirable, the type 35 guide shall include a pipe cradle, welded to the guide structure and strapped securely to the pipe. The pipe shall be separated from the slide material by at least 4 inches or by an amount adequate for the insulation, whichever is greater.

n. Hangers and supports for plastic pipe shall not compress, distort, cut or abrade the piping, and shall allow free movement of pipe except where otherwise required in the control of expansion/contraction.

3. Structural Attachments

Attachment to building structure concrete and masonry shall be by cast-in concrete inserts, built-in anchors, or masonry anchor devices. Inserts and anchors shall be applied with a safety factor not less than 5. Supports shall not be attached to metal decking. Supports shall not be attached to the underside of concrete filled floor or concrete roof decks unless approved by the Architect. Masonry anchors for overhead applications shall be constructed of ferrous materials only.

H. Welded Installation

Plumbing pipe weldments shall be as indicated. Changes in direction of piping shall be made with welding fittings only; mitering or notching pipe to form elbows and tees or other similar type construction will not be permitted. Branch connection may be made with either welding tees or forged branch outlet fittings. Branch outlet fittings shall be forged, flared for improvement of flow where attached to the run, and reinforced against external strains. Beveling, alignment, heat treatment, and inspection of weld shall conform to ASME B31.1. Weld defects shall be removed and repairs made to the weld, or the weld joints shall be entirely removed and rewelded. After filler metal has been removed from its original package, it shall be protected or stored so that its characteristics or welding properties are not affected. Electrodes that have been wetted or that have lost any of their coating shall not be used.

I. Pipe Cleanouts

Pipe cleanouts shall be the same size as the pipe except that cleanout plugs larger than 4 inches will not be required. A cleanout installed in connection with cast-iron soil pipe shall consist of a long-sweep 1/4 bend or one or two 1/8 bends extended to the place shown. An extra-heavy cast-brass or cast-iron ferrule with countersunk cast-brass head screw plug shall be caulked into the hub of the fitting and shall be flush with the floor. Cleanouts in connection with other pipe, where indicated, shall be T-pattern, 90-degree branch drainage fittings with cast-brass screw plugs, except plastic plugs shall be installed in plastic pipe. Plugs shall be the same size as the pipe up to and including 4 inches. Cleanout tee branches with screw plug shall be installed at the foot of soil and waste stacks, at the foot of interior downspouts, on each connection to building storm drain where interior downspouts are indicated, and on each building drain outside the building. Cleanouts on pipe concealed in partitions shall be provided with chromium plated bronze, nickel bronze, nickel brass or stainless steel flush type access cover plates. Round access covers shall be provided and secured to plugs with securing screw. Square access covers may be provided with matching frames, anchoring lugs and cover screws. Cleanouts in finished walls shall have access covers and frames installed flush with the finished wall. Cleanouts installed in finished floors subject to foot traffic shall be provided with a

chrome-plated cast brass, nickel brass, or nickel bronze cover secured to the plug or cover frame and set flush with the finished floor. Heads of fastening screws shall not project above the cover surface.

1.11 3.2 FIXTURES AND FIXTURE TRIMMINGS

A. Equipment Connections

Where space limitations prohibit standard fittings in conjunction with the cast-iron floor flange, special short-radius fittings shall be provided. Connections between earthenware fixtures and flanges on soil pipe shall be made gastight and watertight with a closet-setting compound or neoprene gasket and seal. Use of natural rubber gaskets or putty will not be permitted. Fixtures with outlet flanges shall be set the proper distance from floor or wall to make a first-class joint with the closet-setting compound or gasket and fixture used.

B. Backflow Prevention Devices

Plumbing fixtures, equipment, and pipe connections shall not cross connect or interconnect between a potable water supply and any source of nonpotable water. Backflow preventers shall be installed to preclude a cross-connect or interconnect between a potable water supply and any nonpotable substance. In addition backflow preventers shall be installed at all locations where the potable water outlet is below the flood level of the equipment, or where the potable water outlet will be located below the level of the nonpotable substance. Backflow preventers shall be located so that no part of the device will be submerged. Backflow preventers shall be of sufficient size to allow unrestricted flow of water to the equipment, and preclude the backflow of any nonpotable substance into the potable water system. Bypass piping shall not be provided around backflow preventers. Access shall be provided for maintenance and testing. Each device shall be a standard commercial unit.

C. Access Panels

Access panels shall be provided for concealed valves and controls, or any item requiring inspection or maintenance. Access panels shall be of sufficient size and located so that the concealed items may be serviced, maintained, or replaced.

1.12 3.3 VIBRATION-ABSORBING FEATURES

Mechanical equipment, including compressors and pumps, shall be isolated from the building structure by approved vibration-absorbing features, unless otherwise shown. Each foundation shall include an adequate number of standard isolation units. Each unit shall consist of machine and floor or foundation fastening, together with intermediate isolation material, and shall be a standard product with printed load rating. Piping connected to mechanical equipment shall be provided with flexible connectors.

1.13 3.4 IDENTIFICATION SYSTEMS

A. Identification Tags

Identification tags made of brass, engraved laminated plastic, or engraved anodized aluminum, indicating service and valve number shall be installed on valves, except those valves installed on supplies at plumbing fixtures. Tags shall be 1-3/8 inch minimum diameter, and marking shall be stamped or engraved. Indentations shall be black, for reading clarity. Tags shall be attached to valves with No. 12 AWG, copper wire, chrome-plated beaded chain, or plastic straps designed for that purpose.

B. Color Coding Scheme for Locating Hidden Utility Components

Scheme shall be provided in buildings having suspended grid ceilings. The color coding scheme shall identify points of access for maintenance and operation of operable components which are not visible from the finished space and installed in the space directly above the suspended grid ceiling. The operable components shall include valves, dampers, switches, linkages and thermostats. The color coding scheme shall consist of a color code board and colored metal disks. Each colored metal disk shall be approximately 3/8 inch in diameter and secured to removable ceiling panels with fasteners. The fasteners shall be inserted into the ceiling panels so that the fasteners will be concealed from view. The fasteners shall be manually removable without tools and shall not separate from the ceiling panels when panels are dropped from ceiling height. Installation of colored metal disks shall follow completion of the finished surface on which the disks are to be fastened. The color code board shall have the approximate dimensions of 3 foot width, 30 inches height, and 1/2 inch thickness. The board shall be made of wood fiberboard and framed under glass or 1/16 inch transparent plastic cover. Unless otherwise directed, the color code symbols shall be approximately 3/4 inch in diameter and the related lettering in 1/2 inch high capital letters. The color code board shall be mounted and located in the mechanical or equipment room. The color code system shall be as indicated below:

Color	System	Location
Red	How Water	At all Directions Changes and Valve Locations
Blue	Cold Water	At all Directions Changes and Valve Locations

C. Pipe Labels

Provide color code marking of piping conforming to ASME A13.1. All piping shall be marked with the type and directional flow arrow. Pipe labels should be positioned so that they can be easily seen from the normal angle of approach—for instance, below the centerline of the pipe if the pipe is overhead, and above the centerline if the pipe is below eye level. Pipe labels shall be placed:

- Adjacent to all valves and flanges
- Adjacent to all changes of direction
- On both sides of wall or floor penetrations
- At regular intervals on straight runs (20' is the acceptable maximum spacing, but closer spacing might be necessary for visibility.)

1.14 3.5 ESCUTCHEONS

Escutcheons shall be provided at finished surfaces where bare or insulated piping, exposed to view, passes through floors, walls, or ceilings, except in boiler, utility, or equipment rooms. Escutcheons shall be fastened securely to pipe or pipe covering and shall be satin-finish, corrosion-resisting steel, polished chromium-plated zinc alloy, or polished chromium-plated copper alloy. Escutcheons shall be either one-piece or split-pattern, held in place by internal spring tension or setscrew.

1.15 3.6 PAINTING

Painting of pipes, hangers, supports, and other iron work, either in concealed spaces or exposed spaces, is specified in Division 9.

A. Painting of New Equipment

New equipment painting shall be factory applied or shop applied, and shall be as specified herein, and provided under each individual section.

1. Factory Painting Systems

Manufacturer's standard factory painting systems may be provided subject to certification that the factory painting system applied will withstand 125 hours in a salt-spray fog test, except that equipment located outdoors shall withstand 500 hours in a salt-spray fog test. Salt-spray fog test shall be in accordance with ASTM B117, and for that test the acceptance criteria shall be as follows: immediately after completion of the test, the paint shall show no signs of blistering, wrinkling, or cracking, and no loss of adhesion; and the specimen shall show no signs of rust creepage beyond 0.125 inch on either side of the scratch mark.

The film thickness of the factory painting system applied on the equipment shall not be less than the film thickness used on the test specimen. If manufacturer's standard factory painting system is being proposed for use on surfaces subject to temperatures above 120 degrees F, the factory painting system shall be designed for the temperature service.

2. Shop Painting Systems for Metal Surfaces

Clean, pretreat, prime and paint metal surfaces; except aluminum surfaces need not be painted. Apply coatings to clean dry surfaces. Clean the surfaces to remove dust, dirt, rust, oil and grease by wire brushing and solvent degreasing prior to application of paint, except metal surfaces subject to temperatures in excess of 120 degrees F shall be cleaned to bare metal.

Where more than one coat of paint is specified, apply the second coat after the preceding coat is thoroughly dry. Lightly sand damaged painting and retouch before applying the succeeding coat. Color of finish coat shall be aluminum or light gray.

a. Temperatures Less Than 120 Degrees F: Immediately after cleaning, the metal surfaces subject to temperatures less than 120 degrees F shall receive one coat of pretreatment primer applied to a minimum dry film thickness of 0.3 mil, one coat of primer applied to a minimum dry film thickness of one mil; and two coats of enamel applied to a minimum dry film thickness of one mil per coat.

b. Temperatures Between 120 and 400 Degrees F: Metal surfaces subject to temperatures between 120 and 400 degrees F shall receive two coats of 400 degrees F heat-resisting enamel applied to a total minimum thickness of 2 mils.

c. Temperatures Greater Than 400 Degrees F: Metal surfaces subject to temperatures greater than 400 degrees F shall receive two coats of 600 degrees F heat-resisting paint applied to a total minimum dry film thickness of 2 mils.

1.16 3.7 TESTS, FLUSHING AND DISINFECTION

A. Plumbing System

The following tests shall be performed on the new portions of plumbing system in accordance with the ILPC, except that the drainage and vent system final test shall include the smoke test. The Contractor has the option to perform a peppermint test in lieu of the smoke test. If a peppermint test is chosen, the Contractor must submit a testing procedure to the Architect for approval.

a. Drainage and Vent Systems Test. The final test shall include a smoke test.

b. Building Sewers Tests.

c. Water Supply Systems Tests.

1. Test of Backflow Prevention Assemblies

Backflow prevention assembly shall be tested using gauges specifically designed for the testing of backflow prevention assemblies.

Backflow prevention assembly test gauges shall be tested annually for accuracy in accordance with the requirements of State or local regulatory agencies. If there is no State or local regulatory agency requirements, gauges shall be tested annually for accuracy in accordance with the requirements of University of Southern California's Foundation of Cross Connection Control and Hydraulic Research or the American Water Works Association Manual of Cross Connection (Manual M-14), or any other approved testing laboratory having equivalent capabilities for both laboratory and field evaluation of backflow prevention assembly test gauges. Report form for each assembly shall include, as a minimum, the following:

Data on Device	Data on Testing Firm
Type of Assembly	Name
Manufacturer	Address
Model Number	Certified Tester
Serial Number	Certified Tester No.
Size	Date of Test
Location	
Test Pressure Readings	Serial Number and Test Data of Gauges

If the unit fails to meet specified requirements, the unit shall be repaired and retested.

B. Defective Work

If inspection or test shows defects, such defective work or material shall be replaced or repaired as necessary and inspection and tests shall be repeated. Repairs to piping shall be made with new materials. Caulking of screwed joints or holes will not be acceptable.

C. System Flushing

1. During Flushing

Before operational tests or disinfection, potable water piping system shall be flushed with potable water. Sufficient water shall be used to produce a water velocity that is capable of entraining and removing debris in all portions of the piping system. This requires simultaneous operation of all fixtures on a common branch or main in order to produce a flushing velocity of approximately 4 fps through all portions of the piping system. In the event that this is impossible due to size of

system, the Architect (or the designated representative) shall specify the number of fixtures to be operated during flushing. Contractor shall provide adequate personnel to monitor the flushing operation and to ensure that drain lines are unobstructed in order to prevent flooding of the facility. Contractor shall be responsible for any flood damage resulting from flushing of the system. Flushing shall be continued until entrained dirt and other foreign materials have been removed and until discharge water shows no discoloration. All faucets and drinking water fountains, to include any device considered as an end point device by NSF/ANSI 61, Section 9, shall be flushed a minimum of 0.25 gallons per 24 hour period, ten times over a 14 day period.

2. After Flushing

System shall be drained at low points. Strainer screens shall be removed, cleaned, and replaced. After flushing and cleaning, systems shall be prepared for testing by immediately filling water piping with clean, fresh potable water. Any stoppage, discoloration, or other damage to the finish, furnishings, or parts of the building due to the Contractor's failure to properly clean the piping system shall be repaired by the Contractor. When the system flushing is complete, the hot-water system shall be adjusted for uniform circulation. Flushing devices and automatic control systems shall be adjusted for proper operation according to manufacturer's instructions. Comply with ASHRAE 90.1 - IP for minimum efficiency requirements. Unless more stringent local requirements exist, lead levels shall not exceed limits established by 40 CFR 141.80 (c)(1). The water supply to the building shall be tested separately to ensure that any lead contamination found during potable water system testing is due to work being performed inside the building.

D. Operational Test

Upon completion of flushing and prior to disinfection procedures, the Contractor shall subject the plumbing system to operating tests to demonstrate satisfactory installation, connections, adjustments, and functional and operational efficiency. Such operating tests shall cover a period of not less than 8 hours for each system and shall include the following information in a report with conclusion as to the adequacy of the system:

a. Time, date, and duration of test.

b. Water pressures at the most remote and the highest fixtures.

c. Operation of each fixture and fixture trim.

d. Operation of each valve, hydrant, and faucet.

e. Pump suction and discharge pressures.

f. Temperature of each domestic hot-water supply.

g. Operation of each floor and roof drain by flooding with water.

h. Operation of each vacuum breaker and backflow preventer.

E. Disinfection

After all system components are provided and operational tests are complete, the entire domestic hot- and cold-water distribution system shall be disinfected. Before introducing disinfecting chlorination material, entire system shall be flushed with potable water until any entrained dirt and other foreign materials have been removed.

Water chlorination procedure shall be in accordance with AWWA C651 and AWWA C652 as modified and supplemented by this specification. The chlorinating material shall be hypochlorites or liquid chlorine. The chlorinating material shall be fed into the water piping system at a constant rate at a concentration of at least 50 parts per million (ppm). Feed a properly adjusted hypochlorite solution injected into the system with a hypochlorinator, or inject liquid chlorine into the system through a solution-feed chlorinator and booster pump until the entire system is completely filled.

Test the chlorine residual level in the water at 6 hour intervals for a continuous period of 24 hours. If at the end of a 6 hour interval, the chlorine residual has dropped to less than 25 ppm, flush the piping including tanks with potable water, and repeat the above chlorination procedures. During the chlorination period, each valve and faucet shall be opened and closed several times.

After the second 24 hour period, verify that no less than 25 ppm chlorine residual remains in the treated system. The 24 hour chlorination procedure must be repeated until no less than 25 ppm chlorine residual remains in the treated system.

Upon the specified verification, the system including tanks shall then be flushed with potable water until the residual chlorine level is reduced to less than one part per million. During the flushing period, each valve and faucet shall be opened and closed several times.

Take addition samples of water in disinfected containers, for bacterial examination, at locations specified by the Architect

Test these samples for total coliform organisms (coliform bacteria, fecal coliform, streptococcal, and other bacteria) in accordance with EPA SM 9223 and AWWA 10084. The testing method used shall be EPA approved for drinking water systems and shall comply with applicable local and state requirements.

Disinfection shall be repeated until bacterial tests indicate the absence of coliform organisms (zero mean coliform density per 100 milliliters) in the samples for at least 2 full days. The system will not be accepted until satisfactory bacteriological results have been obtained.

1.17 3.8 WASTE MANAGEMENT

Place materials defined as hazardous or toxic waste in designated containers. Return solvent and oil soaked rags for contaminant recovery and laundering or for proper disposal. Close and seal tightly partly used sealant and adhesive containers and store in protected, well-ventilated, fire-safe area at moderate temperature. Place used sealant and adhesive tubes and containers in areas designated for hazardous waste. Separate copper and ferrous pipe waste in accordance with the Waste Management Plan and place in designated areas for reuse.

1.18 3.9 POSTED INSTRUCTIONS

Framed instructions under glass or in laminated plastic, including wiring and control diagrams showing the complete layout of the entire system, shall be posted where directed. Condensed operating instructions explaining preventive maintenance procedures, methods of checking the system for normal safe operation, and procedures for safely starting and stopping the system shall be prepared in typed form, framed as specified above for the wiring and control diagrams and posted beside the diagrams. The framed instructions shall be posted before acceptance testing of the systems.

1.19 3.10 TABLES

TABLE I						
PIPE AND FITTING MATERIALS FOR DRAINAGE, WASTE, AND VENT PIPING SYSTEMS						
Item #	Pipe and Fitting Materials	SERVICE A	SERVICE B	SERVICE C	SERVICE D	SERVICE E
1	Cast iron soil pipe and fittings, hub and spigot, ASTM A74 with compression gaskets. Pipe and fittings shall be marked with the CISPI trademark.	X	X	X	X	X
2	Cast iron soil pipe and fittings hubless, CISPI 301 and ASTM A888. Pipe and fittings shall be marked with the CISPI trademark.		X	X	X	X
3	Cast iron drainage fittings, threaded, ASME B16.12 for use with Item 10	X		X	X	
4	Cast iron screwed fittings (threaded) ASME B16.4 for use with Item 10				X	X
5	Grooved pipe couplings, ferrous and non-ferrous pipe ASTM A536 And ASTM A47/A47M	X	X		X	X
6	Ductile iron grooved joint fittings for ferrous pipe ASTM A536 and ASTM A47/A47M for use with Item 5	X	X		X	X

7	Bronze sand casting grooved joint pressure fittings for non-ferrous pipe ASTM B584, for use with Item 5	X	X		X	X
8	Wrought copper grooved joint pressure pressure fittings for non-ferrous pipe ASTM B75/B75M C12200, ASTM B152/B152M, C11000, ASME B16.22 ASME B16.22 for use with Item 5	X	X			
9	Malleable-iron threaded fittings, galvanized ASME B16.3 for use with Item 10				X	X
10	Steel pipe, seamless galvanized, ASTM A53/A53M, Type S, Grade B	X			X	X
11	Seamless red brass pipe, ASTM B43				X	X
12	Bronzed flanged fittings, ASME B16.24 for use with Items 11 and 14				X	X
13	Cast copper alloy solder joint pressure fittings, ASME B16.18for use with Item 14				X	X
14	Seamless copper pipe, ASTM B42					
15	Cast bronze threaded fittings, ASME B16.15				X	X
16	Copper drainage tube, (DWV), ASTM B306	X*	X	X*	X	X

17	Wrought copper and wrought alloy solder-joint drainage fittings. ASME B16.29	X	X	X	X	X
18	Polyvinyl Chloride plastic drain, waste and vent pipe and fittings, ASTM D2665, ASTM F891, (Sch 40) ASTM F1760	X	X	X	X	
19	High-silicon content cast iron pipe and fittings (hub and spigot, and mechanical joint), ASTM A518/A518M		X			X

SERVICE:
A - Underground Building Soil, Waste and Storm Drain
B - Aboveground Soil, Waste, Drain In Buildings
C - Underground Vent
D - Aboveground Vent
E - Interior Rainwater Conductors Aboveground
* - Hard Temper

TABLE II

PIPE AND FITTING MATERIALS FOR DOMESTIC WATER PIPING SYSTEMS

Item #	Pipe and Fitting Materials	SERVICE A	SERVICE B	SERVICE C
1	Bronzed flanged fittings, ASME B16.24 for use with Item 14	X	X	
2	Cast copper alloy solder joint pressure fittings, ASME B16.18 for use with Item 14	X	X	
3	Seamless copper pipe, ASTM B42	X**	X**	X*
4	Cast bronze threaded fittings, ASME B16.15	X	X	

SERVICE:
A - Cold Water Service Aboveground
B - Hot and Cold Water Distribution 180 degrees F Maximum Aboveground
C – Cold Water service, Below Grade
Indicated types are minimum wall thicknesses.
** - Type L
* - Hard Temper

END SECTION 22 00 00

SECTION 23 00 00
AIR SUPPLY, DISTRIBUTION, VENTILATION, & EXHAUST SYSTEMS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ACOUSTICAL SOCIETY OF AMERICA (ASA)

ASA S12.51	(2012) Acoustics Determination of Sound Power Levels of Noise Sources using Sound Pressure Precision Method for Reverberation Rooms

AIR CONDITIONING CONTRACTORS OF AMERICA (ACCA)

ACCA Manual 4	(2001) Installation Techniques for Perimeter Heating and Cooling; 11th Edition

AIR MOVEMENT AND CONTROL ASSOCIATION INTERNATIONAL (AMCA)

AMCA 201	(2002; R 2011) Fans and Systems
AMCA 210	(2007) Laboratory Methods of Testing Fans for Aerodynamic Performance Rating
AMCA 220	(2005) Test Methods for Air Curtain Units
AMCA 300	(2008) Reverberant Room Method for Sound Testing of Fans
AMCA 301	(2014) Methods for Calculating Fan Sound Ratings from Laboratory Test Data

AIR-CONDITIONING, HEATING AND REFRIGERATION INSTITUTE (AHRI)

AHRI 260 I-P	(2012) Sound Rating of Ducted Air Moving and Conditioning Equipment
AHRI 350	(2008) Sound Rating of Non-Ducted Indoor Air-Conditioning Equipment
AHRI 410	(2001; Addendum 1 2002; Addendum 2 2005; Addendum 3 2011) Forced-Circulation Air-Cooling and Air-Heating Coils

AHRI 430	(2009) Central-Station Air-Handling Units
AHRI 440	(2008) Room Fan-Coils and Unit Ventilators
AHRI 880 I-P	(2011) Performance Rating of Air Terminals
AHRI 885	(2008; Addendum 2011) Procedure for Estimating Occupied Space Sound Levels in the Application of Air Terminals and Air Outlets
AHRI DCAACP	(Online) Directory of Certified Applied Air-Conditioning Products
AHRI Guideline D	(1996) Application and Installation of Central Station Air-Handling Units

AMERICAN BEARING MANUFACTURERS ASSOCIATION (ABMA)

ABMA 11	(2014) Load Ratings and Fatigue Life for Roller Bearings
ABMA 9	(1990; ERTA 2012; S 2013) Load Ratings and Fatigue Life for Ball Bearings

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS (ASHRAE)

ANSI/ASHRAE 15 & 34	(2013; Addenda A 2014; ERTA 2014) ANSI/ASHRAE Standard 15-Safety Standard for Refrigeration Systems and ANSI/ASHRAE Standard 34-Designation and Safety Classification of Refrigerants
ASHRAE 52.2	(2012; Errata 2013; INT 1 2014) Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size
ASHRAE 62.1	(2010; Errata 2011; INT 3 2012; INT 4 2012; INT 5 2013) Ventilation for Acceptable Indoor Air Quality
ASHRAE 68	(1997) Laboratory Method of Testing to Determine the Sound Power In a Duct
ASHRAE 70	(2006; R 2011) Method of Testing for Rating the Performance of Air Outlets and Inlets
ASHRAE 84	(2013; Addenda A 2013) Method of Testing Air-to-Air Heat Exchangers
ASHRAE 90.1 - IP	(2010; ERTA 2011-2013) Energy Standard for Buildings Except Low-Rise Residential Buildings

ASME INTERNATIONAL (ASME)

ASME A13.1	(2007; R 2013) Scheme for the Identification of Piping Systems

ASTM INTERNATIONAL (ASTM)

ASTM A123/A123M	(2013) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A167	(2011) Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
ASTM A53/A53M	(2012) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A924/A924M	(2014) Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process
ASTM B117	(2011) Standard Practice for Operating Salt Spray (Fog) Apparatus
ASTM B152/B152M	(2013) Standard Specification for Copper Sheet, Strip, Plate, and Rolled Bar
ASTM B209	(2014) Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
ASTM B766	(1986; R 2008) Standard Specification for Electrodeposited Coatings of Cadmium
ASTM C1071	(2012) Standard Specification for Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material)
ASTM C553	(2013) Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications
ASTM C916	(2014) Standard Specification for Adhesives for Duct Thermal Insulation
ASTM D1654	(2008) Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments
ASTM D1785	(2012) Standard Specification for Poly(Vinyl Chloride) (PVC), Plastic Pipe, Schedules 40, 80, and 120
ASTM D2466	(2013) Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40

ASTM D2564	(2012) Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems
ASTM D2855	(1996; R 2010) Standard Practice for Making Solvent-Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings
ASTM D3359	(2009; E 2010; R 2010) Measuring Adhesion by Tape Test
ASTM D520	(2000; R 2011) Zinc Dust Pigment
ASTM E2016	(2011) Standard Specification for Industrial Woven Wire Cloth
ASTM E84	(2014) Standard Test Method for Surface Burning Characteristics of Building Materials

INSTITUTE OF ENVIRONMENTAL SCIENCES AND TECHNOLOGY (IEST)

IEST RP-CC-001	(2009) HEPA and ULPA Filters

INTERNATIONAL CODE COUNCIL (ICC)

IMC	(2009) International Mechanical Code
IECC	(2009) International Energy Conservation Code

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA ICS 6	(1993; R 2011) Enclosures
NEMA MG 1	(2011; Errata 2012) Motors and Generators
NEMA MG 10	(2013) Energy Management Guide for Selection and Use of Fixed Frequency Medium AC Squirrel-Cage Polyphase Induction Motors
NEMA MG 11	(1977; R 2012) Energy Management Guide for Selection and Use of Single Phase Motors

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2014; AMD 1 2013; Errata 1 2013; AMD 2 2013; Errata 2 2013; AMD 3 2014; Errata 3-4 2014; AMD 4-6 2014) National Electrical Code
NFPA 701	(2010) Standard Methods of Fire Tests for Flame Propagation of Textiles and Films

NFPA 90A	(2015) Standard for the Installation of Air Conditioning and Ventilating Systems
NFPA 96	(2014) Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations

SHEET METAL AND AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION (SMACNA)

SMACNA 1403	(2008) Accepted Industry Practice for Industrial Duct Construction, 2nd Edition
SMACNA 1819	(2002) Fire, Smoke and Radiation Damper Installation Guide for HVAC Systems, 5th Edition
SMACNA 1966	(2005) HVAC Duct Construction Standards Metal and Flexible, 3rd Edition
SMACNA 1981	(2008) Seismic Restraint Manual Guidelines for Mechanical Systems, 3rd Edition

U.S. DEPARTMENT OF ENERGY (DOE)

PL-109-58	(1992; R 2005) Energy Efficient Procurement Requirements

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

40 CFR 82	Protection of Stratospheric Ozone

UNDERWRITERS LABORATORIES (UL)

UL 181	(2013) Factory-Made Air Ducts and Air Connectors
UL 1995	(2011) Heating and Cooling Equipment
UL 555	(2006; Reprint May 2014) Standard for Fire Dampers
UL 586	(2009; Reprint Sep 2014) Standard for High-Efficiency Particulate, Air Filter Units
UL 6	(2007; Reprint Nov 2014) Electrical Rigid Metal Conduit-Steel
UL 705	(2004; Reprint Dec 2013) Standard for Power Ventilators
UL 723	(2008; Reprint Aug 2013) Test for Surface Burning Characteristics of Building Materials
UL 900	(2004; Reprint Feb 2012) Standard for Air Filter Units

UL 94	(2013; Reprint Sep 2014) Standard for Tests for Flammability of Plastic Materials for Parts in Devices and Appliances
UL Bld Mat Dir	(2012) Building Materials Directory
UL Electrical Constructn	(2012) Electrical Construction Equipment Directory
UL Fire Resistance	(2012) Fire Resistance Directory

1.2 SYSTEM DESCRIPTION

A. Furnish all equipment, ductwork, piping offsets, fittings, and accessories as required to provide a complete installation. Coordinate the work of the different trades to avoid interference between piping, equipment, structural, and electrical work. Provide complete, in place, all necessary offsets in piping and ductwork, and all fittings, and other components, required to install the work as indicated and specified.

B. Diagrams

Submit proposed diagrams, at least 2 weeks prior to start of related testing. Provide neat mechanical drawings, system diagrams that show the layout of equipment, piping, and ductwork, and typed condensed operation manuals explaining preventative maintenance procedures, methods of checking the system for normal, safe operation, and procedures for safely starting and stopping the system. After approval, post these items where directed.

1.3 SUBMITTALS

Submit the following in accordance with Section 01 30 00 SUBMITTALS:

Product Data
- Intake Louvers
- Ductwork

Test Reports
- Performance Tests
- Damper Acceptance Test
- Air Balancing Test

Manufacturer's Instructions
- Manufacturer's Installation Instructions

Operation and Maintenance Data
- Louvers

1.4 QUALITY ASSURANCE

A. Except as otherwise specified, approval of materials and equipment is based on manufacturer's published data.

1. Where materials and equipment are specified to conform to the standards of the Underwriters Laboratories, the label of or listing with reexamination in UL Bld Mat Dir, and UL 6 is acceptable as sufficient evidence that the items conform to Underwriters Laboratories requirements. In lieu of such label or listing, submit a written certificate from any nationally recognized testing agency, adequately equipped and competent to perform such services, stating that the items have been tested and that the units conform to the specified requirements. Outline methods of testing used by the specified agencies.

2. Where materials or equipment are specified to be constructed or tested, or both, in accordance with the standards of the ASTM International (ASTM), the ASME International (ASME), or other standards, a manufacturer's certificate of compliance of each item is acceptable as proof of compliance.

3. Conformance to such agency requirements does not relieve the item from compliance with other requirements of these specifications.

B. Prevention of Corrosion

Protect metallic materials against corrosion. Manufacturer shall provide rust-inhibiting treatment and standard finish for the equipment enclosures. Do not use aluminum in contact with earth, and where connected to dissimilar metal. Protect aluminum by approved fittings, barrier material, or treatment. Ferrous parts such as anchors, bolts, braces, boxes, bodies, clamps, fittings, guards, nuts, pins, rods, shims, thimbles, washers, and miscellaneous parts not of corrosion-resistant steel or nonferrous materials shall be hot-dip galvanized in accordance with ASTM A 123/A 123M for exterior locations and cadmium-plated in conformance with ASTM B 766 for interior locations.

C. Asbestos Prohibition

Do not use asbestos and asbestos-containing products.

D. As-Built Drawings

Submit detail drawings showing final equipment layout, including assembly and installation details and electrical connection diagrams; ductwork layout showing the location of all supports and hangers, typical hanger details, gauge reinforcement, reinforcement spacing rigidity classification, and static pressure and seal classifications. Include any information required to demonstrate that the system has been coordinated and functions properly as a unit on the drawings and show equipment relationship to other parts of the work, including clearances required for operation and maintenance. Submit drawings showing bolt-setting information, and foundation bolts prior to concrete foundation construction for all equipment indicated or required to have concrete foundations. Submit function designation of the equipment and any other requirements specified throughout this Section with the shop drawings.

E. Test Procedures

Submit proposed test procedures and test schedules for the performance tests of systems, at least 2 weeks prior to the start of related testing.

1.5 DELIVERY, STORAGE, AND HANDLING

Protect stored equipment at the jobsite from the weather, humidity and temperature variations, dirt and dust, or other contaminants. Additionally, cap or plug all pipes until installed.

PART 2 PRODUCTS

2.1 PAINTING

Paint equipment units in accordance with approved equipment manufacturer's standards unless specified otherwise. Field retouch only if approved. Otherwise, return equipment to the factory for refinishing.

2.2 INDOOR AIR QUALITY

Provide equipment and components that comply with the requirements of ASHRAE 62.1 unless more stringent requirements are specified herein.

2.3 DUCT SYSTEMS

A. Metal Ductwork

Provide metal ductwork construction, including all fittings and components, that complies with SMACNA 1966, as supplemented and modified by this specification.

1. Provide radius type elbows with a centerline radius of 1.5 times the width or diameter of the duct where space permits. Otherwise, elbows having a minimum radius equal to the width or diameter of the duct or square elbows with factory fabricated turning vanes are allowed.

2. Provide sealants that conform to fire hazard classification specified in Section 23 07 00 THERMAL INSULATION FOR MECHANICAL SYSTEMS and are suitable for the range of air distribution and ambient temperatures to which it is exposed. Do not use pressure sensitive tape as a sealant.

3. Make spiral lock seam duct, and flat oval with duct sealant and lock with not less than 3 equally spaced drive screws or other approved methods indicated in SMACNA 1966. Apply the sealant to the exposed male part of the fitting collar so that the sealer is on the inside of the joint and fully protected by the metal of the duct fitting. Apply one brush coat of the sealant over the outside of the joint to at least 2 inch band width covering all screw heads and joint gap. Dents in the male portion of the slip fitting collar are not acceptable. Fabricate outdoor air intake ducts and plenums with watertight soldered or brazed joints and seams.

B. General Service Duct Connectors

Provide a flexible duct connector approximately 6 inches in width where sheet metal connections are made to fans or where ducts of dissimilar metals are connected. For round/oval ducts, secure the flexible material by stainless steel or zinc-coated, iron clinch-type draw bands. For rectangular ducts, install the flexible material locked to metal collars using normal duct construction methods. Provide a composite connector system that complies with NFPA 701 and is classified as "flame-retardent fabrics" in UL Bld Mat Dir.

C. Aluminum Ducts

ASTM B209, alloy 3003-H14 for aluminum sheet and alloy 6061-T6 or equivalent strength for aluminum connectors and bar stock.

D. Corrosion Resisting (Stainless) Steel Sheets

ASTM A167

2.4 LOUVERS

A. Acceptable Manufacturers

1. Vent products, Carnes, Greenheck.

2. Equivalent units and manufacturers must meet all performance criteria, and must be approved by the School District during bidding phase.

B. Materials

1. Aluminum Extrusions: ASTM B 221, alloy 6063-T5 or T52.

2. Aluminum Sheet: ASTM B 209, alloy 3003 or 5005 with temper as required for forming, or as otherwise recommended by metal producer for required finish.

3. Aluminum Castings: ASTM B 26/B 26M, alloy 319.

4. Fasteners: Of same basic metal and alloy as fastened metal or 300 Series stainless steel, unless otherwise indicated. Do not use metals that are incompatible with joined materials.

   a. Use types and sizes to suit unit installation conditions.

   b. Use Phillips flat head screws for exposed fasteners, unless otherwise indicated.

5. Post-installed Fasteners for Concrete and Masonry: Torque-controlled expansion anchors, made from stainless-steel components, with capability to sustain, without failure, a load equal to 4 times the loads imposed, for concrete, or 6 times the imposed, for masonry, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.

6. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

C. Fabrication

1. Assemble louvers in factory to minimize field splicing and assembly. Disassemble units as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

2. Vertical Assemblies: Where height of louver units exceeds fabrication and handling limitations, fabricate units to permit field bolted assembly with close fitting joints in jambs and mullions, reinforced with splice plates.

3. Fabricate frames, including integral sills, to fit in openings of sizes indicated, with allowances made for fabrication and installation tolerances, adjoining material tolerances, and perimeter sealant joints.

    a. Frame Type: Channel, unless otherwise indicated in the drawings.

4. Include supports, anchorages and accessories required for complete assembly.

5. Provide vertical visible mullion of type and at spacing indicated, but not more than recommended by manufacturer, or 60 inches (1524mm) oc, whichever is less.

6. Where indicated, provide subsill made of same material as louvers or extended sill for recessed louvers.

D. Fixed, Extruded Aluminum Louvers

Extruded aluminum frame and blades shall be designed to collect and drain water to exterior at sloped sill by means of gutters in front edges of blades and of drain channels in jambs.

1. Louver Depth: 6 inches (152mm)

2. Blade Angle and Spacing: 35 degrees @ open position and approx. 4-7/16” oc.

3. Frame and Blade Nominal Thickness: As required to comply with structural performance requirements, frame .081 inch (2.1mm) and blade .072.

4. Linkage: Plated steel center brackets, brass pivots, 5/16” dia plated steel linkage.

5. Actuator: 120V type, coordinate with Electrical Contractor.

6. Performance Requirements:

    All tests performed at an independent laboratory and based on AMCA standard 500-L for Air Performance and Water Penetration shall meet following requirements

    a. Free Area: Not less than 7.4 sq. ft on 48” x 48” (1219mm x 1219mm) louver (46%)

    b. Water Penetration: 847 FPM velocity through free area

    c. Static Pressure Loss: Not more than .12” (3.1mm) water gauge (0.03kPa) at an airflow of 800 FPM velocity through free area

E. Louver Screens

1. General: Provide screen at each exterior louver.

2. Screen Location for Fixed Louvers: Interior face.

3. Screening Type: Bird screening.

4. Secure screens to louver frames with stainless steel machine screw, spaced a maximum of 6 inches (152mm) from each corner and at 12” oc. (305mm)

5. Louver Screen Frames: Provide rewireable framed removable screen.

    a. Metal: Same kind and form of metal as the louvers.

    b. Finish: Same finish as louver frame to which louver screens are attached.

6. Louver Screening for Aluminum Louvers:

    a. Bird Screen:

        a. Aluminum, 3/4inch by 0.050 inch (19 mm by 1.27 mm), expanded, flattened.

F. Fabrication

1. Fabrication Requirements

    a. Performance: Fabricate as required for optimum performance with respect to water penetration, strength, durability, and appearance.

    b. Size: Fabricate louvers in walls to meet dimensions indicated on Contract Documents.

    c. Field Measurement: Verify size, location, and placement of louvers before fabrication.

    d. Shop Assembly:

        1) Fabricate to minimize field adjustments, splicing, mechanical joints and field assembly of units.

        2) Preassemble units in shop to greatest extent possible and disassemble as necessary for shipping and handling.

        3) Clearly mark units for reassemble and coordinated installation.

    e. Accessories: Include supports, anchorages and accessories required for complete assembly.

    f. Vertical Mullions: Provide vertical mullions of type and spacing indicated but not further apart than recommended by the manufacturer.

    g. Horizontal Mullions: Provide horizontal mullions at horizontal joints between louver units except where continuous vertical assemblies are indicated.

    h. Connections: Join frame and blade members to one another by mechanical fastener, except where field bolted connections between frame members are made necessary by size of louvers.

i. Spacing: Maintain equal blade spacing to produce uniform appearance.

G. Finishes, General

1. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

2. Finish louver after assembly.

H. Aluminum Finishes

1. Comply with NAAMM "Metal Finishes Manual" for finish designations and application recommendations, except as otherwise indicated. Apply finishes in factory. Protect finishes on exposed surfaces prior to shipment. Remove scratches and blemishes from exposed surfaces that will be visible after completing finishing process. Provide custom color as, as selected by architect. Coordinate if louvers are to be factory painted or field painted once color is selected by architect.

2. Prime Coat:

a. Apply alkyd prime coat following chemical cleaning and pretreatment.

b. Primer preparation for field painting

3. Color Anodize

a. Class I Bronze Anodize

1) Light, Medium, Dark, Champagne

2) Comply with Aluminum Association AA-C2242 or AA-C2244.

3) Apply finish following chemical etching and pretreatment

4) Minimum thickness: 0.7 mils (0.018mm).

2.5 FACTORY PAINTING

Factory paint new equipment, which are not of galvanized construction. Paint with a corrosion resisting paint finish according to ASTM A 123/A 123M or ASTM A 924/A 924M. Clean, phosphatize and coat internal and external ferrous metal surfaces with a paint finish which has been tested according to ASTM B 117, ASTM D 1654, and ASTM D 3359. Submit evidence of satisfactory paint performance for a minimum of 125 hours for units to be installed indoors and 500 hours for units to be installed outdoors. Provide rating of failure at the scribe mark that is not less than 6, average creepage not greater than 1/8 inch. Provide rating of the inscribed area that is not less than 10, no failure. On units constructed of galvanized steel that have been welded, provide a final shop docket of zinc-rich protective paint on exterior surfaces of welds or welds that have burned through from the interior according to ASTM D 520 Type I.

Factory painting that has been damaged prior to acceptance by the Contractor shall be field painted in compliance with the requirements of paragraph FIELD PAINTING OF MECHANICAL EQUIPMENT.

2.6 SUPPLEMENTAL COMPONENTS/SERVICES

A. Insulation

The requirements for shop and field applied insulation are specified in Section 23 07 00 THERMAL INSULATION FOR MECHANICAL SYSTEMS.

PART 3 EXECUTION

3.1 EXAMINATION

After becoming familiar with all details of the work, verify all dimensions in the field, and advise the Architect of any discrepancy before performing the work.

3.2 INSTALLATION

a. Install materials and equipment in accordance with the requirements of the contract drawings and approved manufacturer's installation instructions. Accomplish installation by workers skilled in this type of work. Perform installation so that there is no degradation of the designed fire ratings of walls, partitions, ceilings, and floors.

b. No installation is permitted to block or otherwise impede access to any existing machine or system. Install all hinged doors to swing open a minimum of 120 degrees. Provide an area in front of all access doors that clears a minimum of 3 feet. In front of all access doors to electrical circuits, clear the area the minimum distance to energized circuits as specified in OSHA Standards, part 1910.333 (Electrical-Safety Related work practices).

c. Except as otherwise indicated, install emergency switches and alarms in conspicuous locations. Mount all indicators, to include gauges, meters, and alarms in order to be easily visible by people in the area.

A. Equipment and Installation

Provide frames and supports for equipment and ductwork requiring supports. Ceiling hang air handling units as indicated. Anchor and fasten as detailed. Set floor-mounted equipment on not less than 6 inch concrete pads. Make concrete foundations heavy enough to minimize the intensity of the vibrations transmitted to the piping, duct work and the surrounding structure, as recommended in writing by the equipment manufacturer.

B. Access Panels

Install access panels for concealed valves, vents, controls, dampers, and items requiring inspection or maintenance of sufficient size, and locate them so that the concealed items are easily serviced and maintained or completely removed and replaced. Provide access panels as specified in Section 05 50 13 MISCELLANEOUS METAL FABRICATIONS.

C. Metal Ductwork

Install according to SMACNA 1966 unless otherwise indicated. Install duct supports for sheet metal ductwork according to SMACNA 1966, unless otherwise specified. Do not use friction beam clamps indicated in SMACNA 1966. Anchor risers on high velocity ducts in the center of the vertical run to allow ends of riser to move due to thermal expansion. Erect supports on the risers that allow free vertical movement of the duct. Attach supports only to structural framing members and concrete slabs. Do not anchor supports to metal decking unless a means is provided and approved for preventing the anchor from puncturing the metal decking. Where supports are required between structural framing members, provide suitable intermediate metal framing. Where C-clamps are used, provide retainer clips.

D. Dust Control

To prevent the accumulation of dust, debris and foreign material during construction, perform temporary dust control protection. Protect the distribution system (supply and return) with temporary seal-offs at all inlets and outlets at the end of each day's work. Keep temporary protection in place until system is ready for startup.

E. Insulation

Provide thickness and application of insulation materials for ductwork, piping, and equipment according to Section 23 07 00 THERMAL INSULATION FOR MECHANICAL SYSTEMS. Externally insulate outdoor air intake ducts and plenums up to the point where the outdoor air reaches the conditioning unit or up to the point where the outdoor air mixes with the outside air stream.

F. Duct Test Holes

Provide holes with closures or threaded holes with plugs in ducts and plenums as indicated or where necessary for the use of pitot tube in balancing the air system. Plug insulated duct at the duct surface, patched over with insulation and then marked to indicate location of test hole if needed for future use.

3.3 CUTTING AND PATCHING

Install work in such a manner and at such time that a minimum of cutting and patching of the building structure is required. Make holes in exposed locations, in or through existing floors, by drilling and smooth by sanding. Use of a jackhammer is permitted only where specifically approved. Make holes through masonry walls to accommodate sleeves with an iron pipe masonry core saw.

3.4 CLEANING

Thoroughly clean surfaces of piping and equipment that have become covered with dirt, plaster, or other material during handling and construction before such surfaces are prepared for final finish painting or are enclosed within the building structure. Before final acceptance, clean mechanical equipment, including piping, ducting, and fixtures, and free from dirt, grease, and finger marks. When the work area is in an occupied space such as office, laboratory or warehouse, protect all furniture and equipment from dirt and debris. Incorporate housekeeping

for field construction work which leaves all furniture and equipment in the affected area free of construction generated dust and debris; and, all floor surfaces vacuum-swept clean.

3.5 PENETRATIONS

Provide sleeves and prepared openings for duct mains, branches, and other penetrating items, and install during the construction of the surface to be penetrated. Cut sleeves flush with each surface. Place sleeves for round duct 15 inches and smaller. Build framed, prepared openings for round duct larger than 15 inches and square, rectangular or oval ducts. Sleeves and framed openings are also required where grilles, registers, and diffusers are installed at the openings. Provide one inch clearance between penetrating and penetrated surfaces except at grilles, registers, and diffusers. Pack spaces between sleeve or opening and duct or duct insulation with mineral fiber conforming with ASTM C 553, Type 1, Class B-2.

a. Sleeves: Fabricate sleeves, except as otherwise specified or indicated, from 20 gauge thick mill galvanized sheet metal. Where sleeves are installed in bearing walls or partitions, provide black steel pipe conforming with ASTM A 53/A 53M, Schedule 20.

b. Framed Prepared Openings: Fabricate framed prepared openings from 20 gauge galvanized steel, unless otherwise indicated.

c. Insulation: Provide duct insulation in accordance with Section 23 07 00 THERMAL INSULATION FOR MECHANICAL SYSTEMS continuous through sleeves and prepared openings except firewall penetrations. Terminate duct insulation at fire dampers and flexible connections. For duct handling air at or below 60 degrees F, provide insulation continuous over the damper collar and retaining angle of fire dampers, which are exposed to unconditioned air.

d. Closure Collars: Provide closure collars of a minimum 4 inches wide, unless otherwise indicated, for exposed ducts and items on each side of penetrated surface, except where equipment is installed. Install collar tight against the surface and fit snugly around the duct or insulation. Grind sharp edges smooth to prevent damage to penetrating surface. Fabricate collars for round ducts 15 inches in diameter or less from 20 gauge galvanized steel. Fabricate collars for square and rectangular ducts, or round ducts with minimum dimension over 15 inches from 18 gauge galvanized steel. Fabricate collars for square and rectangular ducts with a maximum side of 15 inches or less from 20 gauge galvanized steel. Install collars with fasteners a maximum of 6 inches on center. Attach to collars a minimum of 4 fasteners where the opening is 12 inches in diameter or less, and a minimum of 8 fasteners where the opening is 20 inches in diameter or less.

e. Firestopping: Where ducts pass through fire-rated walls, fire partitions, and fire rated chase walls, seal the penetration with fire stopping materials.

3.6 FIELD PAINTING OF MECHANICAL EQUIPMENT

Clean, pretreat, prime and paint metal surfaces; except aluminum surfaces need not be painted. Apply coatings to clean dry surfaces. Clean the surfaces to remove dust, dirt, rust, oil and grease by wire brushing and solvent degreasing prior to application of paint, except clean to bare metal on metal surfaces subject to temperatures in excess of 120 degrees F. Where more than one coat of paint is specified, apply the second coat after the preceding coat is thoroughly dry. Lightly sand damaged painting and retouch before applying the succeeding coat. Provide aluminum or light gray finish coat.

a. Temperatures less than 120 degrees F: Immediately after cleaning, apply one coat of pretreatment primer applied to a minimum dry film thickness of 0.3 mil, one coat of primer applied to a minimum dry film thickness of one mil; and two coats of enamel applied to a minimum dry film thickness of one mil per coat to metal surfaces subject to temperatures less than 120 degrees F.

b. Temperatures between 120 and 400 degrees F: Apply two coats of 400 degrees F heat-resisting enamel applied to a total minimum thickness of two mils to metal surfaces subject to temperatures between 120 and 400 degrees F.

3.8 TESTING, ADJUSTING, AND BALANCING

The requirements for testing, adjusting, and balancing are specified in Section 23 05 93 TESTING, ADJUSTING AND BALANCING FOR HVAC. Begin testing, adjusting, and balancing only when the air supply and distribution, including controls, has been completed, with the exception of performance tests.

3.9 PERFORMANCE TESTS

After testing, adjusting, and balancing is complete as specified, test each system as a whole to see that all items perform as integral parts of the system and temperatures and conditions are evenly controlled throughout the building. Record the testing during the applicable season. Make corrections and adjustments as necessary to produce the conditions indicated or specified. Conduct capacity tests and general operating tests by an experienced engineer. Provide tests that cover a period of not less than 7 days for each system and demonstrate that the entire system is functioning according to the specifications. Make coincidental chart recordings at points indicated on the drawings for the duration of the time period and record the temperature at space thermostats or space sensors, the humidity at space humidistats or space sensors and the ambient temperature and humidity in a shaded and weather protected area.

Submit test reports for the [ductwork leak test, and] performance tests in booklet form, upon completion of testing. Document phases of tests performed including initial test summary, repairs/adjustments made, and final test results in the reports.

3.10 CLEANING AND ADJUSTING

Thoroughly clean ducts, plenums, and casing of debris and blow free of small particles of rubbish and dust and then vacuum clean before installing outlet faces. Wipe equipment clean, with no traces of oil, dust, dirt, or paint spots. Provide temporary filters prior to startup of all fans that are operated during construction, and install new filters after all construction dirt has been removed from the building, and the ducts, plenums, casings, and other items specified have been vacuum cleaned. Maintain system in this clean condition until final acceptance. Properly lubricate bearings with oil or grease as recommended by the manufacturer. Tighten belts to proper tension. Adjust modulating automatic control valves and other miscellaneous equipment requiring adjustment to setting indicated or directed. Adjust fans to the speed indicated by the manufacturer to meet specified conditions. Maintain all equipment installed under the contract until close out documentation is received, the project is completed and the building has been documented as beneficially occupied.

3.11 OPERATION AND MAINTENANCE

A. Operation and Maintenance Manuals

Submit three manuals at least 2 weeks prior to field training. Submit data complying with the requirements specified in Section 01 78 23 OPERATION AND MAINTENANCE DATA.

B. Operation and Maintenance Training

Conduct a training course for the members of the operating staff as designated by the Architect. Make the training period consist of a total of 16 hours of normal working time and start it after all work specified herein is functionally completed and the Performance Tests have been approved. Conduct field instruction that covers all of the items contained in the Operation and Maintenance Manuals as well as demonstrations of routine maintenance operations. Submit the proposed On-site Training schedule concurrently with the Operation and Maintenance Manuals and at least 14 days prior to conducting the training course.

END SECTION 23 00 00

SECTION 23 01 30
HVAC REFURBISHING AND CLEANING

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS (ASHRAE)

ASHRAE 62.1	(2010; Errata 2011; INT 3 2012; INT 4 2012; INT 5 2013) Ventilation for Acceptable Indoor Air Quality

NORTH AMERICAN INSULATION MANUFACTURERS ASSOCIATION (NAIMA)

NAIMA AH112	(1993) Cleaning Fibrous Glass or Lined Sheet Metal Ducts
NAIMA AH122	(2006) Cleaning Fibrous Insulated Duct Systems - Recommended Practices
NAIMA AH127	(1999) Impact of Duct Cleaning on Internal Duct Insulation

SHEET METAL AND AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION (SMACNA)

SMACNA 1966	(2005) HVAC Duct Construction Standards Metal and Flexible, 3rd Edition

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1	(2014) Safety and Health Requirements Manual

U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)

EPA 402-C-01-001	(2001) IAQ Building Education and Assessment Tool (I-BEAM)
EPA 402-F-91-102	(1991) Building Air Quality: A Guide for Building Owners and Facility Managers

UNDERWRITERS LABORATORIES (UL)

UL 181	(2013) Factory-Made Air Ducts and Air Connectors
UL 181A	(2013) Standard for Closure Systems for Use with Rigid Air Ducts and Air Connectors
UL 181B	(2013) Standard for Closure Systems for Use with Flexible Air Ducts and Air Connectors

1.2 DEFINITIONS

Perform the services specified here in accordance with the current published standards of the National Air Duct Cleaners Association (ACR and NADCA HVAC Inspection Manual).

1.3 SUBMITTALS

Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

Preconstruction Submittals

Record of Existing Conditions

Coordination Plan

Records of Experience in the Field of HVAC System Cleaning

Product Data

Material Safety Data Sheets (MSDS)

Test Reports

Testing Procedures Summary

Post-Project Report

1.4 QUALITY CONTROL

A. Experience

Submit records of experience in the field of HVAC system cleaning. Bids will only be considered from firms which are regularly engaged in HVAC system maintenance.

B. Equipment, Materials and Labor

Possess and furnish all necessary equipment, materials and labor to adequately perform the specified services and comply with the applicable provisions of NADCA General Specifications for the Cleaning of Commercial HVAC Systems and ASHRAE 62.1.

a. Assure that all employees have received safety equipment training, medical surveillance programs, individual health protection measures, and manufacturer's product and Material Safety Data Sheets (MSDS) as required for the work by the U.S. Occupational Safety and Health Administration, and as described by this specification. For work performed in countries outside of the U.S.A., comply with applicable national safety codes and standards.

b. Maintain a copy of all current MSDS documentation and safety certifications at the site at all times, as well as comply with all other site documentation requirements of applicable OSHA programs and this specification.

c. Submit all Material Safety Data Sheets (MSDS) for all chemical products proposed used in the cleaning process, including all VOC ratings.

C. Licensing

Provide proof of maintaining the proper license(s), if any, as required to do work in the state of Illinois. Comply with all Federal, State and local rules, regulations, and licensing requirements.

D. Health and Safety

1. Safety Standards

Comply with all applicable Federal, State, and local requirements for protecting the safety of the contractors' employees, building occupants, and the environment. In particular, follow all applicable standards of the Occupational Safety and Health Administration (OSHA) when working in accordance with this specification.

2. Occupant Safety

Employ no processes or materials in such a manner that introduce additional hazards into occupied spaces.

3. Disposal of Debris

Dispose of all debris removed from the HVAC System in accordance with applicable Federal, State and local requirements.

1.5 PROJECT/SITE CONDITIONS

A. Mechanical Drawings

Obtain one copy of the following documents:

a. Project drawings and specifications including all addendums

b. Approved construction revisions pertaining to the HVAC system

B. Site Conditions

The HVAC system includes all air handlers of the facility's fresh air distribution and exhaust system for spaces and/or occupied zones. This includes the entire heating, and ventilation system from the points where the air enters the system to the points where the air is discharged from the system. The air handling unit (AHU), the interior surfaces of the AHU, mixing box, coil compartment, fans, fan housing, fan blades, filters, filter housings, and heating coils are all considered part of the scope of work. The HVAC system may also include other components such as dedicated exhaust and ventilation components and make-up air systems.

PART 2 PRODUCTS

Provide all necessary motors, belts, filters, bearings, pulleys, tensioners, and other materials per the manufacturer’s replacement part schedule and district maintenance standards.

2.1 MOTORS

A. Motors

1. Provide motors of the permanent split-capacitor type with built-in thermal overload protection, directly connected to unit fans. Provide motors compatible with a solid-state variable-speed controller having a minimum speed reduction of 50 percent. Provide motors with permanently-lubricated or oilable sleeve-type or combination ball and sleeve-type bearings with vibration isolating mountings suitable for continuous duty

2. Provide electrical wiring, as specified in Division 26. Provide manual and automatic control and protective or signal devices required for the operation specified and control wiring required for controls and devices specified, but not shown. For packaged equipment, include manufacturer provided controllers with the required monitors and timed restart.

3. For single-phase motors, provide high-efficiency type, fractional-horsepower alternating-current motors, including motors that are part of a system, in accordance with NEMA MG 11. Integral size motors shall be the premium efficiency type in accordance with NEMA MG 1.

4. For polyphase motors, provide squirrel-cage medium induction motors, including motors that are part of a system , and that meet the efficiency ratings for premium efficiency motors in accordance with NEMA MG 1. Select premium efficiency polyphase motors in accordance with NEMA MG 10.

5. Provide motors in accordance with NEMA MG 1 and of sufficient size to drive the load at the specified capacity without exceeding the nameplate rating of the motor. Provide motors rated for continuous duty with the enclosure specified. Provide motor duty that allows for maximum frequency start-stop operation and minimum encountered interval between start and stop. Provide motor torque capable of accelerating the connected load within 20 seconds with 80 percent of the rated voltage maintained at motor terminals during one starting period. Provide motor starters complete with thermal overload protection and other necessary appurtenances. Fit motor bearings with grease supply fittings and grease relief to outside of the enclosure.

6. Provide variable frequency drives for motors as specified in Section 23 99 00 VARIABLE FREQUENCY MOTOR CONTROLLER.

PART 3 EXECUTION

Perform the services specified here in accordance with the current published standards of the National Air Duct Cleaners Association (ACR and NADCA HVAC Inspection Manual), established industry standards, and manufacturer's instructions.

a. All terms in this specification have their meaning defined as stated in the NADCA Standards.

b. Follow NADCA Standards with no modifications or deviations being allowed. Remove visible surface contaminants and deposits from within the HVAC system in strict accordance with these specifications.

3.1 PREPARATION

A. HVAC System Inspections

1. HVAC System Evaluation

Prior to the commencement of any work, perform a visual inspection and checkout of the HVAC system in the presence of the owner's representative to determine the appropriate methods, tools, and equipment required to satisfactorily complete this project.

Document damaged system components found during the inspection and submit to the owner, clearly labeled "Record of Existing Conditions."

3.2 APPLICATION

A. General HVAC System Cleaning Requirements

1. Containment

Collect debris removed during cleaning and take precautions to ensure that debris is not otherwise dispersed outside the HVAC system during the cleaning process.

2. Particulate Collection

Where the Particulate Collection Equipment (PCE) is exhausting inside the building, use HEPA filtration with 99.97 percent collection efficiency for 0.3-micron size (or greater). When the PCE is exhausting outside the building, undertake mechanical cleaning operations only with PCE, including adequate filtration to contain debris removed from the HVAC system. When the PCE is exhausting outside the building, take precautions to locate the equipment down wind and away from all air intakes and other points of entry into the building.

3. Controlling Odors

Take all reasonable measures to control offensive odors and/or mist vapors during the cleaning process.

4. Component Cleaning

Employ cleaning methods such that all HVAC system components are Visibly Clean as defined in applicable standards. Upon completion, return all components to those settings recorded just prior to cleaning operations.

5. Air-Volume Control Devices

Mark the position of dampers and any air-directional mechanical devices inside the HVAC system prior to cleaning and, upon completion, restore to their marked position.

6. Service Openings

Utilize service openings, as required for proper cleaning, at various points of the HVAC system for physical and mechanical entry, and inspection. Utilize the existing service openings already installed in the HVAC system where possible.

Create other openings where needed, created and resealed in conformance with NADCA Standard 05. Place closures so they do not significantly hinder, restrict, alter the air-flow within the system, or compromise the structural integrity of the system. Properly insulate closures to prevent heat loss/gain or condensation on surfaces within the system. Conform construction techniques used in the creation of openings to requirements of applicable building and fire codes, and applicable NFPA, SMACNA and

NADCA Standards. Cutting service openings into flexible duct is not permitted. Disconnect flexible duct at the ends as needed for proper cleaning and inspection.

Reseal rigid fiber glass ductboard duct systems in accordance with NAIMA recommended practices; NAIMA AH112, NAIMA AH122, and NAIMA AH127. Only closure techniques which comply with UL 181, UL 181A, or UL 181B are suitable for fiber glass duct system closures.

Clearly mark all service openings, capable of being re-opened for future inspection or remediation, and report their location in project report documents.

7. Air Handling Units

Ensure that supply, return, and exhaust fans and blowers are thoroughly cleaned. Areas for cleaning include blowers, fan housings, plenums (except ceiling supply and return plenums), scrolls, blades, or vanes, shafts, baffles, dampers and drive assemblies. Remove all visible surface contamination deposits in accordance with NADCA Standards.

a. Clean all air handling unit (AHU) internal surfaces, components and condensate collectors and drains.

b. Assure that a suitable operative drainage system is in place prior to beginning wash down procedures.

c. Clean all coils and related components, including evaporator fins.

B. Mechanical Cleaning Methodology

1. Source Removal Cleaning Methods

Clean the HVAC system using Source Removal mechanical cleaning methods designed to extract contaminants from within the HVAC system and safely remove contaminants from the facility. Select Source Removal methods which will render the HVAC System Visibly Clean and capable of passing NADCA cleaning verification methods Standards and other specified standards and tests, in accordance with all general requirements. Use no cleaning method, or combination of methods, which could potentially damage components of the HVAC system or negatively alter the integrity of the system.

Completely remove any visible corrosion from metal surfaces, prime and paint to match existing. Clean, pretreat, prime and paint metal surfaces; except aluminum surfaces need not be painted. Apply coatings to clean dry surfaces. Clean the surfaces to remove dust, dirt, rust, oil and grease by wire brushing and solvent degreasing prior to application of paint, except clean to bare metal on metal surfaces subject to temperatures in excess of 120 degrees F. Apply the second coat after the preceding coat is thoroughly dry. Lightly sand damaged painting and retouch before applying the succeeding coat. Match existing or provide aluminum or light gray finish coat.

Incorporate the use of vacuum collection devices that are operated continuously during cleaning for all methods used. Connect a vacuum device to the downstream end of the section being cleaned through a predetermined opening. Use a vacuum collection device of sufficient power to render all areas being cleaned under negative pressure, such that containment of debris and the protection of the indoor environment is assured.

Equip all vacuum devices exhausting air inside the building, including hand-held vacuums and wet-vacuums, with HEPA filters (minimum efficiency).

Equip all vacuum devices exhausting air outside the facility with Particulate Collection including adequate filtration to contain Debris removed from the HVAC system, in a manner that does not allow contaminants to re-enter the facility. Release of debris outdoors which violates any outdoor environmental standards, codes or regulations is not allowed.

All methods require mechanical agitation devices to dislodge debris adhered to interior HVAC system surfaces, such that debris may be safely conveyed to vacuum collection devices. Acceptable methods include those which will not potentially damage the integrity of the ductwork, nor damage porous surface materials such as liners inside the ductwork or system components.

2. Cleaning of Coils

Use any cleaning method which renders the coil visibly clean and capable of passing NADCA Coil Cleaning Verification Standards. Coil drain pans are subject to Non-Porous Surfaces Cleaning Verification. Maintain operability of the drain for the condensate at all times. Do not damage, displace, inhibit heat transfer, or cause erosion of the coil surface or fins, and conform to coil manufacturer recommendations when available. Thoroughly rinse coils with clean water to remove any latent residues.

3. Antimicrobial Agents and Coatings

Only apply antimicrobial agents if active fungal growth is reasonably suspected, or where unacceptable levels of fungal contamination have been verified through testing.

Perform application of any antimicrobial agents used to control the growth of fungal or bacteriological contaminants after the removal of surface deposits and debris.

Use only antimicrobial agents registered by the U.S. Environmental Protection Agency (EPA 402-F-91-102)(EPA 402-C-01-001) specifically for use within HVAC system.

Apply antimicrobial agents in strict accordance with manufacturer's instructions.

Use only antimicrobial coating products, for both porous and non-porous surfaces,which are EPA registered, water soluble solutions with supporting efficacy data and MSDS records.

3.3 MAINTENANCE

A. General AHU System Maintenance Requirements

1. HVAC System Evaluation

Prior to the commencement of any work, perform a complete operational checkout of the AHU in the presence of the owner’s representative to determine the appropriate methods, tools, and equipment required to satisfactorily complete this project. Contractor to include all necessary parts and labor for refurbishing the existing air handlers.

B. Belts, Pulleys, and Tensioners

1. Contractor to determine the number of belts (if belt driven), belt Lengths- measured at the pitch line (if belt driven), diameter of the drive sheave at the drive pitch line (if belt driven), and diameter of the driven sheave at the drive pitch line (if belt driven).

2. Replace all belts, pulleys and tensioners with new components. Tighten belts to proper tension. Ensure all components are properly aligned; adjust as needed.

3. Test V-belts and sheaves for proper alignment and tension prior to operation and after 72 hours of operation at final speed. Uniformly load belts on drive side to prevent bouncing. Make alignment of direct driven couplings to within 50 percent of manufacturer's maximum allowable range of misalignment.

C. Filters

1. Contractor to determine the number of number and size of all filters; provide and replace per the district standards.

D. Bearings

1. Contractor to determine the number of number and size of shaft bearings; provide and replace per the district standards. Provide self-lubricating bearings (sealed-cassette ball bearing cartridges preloaded with grease) where possible.

E. Lubrication

1. Provide lubrication for all movable parts and related operating hardware in accordance with manufacturer's printed instructions and industry standard practice so that all parts operate smoothly and quietly without binding.

E. Motors and VFDs

1. Replace existing motors with horsepower and capacity equal to existing. Replace or add new Variable Frequency Drive Motor Controllers. Provide stainless steel mounting hardware for all components. See schedule on plans and Section 23 99 00.

3.4 FIELD QUALITY CONTROL

A. Cleanliness Verification

1. General

Verification of HVAC System cleanliness is determined after mechanical cleaning and before the application of any treatment or introduction of any treatment-related substance to the HVAC system, including antimicrobial agents and coatings.

After completion, test each air handler to demonstrate proper operation at indicated and specified performance requirements including running, balance, noise, and airflow.

2. Visual Inspection

Visually inspect the HVAC system to ensure that no visible contaminants are present.

If no contaminants are evident through visual inspection, consider the HVAC system clean; however, further verification of the system cleanliness through gravimetric or wipe testing analysis testing may be requested at the discretion of the Contracting Officer.

If visible contaminants are evident through visual inspection, re-clean those portions of the system where contaminants are visible, and subject to re-inspection for cleanliness.

3. Verification of Coil Cleaning

Cleaning is to restore the coil pressure drop to within 10 percent of the pressure drop measured prior to cleaning and maintenance performed under this scope. If the original pressure drop is not known, the coil will be considered clean only if the coil is free of foreign matter and chemical residue, based on a thorough visual inspection (see NADCA HVAC Inspection Manual Standards).

B. Post-Project Report

At the conclusion of the project, provide a Testing Procedures Summary and Post-Project Report indicating the following:

a. Success of the cleaning project, as verified through visual inspection; provide photographs in the report documenting work.

b. Areas of the system found to be damaged and the completed repairs for these components.

END SECTION 23 01 30

SECTION 23 05 29
HANGERS AND SUPPORTS FOR MECHANICAL

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. This Section includes the following hangers and supports for HVAC system piping and equipment:

1. Steel pipe hangers and supports.
2. Trapeze pipe hangers.
3. Metal framing systems.
4. Thermal-hanger shield inserts.
5. Fastener systems.
6. Pipe stands.
7. Equipment supports.

B. Related Sections include the following:

1. Division 05 Section "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.
2. Division 23 Section "Steam System Piping" for pipe guides and anchors.
3. Division 23 Section "Vibration Controls for HVAC Piping and Equipment" for vibration isolation devices.
4. Division 23 Section "Thermal Insulation for Mechanical Systems"

1.3 DEFINITIONS

A. MSS: Manufacturers Standardization Society for The Valve and Fittings Industry Inc.

B. Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."

1.4 PERFORMANCE REQUIREMENTS

A. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.

B. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

1.5 SUBMITTALS

A. Product Data: For the following:

1. Steel pipe hangers and supports.
2. Thermal-hanger shield inserts.
3. Powder-actuated fastener systems.

B. Shop Drawings: Show fabrication and installation details and include calculations for the following:

1. Trapeze pipe hangers. Include Product Data for components.
2. Metal framing systems. Include Product Data for components.
3. Pipe stands. Include Product Data for components.
4. Equipment supports.

1.6 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to the following:

1. AWS D1.1, "Structural Welding Code--Steel."
2. AWS D1.3, "Structural Welding Code--Sheet Steel."
3. AWS D1.4, "Structural Welding Code--Reinforcing Steel."
4. ASME Boiler and Pressure Vessel Code: Section IX.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

2.2 STEEL PIPE HANGERS AND SUPPORTS

A. Description: MSS SP-58, Types 1 through 58, factory-fabricated components. Refer to Part 3 "Hanger and Support Applications" Article for where to use specific hanger and support types.

B. Available Manufacturers:

1. AAA Technology & Specialties Co., Inc.
2. Anvil International
3. Bergen-Power Pipe Supports.
4. B-Line Systems, Inc.; a division of Cooper Industries.
5. Carpenter & Paterson, Inc.
6. Empire Industries, Inc.
7. ERICO/Michigan Hanger Co.
8. Globe Pipe Hanger Products, Inc.
9. Grinnell Corp.
10. GS Metals Corp.
11. National Pipe Hanger Corporation.
12. PHD Manufacturing, Inc.
13. PHS Industries, Inc.
14. Piping Technology & Products, Inc.
15. Tolco Inc.

C. Galvanized, Metallic Coatings: Pregalvanized or hot dipped.

D. Nonmetallic Coatings: Plastic coating, jacket, or liner.

E. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion for support of bearing surface of piping.

2.3 TRAPEZE PIPE HANGERS

A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural-steel shapes with MSS SP-58 hanger rods, nuts, saddles, and U-bolts.

2.4 METAL FRAMING SYSTEMS

A. Description: MFMA-3, shop- or field-fabricated pipe-support assembly made of steel channels and other components.

B. Available Manufacturers:

1. B-Line Systems, Inc.; a division of Cooper Industries.
2. ERICO/Michigan Hanger Co.; ERISTRUT Div.

3. GS Metals Corp.
4. Power-Strut Div.; Tyco International, Ltd.
5. Thomas & Betts Corporation.
6. Tolco Inc.
7. Unistrut Corp.; Tyco International, Ltd.

C. Coatings: Manufacturer's standard finish, unless bare metal surfaces are indicated.

D. Nonmetallic Coatings: Plastic coating, jacket, or liner.

2.5 THERMAL-HANGER SHIELD INSERTS

A. Description: 100-psig- minimum, compressive-strength insulation insert encased in sheet metal shield.

B. Available Manufacturers:

1. Carpenter & Paterson, Inc.
2. ERICO/Michigan Hanger Co.
3. PHS Industries, Inc.
4. Pipe Shields, Inc.
5. Rilco Manufacturing Company, Inc.
6. Value Engineered Products, Inc.

C. Insulation-Insert Material for Cold Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate or ASTM C 552, Type II cellular glass with vapor barrier.

D. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate or ASTM C 552, Type II cellular glass.

E. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

F. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

G. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.6 FASTENER SYSTEMS

A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used. Available Manufacturers:

1. Hilti, Inc.
2. ITW Ramset/Red Head.
3. Masterset Fastening Systems, Inc.
4. MKT Fastening, LLC.

5. Powers Fasteners.

B. Mechanical-Expansion Anchors: Insert-wedge-type zinc-coated steel, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
Available Manufacturers:

1. B-Line Systems, Inc.; a division of Cooper Industries.
2. Empire Industries, Inc.
3. Hilti, Inc.
4. ITW Ramset/Red Head.
5. MKT Fastening, LLC.
6. Powers Fasteners.

2.7 PIPE STAND FABRICATION

A. Pipe Stands, General: Shop or field-fabricated assemblies made of manufactured corrosion-resistant components to support roof-mounted piping.

2.8 EQUIPMENT SUPPORTS

A. A. Description: Welded, shop- or field-fabricated equipment support made from structural steel shapes.

2.9 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.

1. Properties: Nonstaining, noncorrosive, and nongaseous.
2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 EXECUTION

3.1 HANGER AND SUPPORT APPLICATIONS

A. Specific hanger and support requirements are specified in Sections specifying piping systems and equipment.

B. Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized, metallic coatings for piping and equipment that will not have field-applied finish.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use padded hangers for copper piping or other piping that is subject to scratching.

F. Hangers and supports for piping connected in conjunction with rotating or reciprocating equipment shall be spring hangers and supports for a distance of 100-pipe diameters, or a distance of three hangers away from rotating or reciprocating equipment whichever is greater. Isolators shall be as specified under Section 230548 – Vibration and Seismic Controls for HVAC Piping and Equipment.

G. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated stationary pipes, NPS 1/2 to NPS 30.
2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of 120 to 450 deg F pipes, NPS 4 to NPS 16, requiring up to 4 inches of insulation.
3. U-Bolts (MSS Type 24): For support of heavy pipes, NPS 1/2 to NPS 30.
4. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
5. Pipe Saddle Supports (MSS Type 36): For support of pipes, NPS 4 to NPS 36, with steel pipe base stanchion support and cast-iron floor flange.
6. Pipe Stanchion Saddles (MSS Type 37): For support of pipes, NPS 4 to NPS 36, with steel pipe base stanchion support and cast-iron floor flange and with U-bolt to retain pipe.
7. Adjustable, Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes, NPS 2-1/2 to NPS 36, if vertical adjustment is required, with steel pipe base stanchion support and cast-iron floor flange.
8. Single Pipe Rolls (MSS Type 41): For suspension of pipes, NPS 1 to NPS 30, from 2 rods if longitudinal movement caused by expansion and contraction might occur.
9. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes, NPS 2-1/2 to NPS 20, from single rod if horizontal movement caused by expansion and contraction might occur.

10. Complete Pipe Rolls (MSS Type 44): For support of pipes, NPS 2 to NPS 42, if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.
11. Pipe Roll and Plate Units (MSS Type 45): For support of pipes, NPS 2 to NPS 24, if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is not necessary.

H. Vertical-Piping Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers, NPS 3/4 to NPS 20.
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers, NPS 3/4 to NPS 20, if longer ends are required for riser clamps.
3. Piping larger than 4", of lengths exceeding 30 feet, shall be additionally supported on base elbows secured to the building structure, with flexible supporting hangers, provided at top of riser to allow for pipe expansion.

I. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
3. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
4. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.

J. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with barjoistconstruction to attach to top flange of structural shape.
3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
6. C-Clamps (MSS Type 23): For structural shapes.
7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.

10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
11. Malleable Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
12. Welded-Steel Brackets: For support of pipes from below, or for suspending from above by using clip and rod. Use one of the following for indicated loads:
    a. Light (MSS Type 31): 750 lb.
    b. Medium (MSS Type 32): 1500 lb.
    c. Heavy (MSS Type 33): 3000 lb.
13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.

K. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
    1. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
    2. Thermal-Hanger Shield Inserts: For supporting insulated pipe.

L. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
    1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
    2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
    3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41 roll hanger with springs.
    4. Variable-Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from hanger.
    5. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from base support.. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
    6. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from trapeze support.

M. Comply with MSS SP-69 for trapeze pipe hanger selections and applications that are not specified in piping system Sections.

N. Comply with MFMA-102 for metal framing system selections and applications that are not specified in piping system Sections.

O. Use mechanical-expansion anchors instead of building attachments where required in concrete construction.

3.2 HANGER AND SUPPORT INSTALLATION

A. Steel Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.

B. Trapeze Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping and support together on field-fabricated trapeze pipe hangers.

1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified above for individual pipe hangers.

2. Field fabricate from ASTM A 36/A 36M, steel shapes selected for loads being supported. Weld steel according to AWS D1.1.

C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled metal framing systems.

D. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

E. Fastener System Installation:

1. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

F. Pipe Stand Installation:

2. Pipe Stand Types except Curb-Mounting Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.

3. Curb-Mounting-Type Pipe Stands: Assemble components or fabricate pipe stand and mount on permanent, stationary roof curb. Refer to Division 07 Section "Roof Accessories" for curbs.

G. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.

H. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

I. Support apparatus and material for all conditions of operation, including variations in installed and operating weight of equipment and piping.

J. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

K. Install lateral bracing with pipe hangers and supports to prevent swaying.

L. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments within 1 foot of elbows and at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

M. Load Distribution: Install hangers and supports so piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

N. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.1 (for power piping) and ASME B31.9 (for building services piping) are not exceeded.

O. Insulated Piping: Comply with the following:

1. Attach clamps and spacers to piping.

   a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.

   b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.

   c. Do not exceed pipe stress limits according to ASME B31.1 for power piping and ASME B31.9 for building services piping.

2. Install MSS SP-58, Type 40 thermal-hanger protective shields if insulation without vapor barrier is indicated. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

4. Shield Dimensions for Pipe: Not less than the following:

   a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.

   b. NPS 4: 12 inches long and 0.06 inch thick.

   c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.

   d. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.

   e. NPS 16 to NPS 24: 24 inches long and 0.105 inch thick.

5. Insert Material: Length at least as long as protective shield.
6. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.3 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.

B. Grouting: Place grout under supports for equipment and make smooth bearing surface.

C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.4 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1 procedures for shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work, and with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. Finish welds at exposed connections so no roughness shows after finishing and contours of welded surfaces match adjacent contours.

3.5 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to 1 inch.

3.6 PAINTING

A. Touch Up: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.

B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END SECTION 23 05 29

SECTION 23 05 48
VIBRATION CONTROLS FOR HVAC PIPING AND EQUIPMENT

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ACOUSTICAL SOCIETY OF AMERICA (ASA)

ASA S2.40	(1984; R 2001) Mechanical Vibration of Rotating and Reciprocating Machinery - Requirements for Instruments for Measuring Vibration Severity
ASA S2.71	(1983; R 2006) Guide to the Evaluation of Human Exposure to Vibration in Buildings

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS (ASHRAE)

ASHRAE HVAC APP IP HDBK	(2007; Errata 2010) HVAC Applications Handbook, I-P Edition

NATIONAL ENVIRONMENTAL BALANCING BUREAU (NEBB)

NEBB PROCEDURAL STANDARDS	(2005) Procedural Standards for Testing, Adjusting and Balancing (TAB) of Environmental Systems

1.2 GENERAL REQUIREMENTS

All vibration-control apparatus must be the product of a single manufacturing source, where possible. Human exposure levels should be considered using ASA S2.71 and NEBB PROCEDURAL STANDARDS.

Scheduled isolation mounting is in inches and is a minimum static deflection.

Spans referred to in Part 2, "Vibration-Isolation Systems Application," must mean longest bay dimension.

Determine exact mounting sizes and number of isolators by the isolator manufacturer based on equipment that will be installed. Check equipment revolutions per minute (rpm) and spring deflections to verify that resonance cannot occur.

Five working days prior to commencement of installation, submit installation drawings for vibration isolator systems including equipment and performance requirements.

Indicate within outline drawings for vibration isolator systems, overall physical features, dimensions, ratings, service requirements, and weights of equipment.

Within 14 working days of Contract Award, submit equipment and performance data for vibration isolator systems including equipment base design; inertia-block mass relative to support equipment weight; spring loads and free, operating, and solid heights of spring; spring diameters; nonmetallic isolator loading and deflection; disturbing frequency; natural frequency of mounts; deflection of working member; and anticipated amount of physical movement at the reference points.

Ensure data includes the following:

a. Mountings

b. Bases

c. Isolators

d. Floor-Mounted Piping

e. Vertical Piping

1.3 SUBMITTALS

Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

As-Built Drawings

Installation Drawings
Outline Drawings

Product Data

Equipment and Performance Data
Isolators

PART 2 PRODUCTS

2.1 TYPE OF VIBRATION-ISOLATION PROVISIONS

Design for vibration isolation using ASHRAE HVAC APP IP HDBK, Chapter 37, as applicable to the following sections.

Submit test reports for testing vibration isolation for each type of isolator and each type of base, and meet referenced standards contained within this section. Include in test reports allowable deflection and measured deflection also meeting referenced standards within this section.

2.1.1 Materials

Rubber must be natural rubber. Elastomer must be chloroprene. Shore A durometer measurement of both materials and range between 40 and 60.

Inorganic materials such as precompressed, high-density, fibrous glass encased in a resilient moisture-impervious membrane may be used in lieu of specified natural rubber and elastomers. Where this substitution is made, ensure specified deflections are modified by the manufacturing source to accommodate physical characteristics of inorganic materials and to provide equal or better vibration isolation.

Ensure weather-exposed metal vibration-isolator parts are corrosion protected. Chloroprene coat springs.

2.1.2 Mountings

Provide the following mountings:

Type A: Composite pad, with 0.25-inch thick elastomer top and bottom layers, molded to contain a pattern with nonslip characteristics in all horizontal directions. Elastomer loading must not exceed 40 pounds per square inch (psi). Minimum overall thickness must be 1 inch. Maximum deflections up to 0.25-inch are allowed.

2.1.3 Bases

Provide the following bases:

Type U: Unit isolators without rails, structural-steel bases, or inertia blocks.

Type CIB: Concrete inertia blocks must be common to the entire assembly, and have welded-joint construction, mill-rolled structural-steel perimeters, welded-in No. 4 reinforcing bars 8 inches on center each way near the bottom of the block, outrigger-isolator mounting provisions, anchor bolts, and be filled with 3,000 psi cured-strength concrete.

Configuration of inertia bases must be rectangular to accommodate equipment supported.

> Minimum thickness of inertia base, in addition to providing suitable mass, must be sufficient to provide stiffness to maintain equipment manufacturer's recommended alignment and duty efficiency of power-transmission components. Minimum thickness must be sufficient to result in base deflection at midpoint of unsupported span of not more than 1/1,440th of the span between isolators. Minimum thickness, the preceding requirements not withstanding, must be 8 percent of the longest base dimension.

Pumps with flexible couplings must not have inertia bases less than 8 inches thick.

Minimum mass of concrete inertia block must be equal in weight to supported equipment.

2.2 VIBRATION-ISOLATION SYSTEMS APPLICATION

Vibration isolation design per ASHRAE HVAC APP IP HDBK, Chapter 37, and ASA S2.40.

2.3 PIPE AND DUCT VIBRATION ISOLATION

Provide isolators with contained chloroprene-elastomer elements for connecting to building-structure attachments. Load devices by supported system during operating conditions to produce a minimum elastomer static deflection of 3/8 inch.

2.3.1 Floor-Mounted Piping

Provide isolators with floor-supported columns or directly on the floor. Load devices by supported system during operating conditions to produce a minimum spring static deflection of 1 inch.

2.3.2 Vertical Piping

Isolators must be elastomer mounted baseplate and riser pipe-guide devices. Elastomer elements must be contained double acting, and elastomers under rated load must have a minimum static deflection of 3/8 inch. Size isolator to accommodate thermal insulation within the stationary guide ring.

PART 3 EXECUTION

3.1 INSTALLATION

Install equipment in accordance with manufacturer's recommendations.

Rails, structural steel bases, and concrete inertia blocks must be raised not less than 1 inch above the floor and be level when equipment supported is under operating load.

Ensure vibration-isolation installation and deflection testing after equipment start-up is directed by a competent representative of the manufacturer.

3.2 TESTS AND REPORTS

Ensure vibration-isolation devices are deflection tested. Submit test reports in accordance with paragraph entitled, "Submittal Procedures," substantiating that all equipment has been isolated as specified and that minimum specified deflections have been met. Make all measurements in the presence of the Architect.

END SECTION 23 05 48

SECTION 23 05 53
IDENTIFICATION FOR MECHANICAL

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Equipment labels.
2. Warning signs and labels.
3. Pipe labels.
4. Duct labels.
5. Stencils.
6. Valve tags.
7. Warning tags.

1.3 SUBMITTALS

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

B. Samples: For color, letter style, and graphic representation required for each identification material and device.

C. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.

D. Valve numbering scheme.

E. Valve Schedules: For each piping system to include in maintenance manuals.

1.4 COORDINATION

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

B. Coordinate installation of identifying devices with locations of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 PRODUCTS

2.1 EQUIPMENT LABELS

A. Plastic Labels for Equipment:

1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware.
2. Letter Color: White.
3. Background Color: Black.
4. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
5. Minimum Label Size: Length and width vary for required label content, but not less than 1 inch high.
6. Minimum Letter Size: 1/2 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
7. Fasteners: Stainless-steel rivets or self-tapping screws.
8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified.

C. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11inchbond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.2 WARNING SIGNS AND LABELS

A. Material and Thickness: Adhesive backed pressure sensitive stickers. Water resistant laminate.

B. Letter Color: Red.

C. Background Color: White.

D. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

E. Minimum Label Size: Length and width vary for required label content, but not less than 1 inch high.

F. Minimum Letter Size: 1/2 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

G. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

H. Label Content: Include caution and warning information, plus emergency notification instructions.

2.3 PIPE LABELS

A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction or spray on painted stenciling, depending on location. Labels shall meet ASME/ANSI standards. Manufacturers:

1. Kolbi
2. Duralabel
3. Brady

B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to partially cover circumference of pipe and to attach to pipe without fasteners or adhesive.

C. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.

D. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on drawings and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions or as separate unit on each pipe label to indicate flow direction.
2. Lettering Size: At least 1-1/2 inches high. All lettering shall meet ASME/ANSI standards for pipe marking.

2.4 DUCT LABELS

A. Material and Thickness: Adhesive backed pressure sensitive stickers. Water resistant laminate.

B. Letter Color: Red.

C. Background Color: White.

D. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

E. Minimum Label Size: Length and width vary for required label content, but not less than 1 inch high.

F. Minimum Letter Size: 1/2 inch.

G. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

2.5 STENCILS

A. Stencils: Prepared with letter sizes according to ASME A13.1 for piping; minimum letter height of 1-1/4 inches for ducts; and minimum letter height of 3/4 inch for access panel and door labels, equipment labels, pipe labels and similar operational instructions.

1. Stencil Material: Fiberboard or metal.

2. Stencil Paint: Exterior, gloss, acrylic enamel black unless otherwise indicated. Paint may be in pressurized spray-can form.
3. Identification Paint: Exterior, acrylic enamel in colors according to ASME A13.1 unless otherwise indicated.

2.6 VALVE TAGS

A. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers.
   1. Tag Material: Brass, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
   2. Fasteners: Brass wire-link, beaded chain, cable tie; or S-hook.

B. Valve Schedules: For each piping system, on 8-1/2-by-11-inch bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses. Valve-tag schedule shall be included in operation and maintenance data.

2.7 WARNING TAGS

A. Warning Tags: Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with matte finish suitable for writing.
   1. Size: 3 by 5-1/4 inches minimum.
   2. Fasteners: Reinforced grommet and wire or plastic tie-wrap.
   3. Nomenclature: Large-size primary caption such as "DANGER," "CAUTION," or "DO NOT OPERATE."
   4. Color: Yellow background with black lettering.

PART 3 EXECUTION

3.1 PREPARATION

A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

B. Color Coding Scheme for Locating Hidden Utility Components

1. Scheme shall be provided in buildings having suspended grid ceilings. The color coding scheme shall identify points of access for maintenance and operation of operable components which are not visible from the finished space and installed in the space directly above the suspended grid ceiling. The operable components shall include valves, dampers, switches, linkages and thermostats. The color coding scheme shall consist of a color code board and colored metal disks. Each colored metal disk shall be approximately 3/8 inch in diameter and secured to removable ceiling panels with fasteners. The fasteners shall be inserted into the ceiling panels so that the fasteners will be concealed from view. The fasteners shall be manually removable without tools and shall not separate from the ceiling panels when panels are dropped from ceiling height. Installation of colored metal disks shall follow completion of the finished surface on which the disks are to be fastened. The color code board shall have the approximate dimensions of 3 foot width, 30 inches height, and 1/2 inch thickness. The board shall be made of wood fiberboard and framed under glass or 1/16 inch transparent plastic cover. Unless otherwise directed, the color code symbols shall be approximately 3/4 inch in diameter and the related lettering in 1/2 inch high capital letters. The color code board shall be mounted and located in the mechanical or equipment room. The color code system shall be as indicated below:

Color	System	Location
Green	Steam Supply	At all Directions Changes and Valve Locations
Yellow	Condensate Return	At all Directions Changes and Valve Locations

3.2 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of mechanical equipment.

B. Locate equipment labels where accessible and visible.

3.3 PIPE LABEL INSTALLATION

A. Stenciled Pipe Labels: Provide stenciled labels on each piping system for piping systems in concealed vertical chases, above removable finished ceilings and on piping exposed in the upper occupied levels of the building. Exposed visible piping in the upper levels shall into be stenciled in areas only where the stenciling would not be visible.

1. Identification Paint: Use for contrasting background.
2. Stencil Paint: Use for pipe marking.

B. Locate pipe labels on piping where the piping is exposed in mechanical rooms and on exposed main piping in service corridors.

C. Piping identification shall conform to the following:

1. Near each valve and control device.
2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
4. At access doors, manholes, and similar access points that permit view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced at maximum intervals of 20 feet along each run. Reduce intervals to 10 feet in areas of congested piping and equipment.
7. Once per room.
8. Include flow direction arrows, whether stenciled or labeled.

D. Pipe Label Color Schedule:

1. Steam Piping:

a. Background Color: Green.

b. Letter Color: White.

c. Text: LOW PRESSURE STEAM SUPPLY

CONDENSATE RETURN

2. Gas Piping:

a. Background Color: Yellow.

b. Letter Color: Black.

c. Text: NATURAL GAS

3.4 VALVE-TAG INSTALLATION

A. Install tags on valves and control devices in piping systems, except check valves; valves within factory-fabricated equipment units; shutoff valves; faucets; convenience and lawn watering hose connections; and HVAC terminal devices and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.

B. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following subparagraphs:

1. Valve-Tag Size and Shape: 1-1/2 inches, round.
2. Valve-Tag Color: Natural brass finish.
3. Letter Color: Black.
4. Identify valve tags as follows:

   PIPING VALVES

   Domestic Cold Water Supply (DCW) CW-1, CW-2, CW-3, etc.

   Domestic Soft Water (DSW) DSW-1, DSW-2, DSW-3, etc.

   Low Pressure Steam (LPS) LPS-1, LPS-2, LPS-3, etc.

   Condensate Return (CR) CR-1, CR-2, CR-3, etc.

3.5 WARNING-TAG INSTALLATION

A. Write required message on, and attach warning tags to, equipment and other items where required.

3.6 EQUIPMENT FACTORY INSTALLED NAMEPLATES

A. Factory installed nameplates shall be located for easy reading. Relocate or provide new nameplates on motors if they are not located for easy reading.

END SECTION 23 05 53

SECTION 23 05 93
TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ACOUSTICAL SOCIETY OF AMERICA (ASA)

ASA S1.11	(2004; Errata 2005) Specification for Octave- Band and Fractional-Octave-Band Analog and Digital Filters (ASA 65)
ASA S1.4	(1983; Amendment 1985; R 2006) Specification for Sound Level Meters (ASA 47)

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS (ASHRAE)

ASHRAE HVAC APP IP HDBK	(2007; Errata 2010) HVAC Applications Handbook, I-P Edition

ASSOCIATED AIR BALANCE COUNCIL (AABC)

AABC MN-1	(2002; 6th ed) National Standards for Total System Balance
AABC MN-4	(1996) Test and Balance Procedures

NATIONAL ENVIRONMENTAL BALANCING BUREAU (NEBB)

NEBB MASV	(2006) Procedural Standards for Measurements of Sound and Vibration; 2nd Edition
NEBB PROCEDURAL STANDARDS	(2005) Procedural Standards for Testing, Adjusting and Balancing (TAB) of Environmental Systems

SHEET METAL AND AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION (SMACNA)

SMACNA 1143	(1985) HVAC Air Duct Leakage Test Manual, 1st Edition
SMACNA 1780	(2002) HVAC Systems - Testing, Adjusting and Balancing, 3rd Edition

SMACNA 1858	(2004) HVAC Sound And Vibration Manual - First Edition

1.2 DEFINITIONS

a. AABC: Associated Air Balance Council.

b. OTR: Owner's Technical Representative.

c. HVAC: Heating, ventilating, and air conditioning; or heating, ventilating, and cooling.

d. NEBB: National Environmental Balancing Bureau

e. Out-of-tolerance data: Pertains only to field acceptance testing of Final DALT or TAB report. When applied to DALT work, this phase means When applied to TAB work this phase means "a measurement taken during TAB field acceptance testing which does not fall within the range of plus 5 to minus 5 percent of the original measurement reported on the TAB Report for a specific parameter."

f. Season of maximum heating load: The time of year when the outdoor temperature at the project site remains within plus or minus 30 degrees Fahrenheit of the project site's winter outdoor design temperature, throughout the period of TAB data recording.

g. Season of maximum cooling load: The time of year when the outdoor temperature at the project site remains within plus or minus 5 degrees Fahrenheit of the project site's summer outdoor design temperature, throughout the period of TAB data recording.

h. Season 1, Season 2: Depending upon when the project HVAC is completed and ready for TAB, Season 1 is defined, thereby defining Season 2. Season 1 could be the season of maximum heating load, or the season of maximum cooling load.

i. Sound measurements terminology: Defined in AABC MN-1, NEBB MASV, or SMACNA 1858 (TABB).

j. TAB: Testing, adjusting, and balancing (of HVAC systems).

k. TAB'd: HVAC Testing/Adjusting/Balancing procedures performed.

l. TAB Agency: TAB Firm

m. TAB team field leader: TAB team field leader

n. TAB team supervisor: TAB team engineer.

o. TAB team technicians: TAB team assistants.

p. TABB: Testing Adjusting and Balancing Bureau.

1.3 WORK DESCRIPTION

The work includes testing, adjusting, and balancing (TAB) of heating, ventilating, and cooling (HVAC) air and water distribution systems including ducts, and piping which are located within, on, under, between, and adjacent to buildings.

Perform TAB in accordance with the requirements of the TAB procedural standard recommended by the TAB trade association that approved the TAB Firm's qualifications.

Comply with requirements of AABC MN-1, NEBB PROCEDURAL STANDARDS, or SMACNA 1780 (TABB) as supplemented and modified by this specification section. All recommendations and suggested practices contained in the TAB procedural standards are considered mandatory.

Conduct TAB of the systems and equipment and submit the specified TAB reports for approval. Conduct TAB work in accordance with the requirements of this section.

1.3.1 Air Distribution Systems

Test, adjust, and balance systems (TAB) in compliance with this section. Obtain Owner's written approval before applying insulation to exterior of air distribution systems as specified under Section 23 07 00 THERMAL INSULATION FOR MECHANICAL SYSTEMS.

1.4 QUALITY ASSURANCE

1.4.1 Independent TAB Agency and Personnel Qualifications

To secure approval for the proposed agency, submit information certifying that the TAB agency is a first tier subcontractor who is not affiliated with any other company participating in work on this contract, including design, furnishing equipment, or construction. Further, submit the following, for the agency, to Architect for approval:

a. Independent AABC or NEBB or TABB TAB agency:

TAB agency: AABC registration number and expiration date of current certification; or NEBB certification number and expiration date of current certification; or TABB certification number and expiration date of current certification.

TAB team supervisor: Name and copy of AABC or NEBB or TABB TAB supervisor certificate and expiration date of current certification.

TAB team field leader: Name and documented evidence that the team field leader has satisfactorily performed full-time supervision of TAB work in the field for not less than 3 years immediately preceding this contract's bid opening date.

TAB team field technicians: Names and documented evidence that each field technician has satisfactorily assisted a TAB team field leader in performance of TAB work in the field for not less than one year immediately preceding this contract's bid opening date.

Current certificates: Registrations and certifications are current, and valid for the duration of this contract. Renew Certifications which expire prior to completion of the TAB work, in a timely manner so that there is no lapse in registration or certification. TAB agency or TAB team personnel without a current registration or current certification are not to perform TAB work on this contract.

b. TAB Team Members: TAB team approved to accomplish work on this contract are full-time employees of the TAB agency. No other personnel is allowed to do TAB work on this contract.

c. Replacement of TAB team members: Replacement of members may occur if each new member complies with the applicable personnel qualifications and each is approved by the Owner.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.1 WORK DESCRIPTIONS OF PARTICIPANTS

Comply with requirements of this section.

3.2 PRE-DALT/TAB MEETING

Meet with the Owner's Technical Representative (OTR) and the designing engineer of the HVAC systems to develop a mutual understanding relative to the details of the TAB work requirements. Ensure that the TAB supervisor is present at this meeting. Requirements to be discussed include required submittals, work schedule, and field quality control.

3.3 TAB PROCEDURES

3.3.1 TAB Field Work

Test, adjust, and balance the HVAC systems until measured flow rates (air and water flow) are within plus or minus 5 percent of the design flow rates as specified or indicated on the contract documents.

That is, comply with the the requirements of AABC MN-1 , or SMACNA 1780 (TABB) and SMACNA 1858 (TABB),except as supplemented and modified by this section.

Provide all instruments and consumables required to accomplish the TAB work. Calibrate and maintain instruments in accordance with manufacturer's written procedures.

3.3.2 Preliminary Procedures

Use the approved pre-field engineering report as instructions and procedures for accomplishing TAB field work. TAB engineer is to locate, in the field, test ports required for testing. It is the responsibility of the sheet metal contractor to provide and install test ports as required by the TAB engineer.

3.3.3 TAB Work on Performance Tests Without Seasonal Limitations

3.3.3.1 Performance Tests

In addition to the TAB proportionate balancing work on the air distribution systems and the water distribution systems, accomplish TAB work on the HVAC systems which directly transfer thermal energy. TAB the operational performance of the heating systems and cooling systems.

3.3.3.2 Ambient Temperatures

On each tab report form used for recording data, record the outdoor and indoor ambient dry bulb temperature range and the outdoor and indoor ambient wet bulb temperature range within which the report form's data was recorded. Record these temperatures at beginning and at the end of data taking.

3.3.4 Workmanship

Conduct TAB work on the HVAC systems until measured flow rates are within plus or minus 5 percent of the design flow rates as specified or indicated on the contract documents. This TAB work includes adjustment of balancing valves, balancing dampers, and sheaves. Further, this TAB work includes changing out fan sheaves and pump impellers if required to obtain air and water flow rates specified or indicated. If, with these adjustments and equipment changes, the specified or indicated design flow rates cannot be attained, contact the Owner for direction.

3.3.5 Deficiencies

Strive to meet the intent of this section to maximize the performance of the equipment as designed and installed. However, if deficiencies in equipment design or installation prevent TAB work from being accomplished within the range of design values specified in the paragraph entitled "Workmanship," provide written notice as soon as possible to the Contractor and the Owner describing the deficiency and recommended correction.

Responsibility for correction of installation deficiencies is the Contractor's. If a deficiency is in equipment design, call the TAB team supervisor for technical assistance. Responsibility for reporting design deficiencies to Contractor is the TAB team supervisor's.

3.3.6 Quality Assurance - OTR TAB Field Acceptance Testing

3.3.6.1 TAB Field Acceptance Testing

During the field acceptance testing, verify, in the presence of the OTR, random selections of data (water, air quantities, air motion, recorded in the TAB Report. Points and areas for field acceptance testing are to be selected by the OTR. Measurement and test procedures are the same as approved for TAB work for the TAB Report.

Field acceptance testing includes verification of TAB Report data recorded for the following equipment groups:

Group 1: All boilers

3.3.6.2 Additional OTR TAB Field Acceptance Testing

If any of the acceptance testing measurements for a given equipment group is found not to fall within the range of plus 5 to minus 5 percent of the TAB Report data, terminate data verification for all affected data for that group. The affected data for the given group will be disapproved. Make the necessary corrections and prepare a revised TAB Report. Reschedule acceptance testing of the revised report data with the OTR.

3.3.6.3 Prerequisite for Approval

Compliance with the field acceptance testing requirements of this section is a prerequisite for the final Owner approval of the TAB Report submitted.

3.4 MARKING OF SETTINGS

Upon the final TAB work approval, permanently mark the settings of HVAC adjustment devices including valves, gauges, splitters, and dampers so that adjustment can be restored if disturbed

at any time. Provide permanent markings clearly indicating the settings on the adjustment devices which result in the data reported on the submitted TAB report.

3.5 MARKING OF TEST PORTS

The TAB team is to permanently and legibly mark and identify the location points of the duct test ports. If the ducts have exterior insulation, make these markings on the exterior side of the duct insulation. Show the location of test ports on the as-built mechanical drawings with dimensions given where the test port is covered by exterior insulation.

END SECTION 23 05 93

SECTION 23 07 00
THERMAL INSULATION

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only. At the discretion of the Government, the manufacturer of any material supplied will be required to furnish test reports pertaining to any of the tests necessary to assure compliance with the standard or standards referenced in this specification.

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS (ASHRAE)

ASHRAE 189.1	(2011; Errata 1-2 2012; INT 1 2013; Errata 3-8 2013) Standard for the Design of High-Performance Green Buildings Except Low-Rise Residential Buildings
ASHRAE 90.1 - IP	(2010; ERTA 2011-2013) Energy Standard for Buildings Except Low-Rise Residential Buildings
ASHRAE 90.2	(2007; Addendum B 2010) Energy Efficient Design of Low-Rise Residential Buildings

ASTM INTERNATIONAL (ASTM)

ASTM A167	(2011) Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
ASTM A240/A240M	(2014) Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications
ASTM A580/A580M	(2014) Standard Specification for Stainless Steel Wire
ASTM B209	(2014) Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
ASTM C1126	(2014) Standard Specification for Faced or Unfaced Rigid Cellular Phenolic Thermal Insulation
ASTM C1136	(2012) Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation
ASTM C1290	(2011) Standard Specification for Flexible Fibrous Glass Blanket Insulation Used to Externally Insulate HVAC Ducts
ASTM C1710	(2011) Standard Guide for Installation of Flexible Closed Cell Preformed Insulation in Tube and Sheet Form
ASTM C195	(2007; R 2013) Standard Specification for Mineral Fiber Thermal Insulating Cement

ASTM C450	(2008) Standard Practice for Fabrication of Thermal Insulating Fitting Covers for NPS Piping, and Vessel Lagging
ASTM C533	(2013) Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation
ASTM C534/C534M	(2014) Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form
ASTM C547	(2012) Standard Specification for Mineral Fiber Pipe Insulation
ASTM C552	(2014) Standard Specification for Cellular Glass Thermal Insulation
ASTM C585	(2010) Standard Practice for Inner and Outer Diameters of Thermal Insulation for Nominal Sizes of Pipe and Tubing
ASTM C592	(2013) Standard Specification for Mineral Fiber Blanket Insulation and Blanket-Type Pipe Insulation (Metal-Mesh Covered) (Industrial Type)
ASTM C610	(2011) Standard Specification for Molded Expanded Perlite Block and Pipe Thermal Insulation
ASTM C612	(2014) Mineral Fiber Block and Board Thermal Insulation
ASTM C647	(2008; R 2013) Properties and Tests of Mastics and Coating Finishes for Thermal Insulation
ASTM C795	(2008; R 2013) Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel
ASTM C916	(2014) Standard Specification for Adhesives for Duct Thermal Insulation
ASTM C920	(2014a) Standard Specification for Elastomeric Joint Sealants
ASTM C921	(2010) Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation
ASTM D2863	(2013) Measuring the Minimum Oxygen Concentration to Support Candle-Like Combustion of Plastics (Oxygen Index)
ASTM D5590	(2000; R 2010; E 2012) Standard Test Method for Determining the Resistance of Paint Films and Related Coatings to Fungal Defacement by Accelerated Four-Week Agar Plate Assay
ASTM D882	(2012) Tensile Properties of Thin Plastic Sheeting
ASTM E2231	(2014) Specimen Preparation and Mounting of Pipe and Duct Insulation Materials to Assess Surface Burning Characteristics

ASTM E2336	(2014) Standard Test Methods for Fire Resistive Grease Duct Enclosure Systems
ASTM E84	(2014) Standard Test Method for Surface Burning Characteristics of Building Materials
ASTM E96/E96M	(2013) Standard Test Methods for Water Vapor Transmission of Materials

FM GLOBAL (FM)

FM APP GUIDE	(updated on-line) Approval Guide http://www.approvalguide.com/

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO)

ISO 2758	(2014) Paper - Determination of Bursting Strength

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)

MSS SP-69	(2003; Notice 2012) Pipe Hangers and Supports - Selection and Application (ANSI Approved American National Standard)

MIDWEST INSULATION CONTRACTORS ASSOCIATION (MICA)

MICA Insulation Stds	(1999) National Commercial & Industrial Insulation Standards

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 90A	(2015) Standard for the Installation of Air Conditioning and Ventilating Systems
NFPA 90B	(2015) Standard for the Installation of Warm Air Heating and Air Conditioning Systems
NFPA 96	(2014) Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations

TECHNICAL ASSOCIATION OF THE PULP AND PAPER INDUSTRY (TAPPI)

TAPPI T403 OM	(2010) Bursting Strength of Paper

U.S. DEPARTMENT OF DEFENSE (DOD)

MIL-A-24179	(1969; Rev A; Am 2 1980; Notice 1 1987) Adhesive, Flexible Unicellular-Plastic Thermal Insulation
MIL-A-3316	(1987; Rev C; Am 2 1990) Adhesives, Fire-Resistant, Thermal Insulation
MIL-PRF-19565	(1988; Rev C) Coating Compounds, Thermal Insulation, Fire- and Water-Resistant, Vapor-Barrier

UNDERWRITERS LABORATORIES (UL)

UL 723	(2008; Reprint Aug 2013) Test for Surface Burning Characteristics of Building Materials
UL 94	(2013; Reprint Sep 2014) Standard for Tests for Flammability of Plastic Materials for Parts in Devices and Appliances

1.2 SYSTEM DESCRIPTION

A. General

Provide field-applied insulation and accessories on mechanical systems as specified herein; factory-applied insulation is specified under the piping, duct or equipment to be insulated.

A. Recycled Materials

Provide thermal insulation containing recycled materials to the extent practicable, provided that the materials meet all other requirements of this section. The minimum recycled material content of the following insulation are:

Rock Wool	75 percent slag of weight
Fiberglass	20-25 percent glass cullet by weight
Rigid Foam	9 percent recovered material

1.3 SUBMITTALS

Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

Shop Drawings

Pipe Insulation Systems and Associated Accessories
Equipment Insulation Systems and Associated Accessories

Product Data

Pipe Insulation Systems
Equipment Insulation Systems

Manufacturer's Instructions

Pipe Insulation Systems
Equipment Insulation Systems

1.4 QUALITY ASSURANCE

A. Installer Qualification

Qualified installers shall have successfully completed three or more similar type jobs within the last 5 years.

1.5 DELIVERY, STORAGE, AND HANDLING

Materials shall be delivered in the manufacturer's unopened containers. Materials delivered and placed in storage shall be provided with protection from weather, humidity, dirt, dust and other contaminants. The Contracting Officer may reject insulation material and supplies that become dirty, dusty, wet, or contaminated by some other means. Packages or standard containers of insulation, jacket material, cements, adhesives, and coatings delivered for use, and samples required for approval shall have manufacturer's stamp or label attached giving the name of the manufacturer and brand, and a description of the material, date codes, and approximate shelf life (if applicable). Insulation packages and containers shall be asbestos free.

PART 2 PRODUCTS

2.1 STANDARD PRODUCTS

Provide materials which are the standard products of manufacturers regularly engaged in the manufacture of such products and that essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening. Submit a complete list of materials, including manufacturer's descriptive technical literature, performance data, catalog cuts, and installation instructions. The product number, k-value, thickness and furnished accessories including adhesives, sealants and jackets for each mechanical system requiring insulation shall be included. The product data must be copyrighted, have an identifying or publication number, and shall have been published prior to the issuance date of this solicitation. Materials furnished under this section shall be submitted together in a booklet.

A. Insulation System

Provide insulation systems in accordance with the approved MICA National Insulation Standards plates as supplemented by this specification. Provide field-applied insulation for heating, ventilating, and cooling (HVAC) air distribution systems and piping systems that are located within, on, under, and adjacent to buildings; and for plumbing systems. Insulation shall be CFC and HCFC free.

B. Surface Burning Characteristics

Unless otherwise specified, insulation shall have a maximum flame spread index of 25 and a maximum smoke developed index of 50 when tested in accordance with ASTM E84. Flame spread, and smoke developed indexes, shall be determined by ASTM E84 or UL 723. Insulation shall be tested in the same density and installed thickness as the material to be used in the actual construction. Test specimens shall be prepared and mounted according to ASTM E2231.

2.2 MATERIALS

Provide insulation that meets or exceed the requirements of ASHRAE 90.1 - IP. Insulation exterior shall be cleanable, grease resistant, non-flaking and non-peeling. Materials shall be compatible and shall not contribute to corrosion, soften, or otherwise attack surfaces to which applied in either wet or dry state. Materials to be used on stainless steel surfaces shall meet ASTM C795 requirements. Calcium silicate shall not be used on chilled or cold water systems. Materials shall be asbestos free. Provide product recognized under UL 94 (if containing plastic) and listed in FM APP GUIDE.

A. Adhesives

1. Acoustical Lining Insulation Adhesive

Adhesive shall be a nonflammable, fire-resistant adhesive conforming to ASTM C916, Type I.

2. Mineral Fiber Insulation Cement

   Cement shall be in accordance with ASTM C195.

3. Lagging Adhesive

   Lagging is the material used for thermal insulation, especially around a cylindrical object. This may include the insulation as well as the cloth/material covering the insulation. To resist mold/mildew, lagging adhesive shall meet ASTM D5590 with 0 growth rating. Lagging adhesives shall be nonflammable and fire-resistant and shall have a maximum flame spread index of 25 and a maximum smoke developed index of 50 when tested in accordance with ASTM E84. Adhesive shall be MIL-A-3316, Class 1, pigmented white and be suitable for bonding fibrous glass cloth to faced and unfaced fibrous glass insulation board; for bonding cotton brattice cloth to faced and unfaced fibrous glass insulation board; for sealing edges of and bonding glass tape to joints of fibrous glass board; for bonding lagging cloth to thermal insulation; or Class 2 for attaching fibrous glass insulation to metal surfaces. Lagging adhesives shall be applied in strict accordance with the manufacturer's recommendations for pipe and duct insulation.

4. Contact Adhesive

   Adhesives may be any of, but not limited to, the neoprene based, rubber based, or elastomeric type that have a maximum flame spread index of 25 and a maximum smoke developed index of 50 when tested in accordance with ASTM E84. The adhesive shall not adversely affect, initially or in service, the insulation to which it is applied, nor shall it cause any corrosive effect on metal to which it is applied. Any solvent dispersing medium or volatile component of the adhesive shall have no objectionable odor and shall not contain any benzene or carbon tetrachloride. The dried adhesive shall not emit nauseous, irritating, or toxic volatile matters or aerosols when the adhesive is heated to any temperature up to 212 degrees F. The dried adhesive shall be nonflammable and fire resistant. Flexible Elastomeric Adhesive: Comply with MIL-A-24179, Type II, Class I. Provide product listed in FM APP GUIDE.

B. Caulking

ASTM C920, Type S, Grade NS, Class 25, Use A.

C. Corner Angles

Nominal 0.016 inch aluminum 1 by 1 inch with factory applied kraft backing. Aluminum shall be ASTM B209, Alloy 3003, 3105, or 5005.

D. Fittings

Fabricated Fittings are the prefabricated fittings for flexible elastomeric pipe insulation systems in accordance with ASTM C1710. Together with the flexible elastomeric tubes, they provide complete system integrity for retarding heat gain and controlling condensation drip from chilled-water and refrigeration systems. Flexible elastomeric, fabricated fittings provide thermal protection (0.25 k) and condensation resistance (0.05 Water Vapor Transmission factor). For satisfactory performance, properly installed protective vapor retarder/barriers and vapor stops shall be used on high relative humidity and below ambient temperature applications to reduce movement of moisture through or around the insulation to the colder interior surface.

E. Finishing Cement

ASTM C450: Mineral fiber hydraulic-setting thermal insulating and finishing cement. All cements that may come in contact with Austenitic stainless steel must comply with ASTM C795.

F. Fibrous Glass Cloth and Glass Tape

Fibrous glass cloth, with 20X20 maximum mesh size, and glass tape shall have maximum flame spread index of 25 and a maximum smoke developed index of 50 when tested in accordance with ASTM E84. Tape shall be 4 inch wide rolls. Class 3 tape shall be 4.5 ounces/square yard. Elastomeric Foam Tape: Black vapor-retarder foam tape with acrylic adhesive containing an anti-microbial additive.

G. Staples

Outward clinching type monel.

H. Jackets

1. Aluminum Jackets

Aluminum jackets shall be corrugated, embossed or smooth sheet, 0.016 inch nominal thickness; ASTM B209, Temper H14, Temper H16, Alloy 3003, 5005, or 3105. Corrugated aluminum jacket shall not be used outdoors. Aluminum jacket securing bands shall be Type 304 stainless steel, 0.015 inch thick, 1/2 inch wide for pipe under 12 inch diameter and 3/4 inch wide for pipe over 12 inch and larger diameter. Aluminum jacket circumferential seam bands shall be 2 by 0.016 inch aluminum matching jacket material. Bands for insulation below ground shall be 3/4 by 0.020 inch thick stainless steel, or fiberglass reinforced tape. The jacket may, at the option of the Contractor, be provided with a factory fabricated Pittsburgh or "Z" type longitudinal joint. When the "Z" joint is used, the bands at the circumferential joints shall be designed by the manufacturer to seal the joints and hold the jacket in place.

2. Polyvinyl Chloride (PVC) Jackets

Polyvinyl chloride (PVC) jacket and fitting covers shall have high impact strength, ultraviolet (UV) resistant rating or treatment and moderate chemical resistance with minimum thickness 0.030 inch.

3. Vapor Barrier/Weatherproofing Jacket

Vapor barrier/weatherproofing jacket shall be laminated self-adhesive, greater than 3 plies standard grade, silver, white, black and embossed or greater than 8 ply (minimum 2.9 mils adhesive); with 0.0000 permeability when tested in accordance with ASTM E96/E96M, using the water transmission rate test method; heavy duty, white or natural; and UV resistant. Flexible Elastomeric exterior foam with factory applied, UV Jacket made with a cold weather acrylic adhesive. Construction of laminate designed to provide UV resistance, high puncture, tear resistance and excellent Water Vapor Transmission (WVT) rate.

4. Vapor Barrier/Vapor Retarder

Install vapor barrier per Table 1.

I. Vapor Retarder Required

ASTM C921, Type I, minimum puncture resistance 50 Beach units on all surfaces except concealed ductwork, where a minimum puncture resistance of 25 Beach units is acceptable. Minimum tensile strength, 35 pounds/inch width. ASTM C921, Type II, minimum puncture resistance 25 Beach units, tensile strength minimum 20 pounds/inch width. Jackets used on insulation exposed in finished areas shall have white finish suitable for painting without sizing. Based on the application, insulation materials that require manufacturer or fabricator applied pipe insulation jackets are cellular glass, when all joints are sealed with a vapor barrier mastic, and mineral fiber. All non-metallic jackets shall have

a maximum flame spread index of 25 and a maximum smoke developed index of 50 when tested in accordance with ASTM E84. Flexible elastomerics require (in addition to vapor barrier skin) vapor retarder jacketing for high relative humidity and below ambient temperature applications.

1. White Vapor Retarder All Service Jacket (ASJ)

ASJ is for use on hot/cold pipes, ducts, or equipment indoors or outdoors if covered by a suitable protective jacket. The product shall meet all physical property and performance requirements of ASTM C1136, Type I, except the burst strength shall be a minimum of 85 psi. ASTM D2863 Limited Oxygen Index (LOI) shall be a minimum of 31.

In addition, neither the outer exposed surface nor the inner-most surface contacting the insulation shall be paper or other moisture-sensitive material. The outer exposed surface shall be white and have an emittance of not less than 0.80. The outer exposed surface shall be paintable.

2. Vapor Retarder/Vapor Barrier Mastic Coatings

    a. Vapor Barrier

    The vapor barrier shall be self adhesive (minimum 2 mils adhesive, 3 mils embossed) greater than 3 plies standard grade, silver, white, black and embossed white jacket for use on hot/cold pipes. Permeability shall be less than 0.02 when tested in accordance with ASTM E96/E96M. Products shall meet UL 723 or ASTM E84 flame and smoke requirements and shall be UV resistant.

    b. Vapor Retarder

    The vapor retarder coating shall be fire and water resistant and appropriately selected for either outdoor or indoor service. Color shall be white. The water vapor permeance of the compound shall be 0.013 perms or less at 43 mils dry film thickness as determined according to procedure B of ASTM E96/E96M utilizing apparatus described in ASTM E96/E96M. The coating shall be nonflammable, fire resistant type. To resist mold/mildew, coating shall meet ASTM D5590 with 0 growth rating. Coating shall meet MIL-PRF-19565 Type II (if selected for indoor service) and be Qualified Products Database listed. All other application and service properties shall be in accordance with ASTM C647.

3. Laminated Film Vapor Retarder

ASTM C1136, Type I, maximum moisture vapor transmission 0.02 perms, minimum puncture resistance 50 Beach units on all surfaces except concealed ductwork; where Type II, maximum moisture vapor transmission 0.02 perms, a minimum puncture resistance of 25 Beach units is acceptable. Vapor retarder shall have a maximum flame spread index of 25 and a maximum smoke developed index of 50 when tested in accordance with ASTM E84. Flexible Elastomeric exterior foam with factory applied UV Jacket. Construction of laminate designed to provide UV resistance, high puncture, tear resistance and an excellent WVT rate.

4. Polyvinylidene Chloride (PVDC) Film Vapor Retarder

The PVDC film vapor retarder shall have a maximum moisture vapor transmission of 0.02 perms, minimum puncture resistance of 150 Beach units, a minimum tensile strength in any direction of 30 lb/inch when tested in accordance with ASTM D882, and a maximum flame spread index of 25 and a maximum smoke developed index of 50 when tested in accordance with ASTM E84.

5. Polyvinylidene Chloride Vapor Retarder Adhesive Tape

Requirements must meet the same as specified for Laminated Film Vapor Retarder above.

J. Vapor Retarder Not Required

ASTM C921, Type II, Class D, minimum puncture resistance 50 Beach units on all surfaces except ductwork, where Type IV, maximum moisture vapor transmission 0.10, a minimum puncture resistance of 25 Beach units is acceptable. Jacket shall have a maximum flame spread index of 25 and a maximum smoke developed index of 50 when tested in accordance with ASTM E84.

K. Wire

Soft annealed ASTM A580/A580M Type 302, 304 or 316 stainless steel, 16 or 18 gauge.

L. Insulation Bands

Insulation bands shall be 1/2 inch wide; 26 gauge stainless steel.

M. Sealants

Sealants shall be chosen from the butyl polymer type, the styrene-butadiene rubber type, or the butyl type of sealants. Sealants shall have a maximum permeance of 0.02 perms based on Procedure B for ASTM E96/E96M, and a maximum flame spread index of 25 and a maximum smoke developed index of 50 when tested in accordance with ASTM E84.

2.3 PIPE INSULATION SYSTEMS

Insulation materials shall conform to Table 1. Insulation thickness shall be as listed in Table 2 and meet or exceed the requirements of ASHRAE 90.1 - IP. Pipe insulation materials shall be limited to those listed herein and shall meet the following requirements:

A. Aboveground Cold Pipeline (-30 to 60 deg. F)

Insulation for outdoor, indoor, exposed or concealed applications, shall be as follows:

1. Cellular Glass

ASTM C552, Type II, and Type III. Supply the insulation from the fabricator with (paragraph WHITE VAPOR RETARDER ALL SERVICE JACKET (ASJ)) ASJ vapor retarder and installed with all longitudinal overlaps sealed and all circumferential joints ASJ taped or supply the insulation unfaced from the fabricator and install with all longitudinal and circumferential joints sealed with vapor barrier mastic.

2. Flexible Elastomeric Cellular Insulation

Closed-cell, foam- or expanded-rubber materials containing anti-microbial additive, complying with ASTM C534/C534M, Grade 1, Type I or II. Type I, Grade 1 for tubular materials. Type II, Grade 1, for sheet materials. Type I and II shall have vapor retarder/vapor barrier skin on one or both sides of the insulation, and require an additional exterior vapor retarder covering for high relative humidity and below ambient temperature applications.

3. Mineral Fiber Insulation with Integral Wicking Material (MFIWM)

ASTM C547. Install in accordance with manufacturer's instructions. Do not use in applications exposed to outdoor ambient conditions in climatic zones 1 through 4.

B. Aboveground Hot Pipeline (Above 60 deg. F)

Insulation for outdoor, indoor, exposed or concealed applications shall meet the following requirements. Supply the insulation with manufacturer's recommended factory-applied jacket/vapor barrier.

1. Mineral Fiber

ASTM C547, Types I, II or III, supply the insulation with manufacturer's recommended factory-applied jacket.

2. Calcium Silicate

ASTM C533, Type I indoor only, or outdoors above 250 degrees F pipe temperature. Supply insulation with the manufacturer's recommended factory-applied jacket/vapor barrier.

3. Cellular Glass

ASTM C552, Type II and Type III. Supply the insulation with manufacturer's recommended factory-applied jacket.

4. Flexible Elastomeric Cellular Insulation

Closed-cell, foam- or expanded-rubber materials containing anti-microbial additive, complying with ASTM C534/C534M, Grade 1, Type I or II to 220 degrees F service. Type I for tubular materials. Type II for sheet materials.

5. Phenolic Insulation

ASTM C1126 Type III to 250 degrees F service shall comply with ASTM C795. Supply the insulation with manufacturer's recommended factory-applied jacket/vapor barrier.

6. Perlite Insulation

ASTM C610

C. Below-ground Pipeline Insulation

For below-ground pipeline insulation, use cellular glass, ASTM C552, type II.

2.4 EQUIPMENT INSULATION SYSTEMS

Insulate equipment and accessories as specified in Tables 5 and 6. In outside locations, provide insulation 1/2 inch thicker than specified. Increase the specified insulation thickness for equipment where necessary to equal the thickness of angles or other structural members to make a smooth, exterior surface. Submit a booklet containing manufacturer's published installation instructions for the insulation systems. The instructions must be copyrighted, have an identifying or publication number, and shall have been published prior to the issuance date of this solicitation. A booklet is also required by paragraphs titled: Pipe Insulation Systems.

PART 3 EXECUTION

3.1 APPLICATION - GENERAL

Insulation shall only be applied to unheated and uncooled piping and equipment. Flexible elastomeric cellular insulation shall not be compressed at joists, studs, columns, ducts, hangers, etc. The

insulation shall not pull apart after a one hour period; any insulation found to pull apart after one hour, shall be replaced.

A. Installation

Except as otherwise specified, material shall be installed in accordance with the manufacturer's written instructions. Insulation materials shall not be applied until tests specified in other sections of this specification are completed. Material such as rust, scale, dirt and moisture shall be removed from surfaces to receive insulation. Insulation shall be kept clean and dry. Insulation shall not be removed from its shipping containers until the day it is ready to use and shall be returned to like containers or equally protected from dirt and moisture at the end of each workday. Insulation that becomes dirty shall be thoroughly cleaned prior to use. If insulation becomes wet or if cleaning does not restore the surfaces to like new condition, the insulation will be rejected, and shall be immediately removed from the jobsite. Joints shall be staggered on multi layer insulation. Mineral fiber thermal insulating cement shall be mixed with demineralized water when used on stainless steel surfaces. Insulation, jacketing and accessories shall be installed in accordance with MICA Insulation Stds plates except where modified herein or on the drawings.

B. Firestopping

Where pipes and ducts pass through fire walls, fire partitions, above grade floors, and fire rated chase walls, the penetration shall be sealed with fire stopping materials as specified in Section 07 84 00 FIRESTOPPING. The protection of ducts at point of passage through firewalls must be in accordance with NFPA 90A and/or NFPA 90B. All other penetrations, such as piping, conduit, and wiring, through firewalls must be protected with a material or system of the same hourly rating that is listed by UL, FM, or a NRTL.

C. Painting and Finishing

Painting shall be as specified in Section 09 90 00 PAINTS AND COATINGS.

D. Installation of Flexible Elastomeric Cellular Insulation

Install flexible elastomeric cellular insulation with seams and joints sealed with rubberized contact adhesive. Flexible elastomeric cellular insulation shall not be used on surfaces greater than 220 degrees F. Stagger seams when applying multiple layers of insulation. Protect insulation exposed to weather and not shown to have vapor barrier weatherproof jacketing with two coats of UV resistant finish or PVC or metal jacketing as recommended by the manufacturer after the adhesive is dry and cured.

1. Adhesive Application

Apply a brush coating of adhesive to both butt ends to be joined and to both slit surfaces to be sealed. Allow the adhesive to set until dry to touch but tacky under slight pressure before joining the surfaces. Insulation seals at seams and joints shall not be capable of being pulled apart one hour after application. Insulation that can be pulled apart one hour after installation shall be replaced.

2. Adhesive Safety Precautions

Use natural cross-ventilation, local (mechanical) pickup, and/or general area (mechanical) ventilation to prevent an accumulation of solvent vapors, keeping in mind the ventilation pattern must remove any heavier-than-air solvent vapors from lower levels of the workspaces. Gloves and spectacle-type safety glasses are recommended in accordance with safe installation practices.

E. Welding

No welding shall be done on piping, duct or equipment without written approval of the Contracting Officer. The capacitor discharge welding process may be used for securing metal fasteners to duct.

F. Pipes/Ducts/Equipment That Require Insulation

Insulation is required on all pipes, ducts, or equipment, except for omitted items as specified.

3.2 PIPE INSULATION SYSTEMS INSTALLATION

A. Pipe Insulation

1. General

Pipe insulation shall be installed on aboveground hot and cold pipeline systems as specified below to form a continuous thermal retarder/barrier, including straight runs, fittings and appurtenances unless specified otherwise. Installation shall be with full length units of insulation and using a single cut piece to complete a run. Cut pieces or scraps abutting each other shall not be used. Pipe insulation shall be omitted on the following:

a. Pipe used solely for fire protection.

b. Chromium plated pipe to plumbing fixtures. However, fixtures for use by the physically handicapped shall have the hot water supply and drain, including the trap, insulated where exposed.

c. Sanitary drain lines.

d. Air chambers.

e. Adjacent insulation.

f. ASME stamps.

g. Access plates of fan housings.

h. Cleanouts or handholes.

2. Pipes Passing Through Walls, Roofs, and Floors

Pipe insulation shall be continuous through the sleeve.

An Aluminum jacket or vapor barrier/weather proofing Jacket or Vapor Barrier/Weatherproofing - self adhesive jacket (minimum 2 mils adhesive, 3 mils embossed) less than 0.0000 permeability, greater than 3 ply standard grade, silver, white, black and embossed with factory applied moisture retarder shall be provided over the insulation wherever penetrations require sealing.

a. Penetrate Interior Walls

The aluminum jacket or vapor barrier/weatherproofing - self adhesive jacket (minimum 2 mils adhesive, 3 mils embossed) less than 0.0000 permeability, greater than 3 plies standard grade, silver, white, black and embossed shall extend 2 inches beyond either side of the wall and shall be secured on each end with a band.

3. Pipes Passing Through Hangers

Insulation, whether hot or cold application, shall be continuous through hangers. All horizontal pipes 2 inches and smaller shall be supported on hangers with the addition of a Type 40 protection shield to protect the insulation in accordance with MSS SP-69. Whenever insulation shows signs of being compressed, or when the insulation or jacket shows visible signs of distortion at or near the support shield, insulation inserts as specified below for piping larger than 2 inches shall be installed, or factory insulated hangers (designed with a load bearing core) can be used.

a. Horizontal Pipes Larger Than 2 Inches at 60 Degrees F and Above

Supported on hangers in accordance with MSS SP-69, and Section 23 05 29 HANGARS AND SUPPORTS FOR MECHAICAL.

b. Horizontal Pipes Larger Than 2 Inches and Below 60 Degrees F

Supported on hangers with the addition of a Type 40 protection shield in accordance with MSS SP-69. An insulation insert of cellular glass, prefabricated insulation pipe hangers, or perlite above 80 degrees F shall be installed above each shield. The insert shall cover not less than the bottom 180-degree arc of the pipe. Inserts shall be the same thickness as the insulation, and shall extend 2 inches on each end beyond the protection shield. When insulation inserts are required in accordance with the above, and the insulation thickness is less than 1 inch, wooden or cork dowels or blocks may be installed between the pipe and the shield to prevent the weight of the pipe from crushing the insulation, as an option to installing insulation inserts. The insulation jacket shall be continuous over the wooden dowel, wooden block, or insulation insert.

c. Vertical Pipes

Supported with either Type 8 or Type 42 riser clamps with the addition of two Type 40 protection shields in accordance with MSS SP-69 covering the 360-degree arc of the insulation. An insulation insert of cellular glass or calcium silicate shall be installed between each shield and the pipe. The insert shall cover the 360-degree arc of the pipe. Inserts shall be the same thickness as the insulation, and shall extend 2 inches on each end beyond the protection shield. When insulation inserts are required in accordance with the above, and the insulation thickness is less than 1 inch, wooden or cork dowels or blocks may be installed between the pipe and the shield to prevent the hanger from crushing the insulation, as an option instead of installing insulation inserts. The insulation jacket shall be continuous over the wooden dowel, wooden block, or insulation insert. The vertical weight of the pipe shall be supported with hangers located in a horizontal section of the pipe. When the pipe riser is longer than 30 feet, the weight of the pipe shall be additionally supported with hangers in the vertical run of the pipe that are directly clamped to the pipe, penetrating the pipe insulation. These hangers shall be insulated and the insulation jacket sealed as indicated herein for anchors in a similar service.

d. Inserts

Covered with a jacket material of the same appearance and quality as the adjoining pipe insulation jacket, overlap the adjoining pipe jacket 1-1/2 inches, and seal as required for the pipe jacket. The jacket material used to cover inserts in flexible elastomeric cellular insulation shall conform to ASTM C1136, Type 1, and is allowed to be of a different material than the adjoining insulation material.

4. Flexible Elastomeric Cellular Pipe Insulation

Flexible elastomeric cellular pipe insulation shall be tubular form for pipe sizes 6 inches and less. Grade 1, Type II sheet insulation used on pipes larger than 6 inches shall not be stretched around the pipe. On pipes larger than 12 inches, the insulation shall be adhered directly to the pipe on the

lower 1/3 of the pipe. Seams shall be staggered when applying multiple layers of insulation. Sweat fittings shall be insulated with miter-cut pieces the same size as on adjacent piping. Screwed fittings shall be insulated with sleeved fitting covers fabricated from miter-cut pieces and shall be overlapped and sealed to the adjacent pipe insulation. Type II requires an additional exterior vapor retarder/barrier covering for high relative humidity and below ambient temperature applications.

5. Pipes in high abuse areas.

In high abuse areas such as janitor closets and traffic areas in equipment rooms, kitchens, and mechanical rooms, stainless steel, aluminum or flexible laminate cladding (comprised of elastomeric, plastic or metal foil laminate) laminated self-adhesive (minimum 2 mils adhesive, 3 mils embossed) vapor barrier/weatherproofing jacket, - less than 0.0000 permeability; (greater than 3 ply, standard grade, silver, white, black and embossed) jackets shall be utilized. Pipe insulation to the 6 foot level shall be protected.

6. Pipe Insulation Material and Thicknes

TABLE 1

Insulation Material for Piping

Service					
	Material	Specification	Type	Class	VR/VB Req'd
Heating Hot Water Supply & Return (Max 250 F)					
	Mineral Fiber	ASTM C547	I	1	No
	Calcium Silicate	ASTM C533	I		No
	Cellular Glass	ASTM C552	II	2	No
	Faced Phenolic Foam	ASTM C1126	III		Yes
	Perlite	ASTM C610			No
	Flexible Elastomeric Cellular	ASTM C534/C534M	I	2	No
Steam and Condensate Return (201 to 250 Degrees F)					
	Cellular Glass	ASTM C552	II		No
	Mineral Fiber	ASTM C547	I	1	No
	Calcium Silicate	ASTM C533	I		No
	Faced Phenolic Foam	ASTM C1126	III		Yes
	Perlite	ASTM C610			No
	Flexible Elastomeric Cellular	ASTM C534/C534M	I	2	No
Condensate Drain Located Inside Building					
	Cellular Glass	ASTM C552	II	2	No

TABLE 1					
Insulation Material for Piping					
Service					
	Material	Specification	Type	Class	VR/VB Req'd
	Flexible Elastomeric Cellular	ASTM C534/C534M	I		No
Medium Temperature Hot Water, Steam and Condensate (251 to 350 Degrees F)					
	Mineral Fiber	ASTM C547	I	1	No
	Calcium Silicate	ASTM C533	I		No
	Cellular Glass	ASTM C552	I or II		No
	Perlite	ASTM C610			No
	Flexible Elastomeric Cellular	ASTM C534/C534M	I	2	No
High Temperature Hot Water & Steam (351 to 700 Degrees F)					
	Mineral Fiber	ASTM C547	I	2	No
	Calcium Silicate	ASTM C533	I		No
	Perlite	ASTM C610			No
	Cellular Glass	ASTM C552			No
Note: VR/VB = Vapor Retarder/Vapor Barrier					

TABLE 2						
Piping Insulation Thickness (inch)						
Service						
	Material	Tube And Pipe Size (inch)				
		<1	1-<1.5	1.5-<4	4-<8	> or = >8
Heating Hot Water Supply & Return, Heated Oil (Max 250 F)						
	Mineral Fiber	1.5	1.5	2	2	2
	Calcium Silicate	2.5	2.5	3	3	3
	Cellular Glass	2	2.5	3	3	3

	Perlite	2.5	2.5	3	3	3
	Flexible Elastomeric Cellular	1	1	1	N/A	N/A
Makeup Water Piping						
	Cellular Glass	1.5	1.5	1.5	1.5	1.5
	Flexible Elastomeric Cellular	1	1	1	N/A	N/A

Steam and Condensate Return (201 to 250 Degrees F)						
	Mineral Fiber	1.5	1.5	2	2	2
	Calcium Silicate	2.5	3	4	4	4.5
	Cellular Glass	2	2.5	3	3	3
	Perlite	2.5	3	4	4	4.5
	Flexible Elastomeric Cellular	1	1	1	N/A	N/A
Condensate Drain Located Inside Building						
	Cellular Glass	1.5	1.5	1.5	1.5	1.5
	Flexible Elastomeric Cellular	1	1	1	N/A	N/A
Medium Temperature Hot Water, Steam and Condensate (251 to 350 Degrees F)						
	Mineral Fiber	1.5	3	3	4	4
	Calcium Silicate	2.5	3.5	4.5	4.5	5
	Perlite	2.5	3.5	4.5	4.5	5
	Flexible Elastomeric Cellular	1	1	1	N/A	N/A
High Temperature Hot Water & Steam (351 to 700 Degrees F)						
	Mineral Fiber	2.5	3	3	4	4
	Calcium Silicate	4	4.5	6	6	6
	Perlite	4	4.5	6	6	6

B. Aboveground Cold Pipelines

The following cold pipelines for minus 30 to plus 60 degrees F, shall be insulated in accordance with Table 2 except those piping listed in subparagraph Pipe Insulation in PART 3 as to be omitted. This includes but is not limited to the following:

a. Make-up water.

1. Insulation Material and Thickness

Insulation thickness for cold pipelines shall be determined using Table 2.

2. Factory or Field applied Jacket

Insulation shall be covered with a factory applied vapor retarder jacket/vapor barrier or field applied seal welded PVC jacket or greater than 3 ply laminated self-adhesive (minimum 2 mils adhesive, 3 mils embossed) vapor barrier/weatherproofing jacket - less than 0.0000 permeability, standard grade, sliver, white, black and embossed for use with Mineral Fiber, Cellular Glass, and Phenolic Foam Insulated Pipe. Insulation inside the building, to be protected with an aluminum jacket or greater than 3ply vapor barrier/weatherproofing self-adhesive (minimum 2 mils adhesive, 3 mils embossed) product, less than 0.0000 permeability, standard grade, Embossed Silver, White & Black, shall have the insulation and vapor retarder jacket installed as specified herein. The aluminum jacket or greater than 3ply vapor barrier/weatherproofing self-adhesive (minimum 2 mils adhesive, 3 mils embossed) product, less than 0.0000 permeability, standard grade, embossed silver, White & Black, shall be installed as specified for piping exposed to weather, except sealing of the laps of the aluminum jacket is not required. In high abuse areas such as janitor closets and traffic areas in equipment rooms, kitchens, and mechanical rooms, aluminum jackets or greater than 3ply vapor barrier/weatherproofing self-adhesive (minimum 2 mils adhesive, 3 mils embossed) product, less than 0.0000 permeability, standard grade, embossed silver, white & black, shall be provided for pipe insulation to the 6 ft level.

3. Installing Insulation for Straight Runs Hot and Cold Pipe

Apply insulation to the pipe with tight butt joints. Seal all butted joints and ends with joint sealant and seal with a vapor retarder coating, greater than 3 ply laminate jacket - less than 0.0000 perm adhesive tape or PVDC adhesive tape.

a. Longitudinal Laps of the Jacket Material

Overlap not less than 1-1/2 inches. Provide butt strips 3 inches wide for circumferential joints.

b. Laps and Butt Strips

Secure with adhesive and staple on 4 inch centers if not factory self-sealing. If staples are used, seal in accordance with paragraph STAPLES below. Note that staples are not required with cellular glass systems.

c. Factory Self-Sealing Lap Systems

May be used when the ambient temperature is between 40 and 120 degrees F during installation. Install the lap system in accordance with manufacturer's recommendations. Use a stapler only if specifically recommended by the manufacturer. Where gaps occur, replace the section or repair the gap by applying adhesive under the lap and then stapling.

d. Staples

coat all staples, including those used to repair factory self-seal lap systems, with a vapor retarder coating or PVDC adhesive tape or greater than 3 ply laminate jacket - less than 0.0000 perm adhesive tape. Coat all seams, except those on factory self-seal systems, with vapor retarder coating or PVDC adhesive tape or greater than 3 ply laminate jacket - less than 0.0000 perm adhesive tape.

e. Breaks and Punctures in the Jacket Material

Patch by wrapping a strip of jacket material around the pipe and secure it with adhesive, staple, and coat with vapor retarder coating or PVDC adhesive tape or greater than 3 ply laminate jacket - less than 0.0000 perm adhesive tape. Extend the patch not less than 1-1/2 inches past the break.

f. Penetrations Such as Thermometers

Fill the voids in the insulation and seal with vapor retarder coating or PVDC adhesive tape or greater than 3 ply laminate jacket - less than 0.0000 perm adhesive tape.

g. Flexible Elastomeric Cellular Pipe Insulation

Install by slitting the tubular sections and applying them onto the piping or tubing. Alternately, whenever possible slide un-slit sections over the open ends of piping or tubing. Secure all seams and butt joints and seal with adhesive. When using self seal products only the butt joints shall be secured with adhesive. Push insulation on the pipe, never pulled. Stretching of insulation may result in open seams and joints. Clean cut all edges. Rough or jagged edges of the insulation are not be permitted. Use proper tools such as sharp knives. Do not stretch Grade 1, Type II sheet insulation around the pipe when used on pipe larger than 6 inches. On pipes larger than 12 inches, adhere sheet insulation directly to the pipe on the lower 1/3 of the pipe.

4. Insulation for Fittings and Accessories

a. Pipe insulation shall be tightly butted to the insulation of the fittings and accessories. The butted joints and ends shall be sealed with joint sealant and sealed with a vapor retarder coating or PVDC adhesive tape or greater than 3 ply laminate jacket - less than 0.0000 perm adhesive tape.

b. Precut or preformed insulation shall be placed around all fittings and accessories and shall conform to MICA plates except as modified herein: 5 for anchors; 10, 11, and 13 for fittings; 14 for valves; and 17 for flanges and unions. Insulation shall be the same insulation as the pipe insulation, including same density, thickness, and thermal conductivity. Where precut/preformed is unavailable, rigid preformed pipe insulation sections may be segmented into the shape required. Insulation of the same thickness and conductivity as the adjoining pipe insulation shall be used. If nesting size insulation is used, the insulation shall be overlapped 2 inches or one pipe diameter. Elbows insulated using segments shall conform to MICA Tables 12.20 "Mitered Insulation Elbow'. Submit a booklet containing completed MICA Insulation Stds plates detailing each insulating system for each pipe, duct, or equipment insulating system, after approval of materials and prior to applying insulation.

(1) The MICA plates shall detail the materials to be installed and the specific insulation application. Submit all MICA plates required showing the entire insulating system, including plates required to show insulation penetrations, vessel bottom and top heads, legs, and skirt insulation as applicable. The MICA plates shall present all variations of insulation systems including locations, materials, vaporproofing, jackets and insulation accessories.

(2) If the Contractor elects to submit detailed drawings instead of edited MICA Plates, the detail drawings shall be technically equivalent to the edited MICA Plate submittal.

c. Upon completion of insulation installation on flanges, unions, valves, anchors, fittings and accessories, terminations, seams, joints and insulation not protected by factory vapor retarder jackets or PVC fitting covers shall be protected with PVDC or greater than 3 ply laminate jacket - less than 0.0000 perm adhesive tape or two coats of vapor retarder coating with a minimum total thickness of 1/16 inch, applied with glass tape embedded between coats. Tape seams shall overlap 1 inch. The coating shall extend out onto the adjoining pipe insulation 2 inches. Fabricated insulation with a factory vapor retarder jacket shall be protected with either greater than 3 ply laminate jacket - less than 0.0000 perm adhesive tape, standard grade, silver, white, black and embossed or PVDC adhesive tape or two coats of vapor retarder coating with a minimum thickness of 1/16 inch and with a 2 inch wide glass tape embedded

between coats. Where fitting insulation butts to pipe insulation, the joints shall be sealed with a vapor retarder coating and a 4 inch wide ASJ tape which matches the jacket of the pipe insulation.

d. Anchors attached directly to the pipe shall be insulated for a sufficient distance to prevent condensation but not less than 6 inches from the insulation surface.

e. Insulation shall be marked showing the location of unions, strainers, and check valves.

5. Optional PVC Fitting Covers

At the option of the Contractor, premolded, one or two piece PVC fitting covers may be used in lieu of the vapor retarder and embedded glass tape. Factory precut or premolded insulation segments shall be used under the fitting covers for elbows. Insulation segments shall be the same insulation as the pipe insulation including same density, thickness, and thermal conductivity. The covers shall be secured by PVC vapor retarder tape, adhesive, seal welding or with tacks made for securing PVC covers. Seams in the cover, and tacks and laps to adjoining pipe insulation jacket, shall be sealed with vapor retarder tape to ensure that the assembly has a continuous vapor seal.

C. Aboveground Hot Pipelines

1. General Requirements

All hot pipe lines above 60 degrees F, except those piping listed in subparagraph Pipe Insulation in PART 3 as to be omitted, shall be insulated in accordance with Table 2. This includes but is not limited to the following:

a. Steam.

b. Condensate discharge

c. Domestic hot water

Insulation shall be covered, in accordance with manufacturer's recommendations, with a factory applied Type I jacket or field applied aluminum where required or seal welded PVC.

2. Insulation for Fittings and Accessories

Pipe insulation shall be tightly butted to the insulation of the fittings and accessories. The butted joints and ends shall be sealed with joint sealant. Insulation shall be marked showing the location of unions, strainers, check valves and other components that would otherwise be hidden from view by the insulation.

a. Precut or Preformed

Place precut or preformed insulation around all fittings and accessories. Insulation shall be the same insulation as the pipe insulation, including same density, thickness, and thermal conductivity.

b. Rigid Preformed

Where precut/preformed is unavailable, rigid preformed pipe insulation sections may be segmented into the shape required. Insulation of the same thickness and conductivity as the adjoining pipe insulation shall be used. If nesting size insulation is used, the insulation shall be overlapped 2 inches or one pipe diameter. Elbows insulated using segments shall conform to MICA Tables 12.20 "Mitered Insulation Elbow".

D. Piping Exposed to Weather

Piping exposed to weather shall be insulated and jacketed as specified for the applicable service inside the building. After this procedure, a laminated self-adhesive (minimum 2 mils adhesive, 3 mils embossed) vapor barrier/weatherproofing jacket - less than 0.0000 permeability (greater than 3 ply, standard grade, silver, white, black and embossed aluminum jacket or PVC jacket shall be applied. PVC jacketing requires no factory-applied jacket beneath it, however an all service jacket shall be applied if factory applied jacketing is not furnished. Flexible elastomeric cellular insulation exposed to weather shall be treated in accordance with paragraph INSTALLATION OF FLEXIBLE ELASTOMERIC CELLULAR INSULATION in PART 3.

1. Aluminum Jacket

The jacket for hot piping may be factory applied. The jacket shall overlap not less than 2 inches at longitudinal and circumferential joints and shall be secured with bands at not more than 12 inch centers. Longitudinal joints shall be overlapped down to shed water and located at 4 or 8 o'clock positions. Joints on piping 60 degrees F and below shall be sealed with metal jacketing/flashing sealant while overlapping to prevent moisture penetration. Where jacketing on piping 60 degrees F and below abuts an un-insulated surface, joints shall be caulked to prevent moisture penetration. Joints on piping above 60 degrees F shall be sealed with a moisture retarder.

2. Insulation for Fittings

Flanges, unions, valves, fittings, and accessories shall be insulated and finished as specified for the applicable service. Two coats of breather emulsion type weatherproof mastic (impermeable to water, permeable to air) recommended by the insulation manufacturer shall be applied with glass tape embedded between coats. Tape overlaps shall be not less than 1 inch and the adjoining aluminum jacket not less than 2 inches. Factory preformed aluminum jackets may be used in lieu of the above. Molded PVC fitting covers shall be provided when PVC jackets are used for straight runs of pipe. PVC fitting covers shall have adhesive welded joints and shall be weatherproof laminated self-adhesive (minimum 2 mils adhesive, 3 mils embossed) vapor barrier/weatherproofing jacket - less than 0.0000 permeability, (greater than 3 ply, standard grade, silver, white, black and embossed, and UV resistant.

3. PVC Jacket

PVC jacket shall be ultraviolet resistant and adhesive welded weather tight with manufacturer's recommended adhesive. Installation shall include provision for thermal expansion.

3.3 EQUIPMENT INSULATION SYSTEMS INSTALLATION

A. General

Removable insulation sections shall be provided to cover parts of equipment that must be opened periodically for maintenance including vessel covers, fasteners, flanges and accessories. Equipment insulation shall be omitted on the following:

a. Hand-holes.

b. Boiler manholes.

c. Cleanouts.

d. ASME stamps.

e. Manufacturer's nameplates.

B. Insulation for Hot Equipment

Insulation shall be furnished on equipment handling media above 60 degrees F including the following:

a. Pumps handling media above 130 degrees F.

b. Hot water storage tanks.

c. Boiler flue gas connection from boiler to stack (if inside).

1. Insulation

Insulation shall be suitable for the temperature encountered. Shell and tube-type heat exchangers shall be insulated for the temperature of the shell medium.

Insulation thickness for hot equipment shall be determined using Table 6:

TABLE 6		
Insulation Thickness for Hot Equipment (inches)		
Equipment handling steam or media at indicated pressure or temperature limit		
	Material	Thickness (inches)
15 psig or 250 degrees F		
	Rigid Mineral Fiber	2
	Flexible Mineral Fiber	2
	Calcium Silicate/Perlite	4
	Cellular Glass	3
	Faced Phenolic Foam	1.5
	Flexible Elastomeric Cellular (<200 F)	1
200psig or 400 degrees F		
	Rigid Mineral Fiber	3
	Flexible Mineral Fiber	3
	Calcium Silicate/Perlite	4
	Cellular Glass	4
600 degrees F		
	Rigid Mineral Fiber	5

TABLE 6		
Insulation Thickness for Hot Equipment (inches)		
Equipment handling steam or media at indicated pressure or temperature limit		
	Material	Thickness (inches)
	Flexible Mineral Fiber	6
	Calcium Silicate/Perlite	6
	Cellular Glass	6
600 degrees F: Thickness necessary to limit the external temperature of the insulation to 120 F. Heat transfer calculations shall be submitted to substantiate insulation and thickness selection.		

2. Insulation of Boiler Stack Pipe

Inside boiler Room, bevel insulation neatly around openings and provide sheet metal insulation stop strips around such openings. Apply a skim coat of hydraulic setting cement directly to insulation. Apply a flooding coat of adhesive over hydraulic setting cement, and while still wet, press a layer of glass cloth or tape into adhesive and seal laps and edges with adhesive. Coat glass cloth with adhesive. When dry, apply a finish coat of adhesive at can-consistency so that when dry no glass weave shall be observed. Provide metal jackets for stacks and exhaust pipes that are located above finished floor and spaces outside boiler room. Apply metal jackets directly over insulation and secure with 3/4 inch wide metal bands spaced on 18 inch centers. Do not insulate name plates. Insulation type and thickness shall be in accordance with the following Table 7.

TABLE 7						
Insulation and Thickness for Boiler Stack Pipe						
Service & Surface Temperature Range (Degrees F)						
	Material	Outside Diameter (Inches)				
		0.25 - 1.25	1 - 1.67	3.5-5	6 - 10	> or = 11 - 36
Boiler Stack (Up to 400 degrees F)						

TABLE 7						
Insulation and Thickness for Boiler Stack Pipe						
Service & Surface Temperature Range (Degrees F)						
	Material	Outside Diameter (Inches)				
		0.25 - 1.25	1 - 1.67	3.5-5	6 - 10	> or = 11 - 36
	Mineral Fiber ASTM C585 Class B-3, ASTM C547 Class 1, or ASTM C612 Class 1	N/A	N/A	3	3.5	4
	Calcium Silicate ASTM C533, Type 1	N/A	N/A	3	3.5	4
	Cellular Glass ASTM C552, Type II	1.5	1.5	1.5	2	2.5
Boiler Stack (401 to 600 degrees F)						
	Mineral Fiber ASTM C547 Class 2, ASTM C592 Class 1, or ASTM C612 Class 3	N/A	N/A	4	4	5
	Calcium Silicate ASTM C533, Type I or II	N/A	N/A	4	4	4
	Mineral Fiber/Cellular Glass Composite:					
	Mineral Fiber ASTM C547 Class 2, ASTM C592 Class 1, or ASTM C612 Class 3	1	1	1	1	2
	Cellular Glass ASTM C552, Type II	2	2	2	2	2
Boiler Stack (601 to 800 degrees F)						

TABLE 7						
Insulation and Thickness for Boiler Stack Pipe						
Service & Surface Temperature Range (Degrees F)						
	Material	Outside Diameter (Inches)				
		0.25 - 1.25	1 - 1.67	3.5-5	6 - 10	> or = 11 - 36
	Mineral Fiber ASTM C547 Class 3, ASTM C592 Class 1, or ASTM C612 Class 3	N/A	N/A	4	4	6
	Calcium Silicate ASTM C533, Type I or II	N/A	N/A	4	4	6
	Mineral Fiber/Cellular Glass Composite:					
	Mineral Fiber ASTM C547 Class 2, ASTM C592 Class 1, or ASTM C612 Class 3	2	2	2	3	3
	Cellular Glass ASTM C552, Type II	2	2	2	2	2

3. Insulation of Pumps

Insulate pumps by forming a box around the pump housing. The box shall be constructed by forming the bottom and sides using joints that do not leave raw ends of insulation exposed. Bottom and sides shall be banded to form a rigid housing that does not rest on the pump. Joints between top cover and sides shall fit tightly. The top cover shall have a joint forming a female shiplap joint on the side pieces and a male joint on the top cover, making the top cover removable. Two coats of Class I adhesive shall be applied over insulation, including removable sections, with a layer of glass cloth embedded between the coats. A parting line shall be provided between the box and the removable sections allowing the removable sections to be removed without disturbing the insulation coating. The total dry thickness of the finish shall be 1/16 inch. Caulking shall be applied to parting line of the removable sections and penetrations.

4. Other Equipment

a. Insulation shall be formed or fabricated to fit the equipment. To ensure a tight fit on round equipment, edges shall be beveled and joints shall be tightly butted and staggered.

b. Insulation shall be secured in place with bands or wires at intervals as recommended by the manufacturer but not greater than 12 inch centers except flexible elastomeric cellular which shall be adhered. Insulation corners shall be protected under wires and bands with suitable corner angles.

c. On high vibration equipment, cellular glass insulation shall be set in a coating of bedding compound as recommended by the manufacturer, and joints shall be sealed with bedding compound. Mineral fiber joints shall be filled with finishing cement.

d. Insulation on heads of heat exchangers shall be removable. The removable section joint shall be fabricated using a male-female shiplap type joint. Entire surface of the removable section shall be finished as specified.

e. Exposed insulation corners shall be protected with corner angles.

f. On equipment with ribs, such as boiler flue gas connection, draft fans, and fly ash or soot collectors, insulation shall be applied over 6 by 6 inch by 12 gauge welded wire fabric which has been cinched in place, or if approved by the Contracting Officer, spot welded to the equipment over the ribs. Insulation shall be secured to the fabric with J-hooks and 2 by 2 inch washers or shall be securely banded or wired in place on 12 inch (maximum) centers.

g. On equipment handling media above 600 degrees F, insulation shall be applied in two or more layers with joints staggered.

h. Upon completion of installation of insulation, penetrations shall be caulked. Two coats of adhesive shall be applied over insulation, including removable sections, with a layer of glass cloth embedded between the coats. The total dry thickness of the finish shall be 1/16 inch. Caulking shall be applied to parting line between equipment and removable section insulation.

END SECTION 23 07 00

SECTION 23 08 00
TESTING OF HVAC SYSTEMS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASSOCIATED AIR BALANCE COUNCIL (AABC)

ACG Commissioning Guideline (2005) Commissioning Guideline

NATIONAL ENVIRONMENTAL BALANCING BUREAU (NEBB)

NEBB Commissioning Standard (2009) Procedural Standards for Whole Building Systems Commissioning of New Construction; 3rd Edition

SHEET METAL AND AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION (SMACNA)

SMACNA 1429 (1994) HVAC Systems Commissioning Manual, 1st Edition

1.2 DEFINITIONS

In some instances, terminology differs between the Contract and the Commissioning Standard primarily because the intent of this Section is to use the industry standards specified, along with additional requirements listed herein to produce optimal results. The following table of similar terms is provided for clarification only. Contract requirements take precedent over the corresponding ACG, NEBB, or TABB requirements where differences exist.

SIMILAR TERMS			
Contract Term	ACG	NEBB	TABB
Commissioning Standard	ACG Commissioning Guideline	Procedural Standards for Building Systems Commissioning	SMACNA HVAC Commissioning Guidelines
Commissioning Specialist	ACG Certified Commissioning Agent	NEBB Qualified Commissioning Administrator	TABB Certified Commissioning Supervisor

1.3 SYSTEM DESCRIPTION

A. General

1. Perform Commissioning in accordance with the requirements of the standard under which the Commissioning Firm's qualifications are approved, i.e., ACG Commissioning Guideline, NEBB Commissioning Standard, or SMACNA 1429 unless otherwise stated herein. Consider mandatory all recommendations and suggested practices contained in the Commissioning Standard. Use the Commissioning Standard for all aspects of Commissioning, including qualifications for the Commissioning Firm and Specialist and calibration of Commissioning instruments. Where the instrument manufacturer calibration recommendations are more stringent than those listed in the Commissioning Standard, the manufacturer's recommendations shall be adhered to. All quality assurance provisions of the Commissioning Standard such as performance guarantees shall be part of this contract. For systems or system components not covered in the Commissioning Standard, Commissioning procedures shall be developed by the Commissioning Specialist. Where new procedures, requirements, etc., applicable to the Contract requirements have been published or adopted by the body responsible for the Commissioning Standard used (ACG, NEBB, or TABB), the requirements and recommendations contained in these procedures and requirements shall be considered mandatory.

1.4 SUBMITTALS

Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

Shop Drawings

Commissioning Plan

Product Data

Pre-Functional Performance Test Checklists
Functional Performance Tests

Test Reports

Commissioning Report

Certificates

Commissioning Firm
Commissioning Specialist

1.5 QUALITY ASSURANCE

A. Commissioning Firm

1. Submit certification of the proposed Commissioning Firm's qualifications to perform the duties specified herein and in other related Sections, no later than 21 days after the Notice to Proceed. Include in the documentation the date that the Certification was initially granted and the date when the current Certification expires. The firm is either a member of ACG or certified by the NEBB or the TABB and certified in all categories and functions where measurements or performance are specified on the plans and specifications. Any lapses in Certification of the proposed Commissioning Firm or

disciplinary action taken by ACG, NEBB, or TABB against the proposed Commissioning Firm shall be described in detail. The certification shall be maintained for the entire duration of duties specified herein. If, for any reason, the firm loses subject certification during this period, immediately notify the Owner and submit another Commissioning Firm for approval. Any firm that has been the subject of disciplinary action by the ACG, the NEBB, or the TABB within the five years preceding Contract Award is not eligible to perform any duties related to the HVAC systems, including Commissioning. All work specified in this Section and in other related Sections to be performed by the Commissioning Firm shall be considered invalid if the Commissioning Firm loses its certification prior to Contract completion and must be performed by an approved successor. These Commissioning services are to assist the prime Contractor in performing the quality oversight for which it is responsible. The Commissioning Firm shall be a subcontractor of the prime Contractor and shall be financially and corporately independent of all other sub-Contractors. The Commissioning Firm shall report to and be paid by the prime Contractor.

B. Commissioning Specialist

2. General: Submit certification of the proposed Commissioning Specialist's qualifications to perform the duties specified herein and in other related Sections, no later than 21 days after the Notice to Proceed. The documentation shall include the date that the Certification was initially granted and the date when the current Certification expires. The Commissioning Specialist shall be an ACG Certified Commissioning Agent, a NEBB Qualified Commissioning Administrator, or a TABB Certified Commissioning Supervisor and shall be an employee of the approved Commissioning Firm. Any lapses in Certification of the proposed Commissioning Specialist or disciplinary action taken by ACG, NEBB, or TABB against the proposed Commissioning Specialist shall be described in detail. The certification shall be maintained for the entire duration of duties specified herein. If, for any reason, the Commissioning Specialist loses subject certification during this period, immediately notify the Owner and submit another Commissioning Specialist for approval. Any individual that has been the subject of disciplinary action by the ACG, the NEBB, or the TABB within the five years preceding Contract Award is not eligible to perform any duties related to the HVAC systems, including Commissioning. All work specified in this Section and in other related Sections performed by the Commissioning Specialist shall be considered invalid if the Commissioning Specialist loses certification prior to Contract completion and must be performed by the approved successor.

3. Responsibilities: Perform all Commissioning work specified herein and in related sections under the direct guidance of the Commissioning Specialist. The Commissioning Specialist shall prepare, no later than 28 days after the approval of the Commissioning Specialist, the Commissioning Plan which will be a comprehensive schedule and will include all submittal requirements for procedures, notifications, reports and the Commissioning Report. After approval of the Commissioning Plan, revise the Contract NAS schedule to reflect the schedule requirements in the Commissioning Plan.

1.6 SEQUENCING AND SCHEDULING

A. Begin the work described in this Section only after all work required in related Sections has been successfully completed, and all test and inspection reports and operation and maintenance manuals required in these Sections have been submitted and approved. Pre-Functional Performance Test Checklists shall be performed at appropriate times during the construction phase of the Contract.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.1 COMMISSIONING TEAM AND TEST FORMS AND CHECKLISTS

A. Designate Contractor team members to participate in the Pre- Functional Performance Test Checklists and the Functional Performance Tests specified herein. In addition, the Owner team members will include a representative of the Owner, the Design Agent's Representative, and the District Representative. The team members shall be as follows:

Designation	Function
A	Contractor's Commissioning Specialist
M	Contractor's Mechanical Representative
E	Contractor's Electrical Representative
T	Contractor's Testing, Adjusting, and Balancing (TAB) Specialist
C	Contractor's Controls Representative
D	Design Agency Representative
O	Owner's Representative
U	District Representative

Appendices A and B shall be completed by the commissioning team. Acceptance by each commissioning team member of each Pre- Functional Performance Test Checklist item shall be indicated by initials and date unless an "X" is shown indicating that participation by that individual is not required. Acceptance by each commissioning team member of each functional performance test item shall be indicated by signature and date.

3.2 TESTS

Perform the pre-functional performance test checklists and functional performance tests in a manner that essentially duplicates the checking, testing, and inspection methods established in the related Sections. Where checking, testing, and inspection methods are not specified in other Sections, establish methods which will provide the information required. Testing and verification required by this section shall be performed during the Commissioning phase. Requirements in related Sections are independent from the requirements of this Section and shall not be used to satisfy any of the requirements specified in this Section. Provide all materials, services, and labor required to perform the pre- functional performance tests checks and functional performance tests. A functional performance test shall be aborted if any system deficiency prevents the successful completion of the test or if any participating non-Owner commissioning team member of which participation is specified is not present for the test.

A. Pre-Functional Performance Test Checklists

Perform Pre-Functional Performance Test Checklists, for the items indicated in Appendix A, at least 28 days prior to the start of Pre-Functional Performance Test Checks.. Correct and re-inspect deficiencies discovered during these checks in accordance with the applicable contract requirements. Submit the schedule for the test checks at least 14 days prior to the start of Pre-Functional Performance Test Checks.

B. Functional Performance Tests

Submit test procedures at least 28 days prior to the start of Functional Performance Tests. Submit the schedule for the tests at least 14 days prior to the start of Functional Performance Tests. Perform Functional Performance Tests for the items indicated in Appendix B. Begin Functional Performance Tests only after all Pre-Functional Performance Test Checklists have been successfully completed. Tests shall prove all modes of the sequences of operation, and shall verify all other relevant contract requirements. Begin Tests with equipment or components and progress through subsystems to complete systems. Upon failure of any Functional Performance Test item, correct all deficiencies in accordance with the applicable contract requirements. The item shall then be retested until it has been completed with no errors.

3.3 COMMISSIONING REPORT

Submit the Commissioning Report, no later than 14 days after completion of Functional Performance Tests, consisting of completed Pre- Functional Performance Test Checklists and completed Functional Performance Tests organized by system and by subsystem and submitted as one package. The Commissioning Report shall also include all HVAC systems test reports, inspection reports (Preparatory, Initial and Follow-up inspections), start-up reports, TAB report, TAB verification report, Controls start-up test reports and Controls Performance Verification Test (PVT) report. The results of failed tests shall be included along with a description of the corrective action taken.

APPENDIX A

PRE-FUNCTIONAL PERFORMANCE TEST CHECKLISTS

Pre-Functional Performance Test Checklist - Pumps

For Pump: [_____]

Checklist Item	**A**	**M**	**E**	**T**	**C**	**O**
Installation						
a. Piping system installed.	___	___	X	X	X	___
Electrical	**A**	**M**	**E**	**T**	**C**	**O**
a. Power available to pump disconnect.	___	X	___	X	X	___
b. Pump rotation verified.	___	X	___	X	X	___
c. Control system interlocks functional.	___	X	___	X	___	___
Testing, Adjusting, and Balancing (TAB)	**A**	**M**	**E**	**T**	**C**	**O**
a. Pressure/temperature gauges installed.	___	___	X	___	X	___
b. TAB Report approved.	___	___	X	___	X	___

Pre-Functional Performance Test Checklist - Steam Boiler

For Boiler: [_____]

Checklist Item

Installation	**A**	**M**	**E**	**T**	**C**	**O**
a. Boiler steam piping installed.	___	___	X	X	X	___
b. Boiler makeup water piping installed.	___	___	X	___	X	___
C. Boiler gas piping installed.	___	___	X	X	X	___
d. Boiler blowdown piping installed.	___	___	X	___	X	___

Startup	**A**	**M**	**E**	**T**	**C**	**O**
a. Boiler safety/protection devices, including high temperature burner shut-off, low water cutoff, flame failure, pre- and post-purge, have been tested.	___	___	___	X	___	___
b. Verify that PRV rating conforms to boiler rating.	___	___	___	X	___	___
c. Boiler feed water system operational.	___	___	___	X	___	___
d. Boiler blowdown system operational.	___	___	___	X	___	___
e. Boiler water treatment system functional.	___	___	X	X	X	___
f. Boiler startup and checkout complete.	___	___	___	X	___	___
g. All steam traps operational.	___	___	X	X	X	___
h All condensate return pumps operational.	___	___	X	X	___	___
i. Combustion efficiency demonstrated.	___	___	X	___	X	___

Electrical	**A**	**M**	**E**	**T**	**C**	**O**
a. Verify that power disconnect is located within sight of the unit served.	___	X	___	X	___	___

Testing, Adjusting, and Balancing (TAB)	**A**	**M**	**E**	**T**	**C**	**O**
a. TAB report approved.	___	___	X	___	X	___

Pre-Functional Performance Test Checklist - HVAC System Controls

For HVAC System: [_____]

Checklist Item

Installation	**A**	**M**	**E**	**T**	**C**	**O**
a. Verify Operation of Control Panel	___	___	X	X	X	___
b. Framed instructions mounted in or near control panel.	___	___	X	X	___	___
c. Components properly labeled (on inside and outside of panel).	___	___	X	X	___	___
d. Control components piped and/or wired to each labeled terminal strip.	___	___	X	X	___	___
e. EMCS connection made to each labeled terminal strip as shown.	___	___	X	X	___	___
f. Control wiring labeled at all terminations, splices, and junctions.	___	___	X	X	___	___
Main Power and Control						
a. 120 volt AC power available to panel.	___	___	___	X	___	___
Testing, Adjusting, and Balancing (TAB)	A	M	E	T	C	O
a. TAB Report submitted.	___	___	X	___	X	___

- End of Appendix A -

APPENDIX B

FUNCTIONAL PERFORMANCE TESTS CHECKLISTS

Functional Performance Test - Pump [_____]

NOTE: Prior to performing this test, for closed loop systems ensure that the system is pressurized and the make-up water system is operational, or for open loop systems ensure that the sumps are filled to the proper level.

1. Activate pump start using control system commands.

a. Verify correct operation in:

HAND_____ OFF_____ AUTO_____

b. Verify pressure drop across strainer:

Strainer inlet pressure _____ psig

Strainer outlet pressure _____ psig

c. Verify pump inlet/outlet pressure reading, compare to Testing, Adjusting, and Balancing (TAB) Report and pump design conditions.

	DESIGN	TAB	ACTUAL
Pump inlet pressure psig	_____	_____	_____
Pump outlet pressure psig	_____	_____	_____

d. Operate pump at shutoff and at 100 percent of designed flow when all components are in full flow. Plot test readings on pump curve and compare results against readings taken from flow measuring devices.

	SHUTOFF	100 percent
Pump inlet pressure psig	_____	_____
Pump outlet pressure psig	_____	_____
Pump flow rate gpm	_____	_____

	SETPOINT
Differential Pressure Transmitter	_____

Functional Performance Test (cont) - Pump [_____]

e. For variable speed pumps, operate pump at shutoff (shutoff to be done in manual on variable speed drive at the minimum rpm that the system is being controlled at) and at minimum flow or when all components are in full by-pass. Plot test readings on pump curve and compare results against readings taken from flow measuring devices.

	SHUTOFF	100 percent
Pump inlet pressure psig	_____	_____
Pump outlet pressure psig	_____	_____
Pump flow rate gpm	_____	_____
	SETPOINT	
Differential Pressure Transmitter	_____	

2. Measure motor amperage each phase and voltage phase to phase and phase to ground for both the full flow and the minimum flow conditions. Compare amperage to nameplate FLA.

a. Full flow:

Nameplate FLA _____

Amperage	Phase 1 _____	Phase 2_____	Phase 3_____
Voltage	Ph1-Ph2 _____	Ph1-Ph3_____	Ph2-Ph3_____
Voltage	Ph1-gnd _____	Ph2-gnd_____	Ph3-gnd_____

b. Minimum flow:

Amperage	Phase 1 _____	Phase 2_____	Phase 3_____
Voltage	Ph1-Ph2 _____	Ph1-Ph3_____	Ph2-Ph3_____
Voltage	Ph1-gnd _____	Ph2-gnd_____	Ph3-gnd_____

3. Note unusual vibration, noise, etc.

_____

_____

Functional Performance Test (cont) - Pump [_____]

4. Certification: We the undersigned have witnessed the above functional performance tests and certify that the item tested has met the performance requirements in this section of the specifications.

	Signature and Date
Contractor's Commissioning Specialist	_____
Contractor's Mechanical Representative	_____
Contractor's Electrical Representative	_____
Contractor's TAB Representative	_____
Contractor's Controls Representative	_____
Owner's Representative	_____
Design Agency Representative	_____
District Representative	_____

Functional Performance Test Checklist - Steam Boiler

For Boiler: [_____]

1. Functional Performance Test: Contractor shall demonstrate operation of steam heating system in accordance with specifications including the following: Start building heating equipment to provide load for boiler. Activate controls system boiler start sequence as follows.

a. Start steam heating system. Verify control system energizes boiler start sequence. _____
Record outdoor air temperature. _____

b. Verify boiler senses steam pressure below set point and control system activates boiler start. _____

c. Shut off building heating equipment to remove load on steam heating system. Verify boiler shutdown sequence is indicated and accomplished after load is removed. _____

d. Verify that water level and makeup water system are operational.
_____

2. Verify boiler inlet/outlet pressure reading, compare to boiler design conditions, and boiler manufacturer's performance data.

	DESIGN	SYSTEM TEST	ACTUAL
Boiler inlet feedwater temp deg F	_____	_____	_____
Boiler outlet pressure psig	_____	_____	_____
Flue gas temp at boiler outlet deg F	_____	_____	_____
Percent carbon dioxide in flue-gas	_____	_____	_____
Draft at boiler flue-gas exit inches-wg	_____	_____	_____
Stack emission pollutants concentration	_____	_____	_____
Fuel type	_____	_____	_____
Combustion efficiency	_____	_____	_____

3. Record the following information:

Ambient temperature _____degrees F

4. Verify proper operation of boiler safties._____

5. Unusal vibration, noise, etc.

_____

_____

6. Visually check refractory for cracks or spalling and refractory and tubes for flame impingement._____

Functional Performance Test Checklist (cont) - Steam Boiler

7. Certification: We the undersigned have witnessed the above functional performance tests and certify that the item tested has met the performance requirements in this section of the specifications.

Signature and Date

Contractor's Commissioning Specialist _____

Contractor's Mechanical Representative _____

Contractor's Electrical Representative _____

Contractor's TAB Representative _____

Contractor's Controls Representative _____

Design Agency Representative _____

Owner's Representative _____

District Representative _____

Functional Performance Test Checklist - HVAC Controls

For HVAC System: [_____]

The Owner will select HVAC control systems to undergo functional performance testing. The number of systems shall not exceed 10 percent. Perform this test simultaneously with FPT for AHU or other controlled equipment.

1. Functional Performance Test: Contractor shall verify operation of HVAC controls by performing the Performance Verification Test (PVT) test for that system. Contractor to provide blank PVT test procedures previously done by the controls Contractor.

2. Verify interlock with BAS system_____.

3. Verify all required I/O points function from the BAS system_____.

4. Certification: We the undersigned have witnessed the Performance Verification Test and certify that the item tested has met the performance requirements in this section of the specifications.

Signature and Date

Contractor's Commissioning Specialist _____

Contractor's Mechanical Representative _____

Contractor's Electrical Representative _____

Contractor's TAB Representative _____

Contractor's Controls Representative _____

Design Agency Representative _____

Architect’s Representative _____

District Representative _____

- End of Appendix B -

END SECTION 23 08 00

SECTION 23 09 23
INSTRUMENTATION AND CONTROL FOR MECHANICAL

PART 1 - GENERAL

1.0 SUMMARY

A. This Section includes modification to existing Building Automation System (BAS) to control HVAC systems and components, including control of all terminal heating and cooling units and other equipment not supplied with factory-supplied controls.

B. The Building Automation System (BAS) manufacturer shall furnish and install all components to integrate new equipment into the existing school system and district wide building automation system, incorporating direct digital control (DDC) for energy management, equipment monitoring and control, and subsystems with open communications capabilities as herein specified. The system integrate with power and lighting control system.

C. The existing school BAS system utilizes a mutli-protocol open architecture. The physical network for the systems, the cable plant, the logical network for the systems and the networking protocols shall be open architectures, supporting multiple applications and equipment manufacturers. The system uses an existing district wide fiber optic network for communication to the Tridium system.

D. The school district has an existing contract with Mechanical Incorporated for the controls management of all equipment. All new work is to be compatible and fully integrated with existing systems.

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

AIR MOVEMENT AND CONTROL ASSOCIATION INTERNATIONAL (AMCA)

AMCA 500-D	(2012) Laboratory Methods of Testing Dampers for Rating

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS (ASHRAE)

ASHRAE 135	(2012; Errata 1 2013; INT 1-9 2013; Errata 2 2013; INT 10-12 2014; Errata 3 2014) BACnet—A Data Communication Protocol for Building Automation and Control Networks

ARCNET TRADE ASSOCIATION (ATA)

ATA 878.1	(1999) Local Area Network: Token Bus

ASME INTERNATIONAL (ASME)

ASME B16.18	(2012) Cast Copper Alloy Solder Joint Pressure Fittings
ASME B16.22	(2013) Standard for Wrought Copper and Copper Alloy Solder Joint Pressure Fittings

ASME B16.26	(2013) Standard for Cast Copper Alloy Fittings for Flared Copper Tubes
ASME B16.34	(2013) Valves - Flanged, Threaded and Welding End
ASME B16.5	(2013) Pipe Flanges and Flanged Fittings: NPS 1/2 Through NPS 24 Metric/Inch Standard
ASME B31.1	(2014; INT 1-47) Power Piping
ASME B40.100	(2013) Pressure Gauges and Gauge Attachments
ASME BPVC	(2010) Boiler and Pressure Vessels Code

ASTM INTERNATIONAL (ASTM)

ASTM A126	(2004; R 2014) Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings
ASTM B117	(2011) Standard Practice for Operating Salt Spray (Fog) Apparatus
ASTM B32	(2008; R 2014) Standard Specification for Solder Metal
ASTM B75/B75M	(2011) Standard Specification for Seamless Copper Tube
ASTM B88	(2014) Standard Specification for Seamless Copper Water Tube
ASTM D1238	(2013) Melt Flow Rates of Thermoplastics by Extrusion Plastometer
ASTM D1693	(2013) Standard Test Method for Environmental Stress-Cracking of Ethylene Plastics
ASTM D635	(2010) Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Self-Supporting Plastics in a Horizontal Position
ASTM D638	(2010) Standard Test Method for Tensile Properties of Plastics
ASTM D792	(2013) Density and Specific Gravity (Relative Density) of Plastics by Displacement

CONSUMER ELECTRONICS ASSOCIATION (CEA)

CEA-709.1-D	(2014) Control Network Protocol Specification

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C57.13	(2008; INT 2009) Standard Requirements for Instrument Transformers

IEEE C62.41.1	(2002; R 2008) Guide on the Surges Environment in Low-Voltage (1000 V and Less) AC Power Circuits
IEEE C62.41.2	(2002) Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and Less) AC Power Circuits
IEEE C62.45	(2002; R 2008) Recommended Practice on Surge Testing for Equipment Connected to Low-Voltage (1000v and less)AC Power Circuits

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO)

ISO 8802-3	(2000) Information Technology - Telecommunications and Information Exchange Between Systems - Local and Metropolitan Area Networks - Specific Requirements - Part 3: Carrier Sense Multiple Access with Collision Detection (CSMA/CD)Access Method and Physical Layer Specifications

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA/ANSI C12.10	(2011) Physical Aspects of Watthour Meters - Safety Standards

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2014; AMD 1 2013; Errata 1 2013; AMD 2 2013; Errata 2 2013; AMD 3 2014; Errata 3-4 2014; AMD 4-6 2014) National Electrical Code
NFPA 72	(2013) National Fire Alarm and Signaling Code
NFPA 90A	(2015) Standard for the Installation of Air Conditioning and Ventilating Systems

SHEET METAL AND AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION (SMACNA)

SMACNA 1966	(2005) HVAC Duct Construction Standards Metal and Flexible, 3rd Edition

UNDERWRITERS LABORATORIES (UL)

UL 1449	(2014) Surge Protective Devices
UL 506	(2008; Reprint Oct 2013) Specialty Transformers
UL 508A	(2013; Reprint Jan 2014) Industrial Control Panels
UL 916	(2007; Reprint Aug 2014) Standard for Energy Management Equipment

1.2 DEFINITIONS

A. DDC: Direct digital control.

B. I/O: Input/output.

C. LonWorks: A control network technology platform for designing and implementing interoperable control devices and networks.

D. MS/TP: Master slave/token passing.

F. PID: Proportional plus integral plus derivative.

G. RTD: Resistance temperature detector.

H. RTC: Real time clock.

I. BAS: Building Automation System.

J. NRC: Network Router/Controller.

K. SDCU: Stand Alone Digital Control Units.

L. APW: Administration and Programming Workstation.

M. WOW: Web-Based Operator Workstation.

N. ODBC: Open Data Base Connectivity.

1.3 SYSTEM PERFORMANCE

A. Comply with the following performance requirements:

1. Object Command: Reaction time of less than two seconds between operator command of a binary object and device reaction.
2. Object Scan: Transmit change of state and change of analog values to control units or workstation within six seconds.
3. Alarm Response Time: Annunciate alarm at workstation within 45 seconds. Multiple workstations must receive alarms within five seconds of each other.
4. Program Execution Frequency: Run capability of applications as often as five seconds, but selected consistent with mechanical process under control.
5. Performance: Programmable controllers shall execute DDC PID control loops, and scan and update process values and outputs at least once per second.
6. Reporting Accuracy and Stability of Control: Report values and maintain measured variables within tolerances as follows:
   a. Water Temperature: Plus or minus 1 deg F (0.5 deg C).
   b. Water Flow: Plus or minus 5 percent of full scale.
   c. Water Pressure: Plus or minus 2 percent of full scale.
   d. Space Temperature: Plus or minus 1 deg F (0.5 deg C).
   e. Ducted Air Temperature: Plus or minus 1 deg F (0.5 deg C).
   f. Outside Air Temperature: Plus or minus 2 deg F (1.0 deg C).
   g. Dew Point Temperature: Plus or minus 3 deg F (1.5 deg C).
   h. Temperature Differential: Plus or minus 0.25 deg F (0.15 deg C).
   i. Relative Humidity: Plus or minus 5 percent.
   j. Airflow (Pressurized Spaces): Plus or minus 3 percent of full scale.
   k. Airflow (Measuring Stations): Plus or minus 5 percent of full scale.
   l. Airflow (Terminal): Plus or minus 10 percent of full scale.

m. Air Pressure (Space): Plus or minus 0.01-inch wg (2.5 Pa).

n. Air Pressure (Ducts): Plus or minus 0.1-inch wg (25 Pa).

o. Carbon Monoxide: Plus or minus 5 percent of reading.

p. Carbon Dioxide: Plus or minus 50 ppm.

q. Electrical: Plus or minus 5 percent of reading.

1.4 SUBMITTALS

A. General: Submit the following in accordance with Division 01 and Division 23

1.5 ACTION SUBMITTALS

A. Shop Drawings: Contractor shall provide shop drawings or other submittals on all hardware, software, and installation to be provided. No work may begin on any segment of this project until submittals have been successfully reviewed for conformity with the design intent. When manufacturer's cut sheets apply to a product series rather than specific products, the data specifically applicable to the project shall be highlighted or clearly indicated by other means. Each submitted piece of literature and drawings shall clearly reference the specification and/or drawing that the submittal is to cover. General catalogs shall not be accepted as cut sheets to fulfill submittal requirements. Submittals shall include:

1. Direct Digital Control System Hardware:

a. A complete bill of materials of equipment to be used indicating quantity, manufacturer, model number, and other relevant technical data.

b. Manufacturer's description and technical data, such as performance curves, product specification sheets, and installation/maintenance instructions for the items listed below and other relevant items not listed below:

1) Direct Digital controller (controller panels).
2) Transducers/Transmitters.
3) Sensors (including accuracy data).
4) Actuators.
5) Valves.
6) Relays/Switches.
7) Control Panels.
8) Power Supply.
9) Batteries.
10) Wiring.

c. Wiring diagrams and layouts for each control panel. Show all termination numbers

d. Schematic diagrams for all field sensors and controllers. Provide floor plans of all sensor locations and control hardware.

2. Controlled Systems:

a. A schematic diagram of each controlled system. The schematics shall have all control points labeled with point names shown or listed. The schematics shall graphically show the location of all control elements in the system.

b. A schematic wiring diagram for each controlled system. Each schematic shall have all elements labeled. Where a control element is the same as that shown on the control system schematic, it shall be labeled with the same name. All terminals shall be labeled.

c. An instrumentation list for each controlled system. Each element of the controlled system shall be listed in table format. The table shall show element name, type of device, manufacturer, model number and product data sheet number.

d. A mounting, wiring, and routing plan-view drawing. The drawing shall be done in 1/4 inch scale. The design shall take into account HVAC, electrical and other systems' design and elevation requirements. The drawing shall show the specific location of all concrete pads and bases and any special wall bracing for panels to accommodate this work.

e. A complete description of the operation of the control system, including sequences of operation. The description shall include and reference a schematic diagram of the controlled system.

f. A point list for each system controller including both inputs and outputs (I/O), point number, the controlled device associated with the I/O point, and the location of the I/O device. Software flag points, alarm points, etc.

3. A BACnet Protocol Implementation Conformance Statement (PICS) for each type of controller and operator interface included in the submittal.

1.6 CLOSEOUT SUBMITTALS

A. Operations and Maintenance Data:

1. Operation and Maintenance (O & M) Manual. This shall include as-built versions of the submittal product data. In addition to the information required for submittals, the O & M manual shall include:

a. Names, addresses, and 24-hour telephone numbers of contractors installing equipment and the control systems and service representatives of each.

b. Operators Manual with procedures for operating the control systems, including logging on/off, alarm handling, producing point reports, trending data, overriding computer control, and changing set points and other variables.

c. One set of Programming Manuals with a description of the programming language (including syntax), statement descriptions (including algorithms and calculations used), point database creation and modification, program creation and modification, and use of the editor.

d. Engineering, Installation and Maintenance Manual(s) that explain how to design and install new points, panels, and the hardware; preventive maintenance and calibration procedures; how to debug hardware problems; and how to repair or replace hardware.

e. A listing and documentation of all custom software created using the programming language, including the set points, tuning parameters, and object database. One set of magnetic/optical media containing files of the software and database also shall be provided.

f. One set of digital media containing files of the software and database also shall be provided.

g. A list of recommended spare parts with part numbers and suppliers.

h. Complete original issue documentation, installation, and maintenance information for all third-party hardware provided, including computer equipment and sensors.

i. Complete original issue digital medias for all software provided, including operating systems, programming language, operator workstation software, and graphics software.

j. Licenses, guarantees, and warranty documents for all equipment and systems.

k. Recommended preventive maintenance procedures for all system components, including a schedule of tasks (inspection, cleaning, calibration, etc.), time between tasks, and task descriptions.

B. Project Record Documents: Upon completion of installation, submit three copies of record (asbuilt)documents. The documents shall be submitted for approval prior to final completion and shall include:

1. Project Record Drawings. These shall be as-built versions of the submittal shop drawings. One set of digital media including CAD, .DWG, or .DXF drawing files also shall be provided.

2. Final Field Quality Control Test Reports:

3. Include locations of device on Record Drawings including addresses.

1.7 QUALITY ASSURANCE

A. Comply with Codes and Standards listed in Paragraph 1.1.

B. The BAS system shall be designed and installed, commissioned and serviced by manufacturer employed, factory trained personnel. Manufacturer shall have an in-place support facility with 40 miles of the site with technical staff, spare parts inventory and necessary test and diagnostic equipment. Distributors or licensed installing contractors are not acceptable.

C. The manufacturer shall provide on site, experienced technicians for this work, responsible for direct supervision of the design, installation, start up and commissioning of the BAS.

D. The contractor shall be regularly engaged in the manufacturing, installation and maintenance of BAS systems and shall have a minimum of ten (10) years of demonstrated technical expertise and experience in the manufacture, installation and maintenance of BAS systems similar in size and complexity to this project. A maintained service organization consisting of at least ten (10) competent servicemen for a period of not less than ten years and provide a list of 10 projects, similar in size and scope to this project, completed within the last five years.

E. Materials and equipment shall be the catalogued products of manufacturers regularly engaged in production and installation of automatic temperature control systems and shall be manufacturer's latest standard design and complies with the specification requirements.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Factory-Mounted Components: Where control devices specified in this Section are indicated to be factory mounted on equipment, arrange for shipping of control devices to equipment manufacturer.

B. System Software: Update all devices to latest version of software at Project completion.

1.9 COORDINATION

A. Coordinate location of thermostats, humidistats, and other exposed control sensors with plans and room details before installation.

B. Coordinate wiring of equipment with Division 28 and Division 26 to achieve compatibility of communication interfaces.

C. Coordinate supply of conditioned electrical branch circuits for control units.

D. Coordinate equipment with Division 26 Section "Enclosed Controllers" to achieve compatibility with starter coils and annunciation devices.

E. Refer to other Division 23 sections for installation of instrument wells, valve bodies, and dampers in mechanical systems.

F. Provide the following electrical work as work of this section, complying with requirements of applicable Division 26 and 27 sections:

1. Control wiring between field-installed controls, indicating devices, and unit control panels consistent with ANSI/TIA/EIA-862.
2. Power wiring for DDC controllers and all other control system components. Provide service from spare 20A circuit breakers in nearest power panel.

1.10 EXTRA MATERIAL

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents. One replacement

relay mechanism for each unique damper motor, valve motor, controller, thermostat, positioning relay.

1.11 WARRANTY

A. Warrant all work as follows:

1. Labor and materials for the control system specified shall be warranted free from defects for a period of 12 months after final completion and acceptance. Control system failures during the warranty period shall be adjusted, repaired, or replaced at no additional cost or reduction in service to the owner. The contractor shall respond to the owner's requires for warranty service within 24 hours during normal business hours.
2. All work shall have a single warranty date, even when the owner has received beneficial use due to an early system start-up. If the work specified is split into multiple contracts or a multi-phase contract, then each contract or phase shall have a separate warranty start date and period.
3. At the end of the final start-up, testing, and commissioning phase, if equipment and systems are operating satisfactorily to the engineer, the engineer shall sign certificates certifying that the control system's operation has been tested and accepted in accordance with the terms of this specification. The date of acceptance shall be the start of warranty.
5. Exception: The contractor shall not be required to warrant reused devices, except for those that have been rebuilt and/or repaired. The contractor shall warrant all installation labor and materials, however, and shall demonstrate that all reused devices are in operable condition at the time of engineer's acceptance.

1.11 RELATED SECTIONS

A. See also Section 23 09 53 Space Temperature Controls and Section 23 52 49 for additional controls related requirements.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Manufacturers: Subject to compliance with requirements, provide all control components compatible with the existing BAS system by:

1. Schneider Electric by Alpha Controls & Services LLC
2. DisTech Controls

B. Installers: The control system shall be installed by a branch or franchise office of an acceptable manufacturer. Manufacturers other than those listed above, must be pre-approved for substitution during bidding.

C. All products used in this project installation shall be new and currently under manufacture and shall have been applied in similar installations for a minimum of two years. Do not use this installation as a product test side unless explicitly approved in writing by an Owner's representative. Spare parts shall be available for at least five years after completion of this contract.

2.2 COMMUNICATION

A. General:

1. The Building Automation System (BAS) shall consist of a family of Standalone Digital Control Units (SDCUs) connecting to the existing Tridium JACE Niagara Control System to provide control, alarm detection, scheduling, reporting and information management for the entire facility.

B. Support For Open Systems Protocols:

1. The BAS design must include solutions for the integration of the following "open systems" protocols: LonTalk, Modbus, BACNet and digital data communication to third party microprocessors such as boiler plant controllers, fire panels and variable frequency drives (VFDs).
2. The system shall also provide the ability to program custom ASCII communication drivers that will reside in a LonWorks Gateway, for communication to third party systems and devices. These drivers will provide real time monitoring and control of the third party systems. Once programmed, these data points shall be monitored and controlled in exactly the same manner as native BAS data points.

2.3 STANDALONE DIGITAL CONTROL UNITS (SDCUS)

A. General:

1. Standalone Digital Control Units shall provide control of HVAC, including boilers and other mechanical equipment. Each controller shall be fully programmable, contain its own control programs and will continue to operate in the event of a failure or communication loss to its associated NRC.

B. Memory:

1. Both the operating system of the controller, plus the application program for the controller, shall be stored in non-volatile, FLASH memory. Controllers shall contain enough memory for the current application, plus required history logging, plus a minimum of 20% additional free memory.

C. Communication Ports:

1. SDCUs shall have RS-485 and Ethernet communication ports to the existing BAS.

D. Input/Output:

1. Each SDCU shall have enough inputs and outputs to meet the application's required points. Each SDCU shall support universal inputs, whereas any input may be software defined as:

a. Digital Inputs for status/alarm contacts.

b. Counter Inputs for summing pulses from meters.

c. Thermistor Inputs for measuring temperatures in space, ducts and thermowells.

d. Analog inputs for pressure, humidity, flow and position measurements. 2. SDCU's must support both digital and analog output types:

a. Digital Outputs for on/off equipment control.

b. Analog Outputs for valve and damper position control, and capacity control of primary equipment.

E. Expandability:

1. For larger controllers (16 base inputs and up), provide input and output expansion through the use of plug-in modules. At least two I/O modules must be capable of being added to the base SDCU.

F. Hardware Override Switches:

1. All digital outputs on air handling unit controllers shall include three position manual override switches to allow selection of the ON, OFF, or AUTO output state. These switches shall be built into the unit and shall provide feedback to the controller so that the position of the override switch can be obtained through software. In addition each analog output on air handling unit controllers shall be equipped with an override potentiometer to allow manual

adjustment of the analog output signal over its full range, when the 3 position manual override switch is placed in the ON position.

H. Networking:

1. Each SDCU will be able to exchange information on a peer to peer basis with other Standalone Digital Control Units, according to the BACnet MS/TP protocol. Each SDCU shall be capable of storing and referencing global variables (on the LAN) with or without any workstations online. Each SDCU shall be able to have its program viewed and/or enabled/disabled through a workstation connected to an NRC.

I. Indicator Lamps:

1. SDCUs will have as a minimum, LED indication of CPU status, and field bus status.

J. Real Time Clock (RTC):

1. All SDCUs shall have a real time clock in either hardware or software. The accuracy shall be within 10 seconds per day. The RTC shall provide the following information: time of day, day, month, year, and day of week. Each SDCU shall receive a signal, every hour, over the network from the NRC, which synchronizes all SDCU real time clocks.

K. Automatic Restart After Power Failure:

1. Upon restoration of power, the SDCU shall automatically and without human intervention, update all monitored functions, resume operation based on current, synchronized time and status, and implement special start-up strategies as required.

L. Battery Back Up:

1. All SDCUs shall store all programming in non-volatile FLASH memory. All SDCUs except terminal controllers shall include an on-board lithium battery to back up the controller's RAM memory. The battery shall have a shelf life of over 10 years, and provide accumulated backup of all RAM and clock functions for at least 3 years. In the case of a power failure, the SDCU shall first try to restart from the RAM memory. If that memory is corrupted or unusable, then the SDCU shall restart itself from its application program stored in its FLASH memory.

M. Software – General:

1. The SDCU shall contain FLASH memory to store both the resident operating system AND the application software. There will be no restrictions placed on the type of application programs in the system. Each SDCU shall be capable of parallel processing, executing all control programs simultaneously. Any program may affect the operation of any other program. Each program shall have the full access of all I/O facilities of the processor. This execution of control function shall not be interrupted due to normal user communications including interrogation, program entry, printout of the program for storage, etc.

N. User Programming Language:

1. The application software shall be user programmable, using the same language as that defined for existing Network Router/Controllers.
2. Control Software, Mathematical Functions, and Energy Management Applications must be identical to that which is provided with the Network Router/Controller.

O. History Logging:

1. Each controller shall be capable of LOCALLY logging any input, output, calculated value or other system variable over user defined time intervals ranging from 1 second to 1440 minutes. Any system can be logged in history. A minimum of 1000 values shall be stored in each log. Each log can record either the instantaneous, average, minimum or maximum value of the point. Logged data shall be downloadable to the Operator Workstation for long term archiving based upon user-defined time intervals, or manual command.

P. Alarm Management:

1. For each system point, alarms can be created based on high/low limits or conditional expressions. All alarms will be tested each scan of the SDCU and can result in the display of one or more alarm messages or reports.
2. Up to 8 alarms can be configured for each point in the controller.
3. Alarms will be generated based on their priority. A minimum of 255 priority levels shall be provided.
4. If communication with the Operator Workstation is temporarily interrupted, the alarm will be time-stamped and buffered in the controller. When communications return, the alarm will be transmitted to the Operator Workstation if the point is still in the alarm condition.
5. Alarms must be capable of being routed to any BACnet workstation that conforms to the B-OWS device profile and uses the BACnet/IP protocol.

2.4 GATEWAY TO THIRD-PARTY DEVICES

A. General:

1. Where required, provide a Gateway to interface to non-compatible systems that use the Modbus, BACNet, LonWorks, or other protocol. The Gateway shall communicate directly over Ethernet TCP/IP and a Bacnet twisted-pair network, and shall connect to the building's central Building Controller.

B. Communication Ports:

1. In addition to its on-board Ethernet port, the Gateway shall have at least two serial communications ports for interfaces to third-party systems.

C. Memory:

1. The Gateway shall have enough RAM memory to store all point configuration data, plus required history logging and alarm buffering. Minimum RAM shall be 8MB. The operating system of the gateway must be stored in FLASH non-volatile memory.

D. User Programming Language:

1. The Gateway shall employ the same user programmable application software that NRCs and SDCUs use.
2. Control Software, Mathematical Functions, and Energy Management Applications must be identical to that which is provided with the Network Router/Controller. Gateways that do not have an application programming language will not be accepted.

E. History Logging:

1. Each Gateway shall be capable of LOCALLY logging any input, output, calculated value or other system variable over user defined time intervals ranging from 1 second to 1440 minutes. Any system can be logged in history. A minimum of 1000 values shall be stored in each log. Each log can record either the instantaneous, average, minimum or maximum value of the point. Logged data shall be downloadable to the district Tridium system for long term archiving based upon user-defined time intervals, or manual command.

2.5 INPUT/OUTPUT INTERFACE

A. Provide instrumentation as required for monitoring, control or optimization functions.

B. Hardwired inputs and outputs may tie into the system through SDCU's.

C. All input points and output points shall be protected such that shorting of the point to itself, to another point, or to ground will cause no damage to the controller. All input and output points shall be protected from voltage up to 24 V of any duration, such that contact with this voltage will cause no damage to the controller.

D. Binary inputs shall allow the monitoring of On/Off signals from remote devices. The binary inputs shall provide a wetting current of at least 12 mA to be compatible with commonly available control devices and shall be protected against the effects of contract bounce and noise. Binary inputs shall

sense "dry contact" closure without external power (other than that provided by the controller) being applied.

E. Pulse accumulation input objects. This type of object shall conform to all the requirements of binary input objects and also accept up to 10 pulses per second for pulse accumulation. F. Analog inputs shall allow the monitoring of low-voltage (0 to 10 VDC), current (4 to 20 mA), or resistance signals (thermistor, RTD). Analog inputs shall be compatible with – and field configurable to – commonly available sensing devices.

F. Binary outputs shall provide for On/Off operation or a pulsed low-voltage signal for pulse width modulation control. Binary outputs on building and custom application controllers shall have three-position (On/Off/Auto) override switches and status lights. Outputs shall be selectable for either normally open or normally closed operation.

G. Analog outputs shall provide a modulating signal for the control of end devices. Outputs shall provide either a 0 to 10 VDC or a 4 to 20 mA signal as required to provide proper control of the output device. Analog outputs on building or custom application controllers shall have status lights and a two-position (AUTO/MANUAL) switch and manually adjustable potentiometer for manual override. Analog outputs shall not exhibit a drift of grater than 0.4% of range per year.

H. Tri-State Outputs. Provide tri-state outputs (two coordinated binary outputs) for control of three point floating type electronic actuators without feedback. Use of three-point floating devices shall be limited to zone control and terminal unit control applications (VAV terminal units, duct mounted heating coils, zone dampers, radiation etc.). Control algorithms shall run the zone actuator to one end of its stroke once every 24 hours for verification of operator tracking.

I. Input/Output points shall be the universal type, i.e., controller input or output may be designated (in software) as either a binary or analog type point with appropriate properties. Application specific controllers are exempted from this requirement.

J. System Object Capacity. The system size shall be expandable to at least twice the number of input/output objects required for this project. Additional controllers (along with associated devices and wiring) shall be all that is necessary to achieve this capacity requirement. The operator interfaces installed for this project shall not require any hardware additions or software revisions in order to expand the system.

2.6 POWER SUPPLIES AND LINE FILTERING

A. Control transformers shall be UL listed. Furnish Class 2 current-limiting type or furnish over-current protection in both primary and secondary circuits for Class 2 service in accordance with NEC requirements. Limit connected loads to 80% of rated capacity.

1. DC power supply output shall match output current and voltage requirements. Unit shall be full-wave rectifier type with output ripple of 5.0 mV maximum peak-to-peak. Regulation shall be 1.0% line and load combined, with 100-microsecond response time for 50% load changes. Unit shall have built-in over-voltage and over-current protection and shall be able to withstand a 150% current overload for at least three seconds without trip-out or failure.

a. Unit shall operate between 0 deg. C and 50 deg. C (32 deg F and 120 deg F). EM/RF shall meet FCC Class B and VDE 0871 for Class B and MIL STD 810C for shock and vibration.

b. Line voltage units shall be UL recognized and CSA approved.

B. Power Line Filtering:

1. Provide transient voltage and surge suppression for all workstations and controllers either internally or as an external component. Surge protection shall have the following at a minimum:

a. Dielectric strength of 1000 volts minimum.

b. Response time of 10 nanoseconds or less.

c. Transverse mode noise attenuation of 65 dB or greater.

d. Common mode noise attenuation of 150 dB or better at 40 Hz to 100 Hz.

2.7 AUXILIARY CONTROL DEVICES

A. Motorized control dampers, unless otherwise specified elsewhere, shall be as follows:

1. Size dampers so that when wide open the pressure drop is a sufficient amount of its close off pressure drop to shift the characteristics curve to near linear.
2. Control dampers shall be the parallel or opposed blade type.
   a. Outdoor and/or return air mixing dampers and face and bypass (F&BP) dampers shall be parallel blade, arranged to direct airstreams toward each other.
   b. Other modulating dampers shall be the opposed blade type.
   c. Two-position shutoff dampers may be parallel or opposed blade type with blade and side seals.
3. Damper frames shall be 13 gauge galvanized or stainless steel channel or 1/8 inch extruded aluminum with reinforced corner bracing.
4. Damper blades shall not exceed 6 inches in width or 48 inches in length. Blades are to be suitable for medium velocity performance (10 m/s [2000 ft/min]). Blades shall be not less than 14 gauge.
5. Damper shaft bearings shall be as recommended by manufacturer for application, oil impregnated sintered bronze, or better.
6. All blade edges and top, bottom and sides of the frame shall be provided with replaceable butyl rubber or neoprene seals. The blade seals shall provide for a maximum leakage rate of 5 cfm per ft 2 at 5 in. w.g. differential pressure. Provide air foil blades suitable for a wide-open face velocity of 1500 fpm.
7. Individual damper sections shall not be larger than 48 inches x 60 inches). Provide a minimum of one damper actuator per section.
8. Dampers shall have exposed linkages.

B. Electric Damper/Valve Actuators:

1. The actuator shall have mechanical or electronic stall protection to prevent damage to the actuator throughout the rotation of the actuator.
2. For power-failure/safety applications, an internal mechanical, spring-return mechanism shall be built into the actuator housing. Arrange spring return, fail-safe at either the normally open or normally closed position in the event of power failure, control failure, fire or freeze-up protection as indicated on the Drawings.
3. Proportional actuators shall accept a 0 to 10 VCD or 0 to 20 mA control signal and provide a 2 to 10 VDC or 4 to 20 mA operating range.
4. All 24 VAC/VDC actuators shall operate on Class 2 wiring.
5. All non-spring-return actuators shall have an external manual gear release to allow manual positioning of the damper when the actuator is not powered. Spring-return actuators with more than 7 Nm (60 in.-lb) torque capacity shall have a manual crank for this purpose.
6. Actuators to be of sufficient size to operate device safely and within the required range.

C. Control Valves:

1. Control valves shall be two-way or three-way type for two-position or modulating service as shown. Provide valves of standard manufacturer.
2. Provide position indicators.
3. Close-off (differential) Pressure Rating: Valve actuator and trim shall be furnished to provide the following minimum close-off pressure ratings:
   a. Water Valves:
   1) Two-way: 150% of total system (pump) head.

2) Three-way: 300% of pressure differential between ports A and B at design flow or 100% of total system (pump) head.

4. Valves shall be designed to modulate with up to 50 psi pressure differential across the valve.

5. Water and Steam Valves:

a. Sizing Criteria:

1) Select two way valves for liquids to have equal percentage characteristics. Select three-way valves for liquids to have linear characteristics.

2) Maximum 10 feet water pressure drop.

b. Valves 1/2 in. through 2 in. shall be bronze body or cast brass ANSI Class 250, with stainless steel trim spring-loaded, PTFE packing, quick opening for twopositionservice. Two-way valves to have replaceable composition disc or stainless steel ball.

c. Valves 2-1/2 in. and larger shall be cast iron ANSI Class 125 with guided plug and PTFE packing, stainless steel trim.

D. Binary Temperature Devices:

1. Low-voltage space thermostat shall be 24 V, bimetal-operated, mercury-switch type, with either adjustable or fixed anticipation heater, concealed setpoint adjustment 13 deg. C to 30 deg. C (55 deg. F to 85 deg. F) set point range, 1 deg C (2 deg F) maximum differential and vented ABS plastic cover.

2. Line-voltage space thermostat shall be bimetal-actuated, open contact type, or bellows actuated,enclosed, snap-switch type of equivalent solid-state type, with heat anticipator, UL listed for electrical rating, concealed setpoint adjustment, 13 deg. C to 30 deg. C (55 deg F to 85 deg. F) setpoint range, 1 deg. C (2 deg. F) maximum differential, and vented ABS plastic cover.

3. Low-limit thermostats. Low-limit airstream thermostats shall be UL listed, vapor pressure type, with an element of 6 m (20 ft) minimum length. Element shall respond to the lowest temperature sensed by an 30 cm (1 ft) section. The low-limit thermostat shall be manual reset only, but also manually resettable from the DDC system operator's workstation.

E. Temperature Sensors:

1. Temperature sensors shall be Resistance Temperature Device (RTD) or thermistor type. Room sensors shall be +/- 1% accuracy with setpoint adjustment.

2. Duct sensors shall be single point or averaging as shown, +/- 0.5% accuracy or +/ -0.25% as required by the application. Averaging sensors shall be a minimum of 5 ft in length per 10 $ft^2$of duct cross section.

3. Immersion sensors shall be provided with a separable stainless steel well. Pressure rating of well is to be consistent with the system pressure in which it is to be installed. The well must withstand the flow velocities in the pipe. 4. Non-Public Spaces: Space sensors shall be equipped with set point adjustment, override digital switch, LCD display, and communication port. Use tamperproof screws to mount covers.

5. Public Spaces and Where Indicated on Drawings: Space sensors shall be a vandal-proof stainless steel plate, recess mounted with tamperproof screws. No setpoint adjustment.

6. Provide matched temperature sensors for differential temperature measurement.

I. Relays:

1. Control relays shall be UL listed plug-in type with dust cover and LED "energized" indicator. Contact rating, configurations, and coil voltage shall be suitable for application.

2. Time delay relays shall be UL listed solid-state plug-in type with adjustable time delay. Delay shall be adjustable +/- 200% (minimum) from set point shown on plans. Contact rating, configuration, and coil voltage shall be suitable for application. Provide NEMA 1 enclosure when not installed in local control panel.

J. Override Timers:

1. Override timers shall be spring-would line voltage, UL Listed, with contact rating and configuration as required by application. Provide 0-to-6-hour calibrated dial unless otherwise specified. Timer shall be suitable for flush mounting on control panel face and located on local control panels or where shown.

K. Current Transmitters:

1. AC current transmitters shall be the self-powered, combination split-core current transformer type with built-in rectifier and high-gain servo amplifier with 4 to 20 mA twowireoutput. Unit ranges shall be 10 A, 20 A, 50 A, 100 A, 150 A, and 200 A full scale, with internal zero and span adjustment and +/- 1% full-scale accuracy at 500 ohm maximum burden.
2. Transmitter shall meet or exceed ANSI/ISA S50.1 requirements and shall be UL/CSA Recognized
3. Unit shall be split-core type for clamp-on installation on existing wiring.

L. Current Transformers:

1. AC current transformers shall be UL/CSA Recognized and completely encased (except for terminals) in approved plastic materials.
2. Transformers shall be available in various current ratios and shall be selected for +/- 1% accuracy at 5 A full-scale output.
3. Transformers shall be fixed-core or split-core type for installation on new or existing wiring, respectively.

M. Voltage Transmitters:

1. AC voltage transmitters shall be self-powered single-loop (two-wire) type, 4 to 20 mA output with zero and span adjustment.
2. Ranges shall include 100 to 130 VAC, 200 to 250 VAC, 250 to 330 VAC, and 400 to 600 VAC full-scale, adjustable, with +/- 1% full-scale accuracy with 500 ohm maximum burden.
3. Transmitters shall be UL/CSA Recognized at 600 VAC rating and meet or exceed ANSI/ISA S50.1 requirements.

N. Voltage Transformers:

1. AC voltage transformers shall be UL/CSA Recognized, 600 VAC rated, complete with built-in fuse protection.
2. Transformers shall be suitable for ambient temperatures of 4 deg. C to 55 deg. C (40 deg. F to 130 deg. F) and shall provide +/- .5% accuracy at 24 VAC and a 5 VA load.
3. Windings (except for terminals) shall be completely enclosed with metal or plastic material.

O. Power Monitors:

1. Power monitors shall be the three-phase type furnished with three-phase disconnect/ shorting switch assembly, UL Listed voltage transformers, and UL Listed split-core current transformers.
2. They shall provide a selectable rate pulse output for kWh reading and a 4 to 20 mA output for kW reading. They shall operate with 5 A current inputs with a maximum error of +/- 2% at 1.0 power factor or +/- 2.5% at 0.5 power factor.

P. Current Switches:

1. Current-operated switches shall be self-powered, solid-state with adjustable trip current. The switches shall be selected to match the current of the application and output requirements of the DDC system.

Q. Pressure Transducers:

1. Transducer shall have linear output signal. Zero and span shall be field adjustable.
2. Transducer sensing elements shall withstand continuous operating conditions of positive or negative pressure 50% greater than calibrated span without damage.

3. Pressure transducer shall have stainless steel diaphragm construction, proof pressure of 150 psi minimum. Transducer shall be complete with 4 to 20 mA output, required mounting brackets, and block and bleed valves.

4. Differential pressure transducer shall have stainless steel diaphragm construction, proof pressure of 150 psi minimum. Over range limit (differential pressure) and maximum static pressure shall be 300 psi. Transducer shall be complete with 4 to 20 mA output, required mounting brackets, and five-valve manifold.

W. Local Control Panels:

1. All indoor control cabinets shall be fully enclosed NEMA 1 construction with (hinged door) key-lock latch and removable subpanels. A single key shall be common to all field panels and subpanels.

2. Interconnections between internal and face-mounted devices shall be prewired with color-coded stranded conductors neatly installed in plastic troughs and/or tie-wrapped. Terminals for field connections shall be UL listed for 600 volt service, individually identified per control/interlock drawings, with adequate clearance or field wiring. Control terminations for field connection shall be individually identified per control drawings.

3. Provide On/OFF power switch with overcurrent protection for control power sources to each local panel.

2.8 WIRING AND RACEWAYS

A. General: Provide copper wiring, plenum cable, and raceways as specified in the applicable sections of Divisions 26, 27, and 28.

B. All insulated wire to be copper conductors, UL labeled for 90 deg. C minimum service.

PART 3 - EXECUTION

3.1 SECTION INCLUDES

A. Examination.

B. Protection.

C. Coordination.

D. General Workmanship.

E. Field Quality Control.

F. Existing Equipment.

G. Wiring.

H. Communication Wiring.

I. Fiber Optic Cable.

J. Installation of Sensors.

K. Flow Switch Installation.

L. Actuators.

M. Warning Labels.

N. Identification of Hardware and Wiring.

O. Controllers.

P. Programming.

Q. Control System Checkout and Testing.

R. Control System Demonstration and Acceptance.

S. Cleaning.

T. Training.

3.2 EXAMINATION

A. The project plans shall be thoroughly examined for control device and equipment requirements. Any discrepancies, conflicts, or omissions shall be reported to the architect/engineer for resolution before rough-in work is started.

B. The contractor shall inspect the site to verify that equipment may be installed as shown. Any discrepancies, conflicts, or omissions shall be reported to the engineer for resolution before rough-in work is started.

C. The contractor shall examine the drawings and specifications for other parts of the work. If head room or space conditions appear inadequate-or if any discrepancies occur between the plans and the contractor's work and the plans and the work of others-the contractor shall report these discrepancies to the engineer and shall obtain written instructions for any changes necessary to accommodate the contractor's work with the work of others. Any changes in the work covered by this specification made necessary by the failure or neglect of the contractor to report such discrepancies shall be made by – and at the expense of – the contractor.

3.3 PROTECTION

A. The contractor shall protect all work and material from damage by his/her work or employees and shall be liable for all damage thus caused.

B. The contractor shall be responsible for his/her work and equipment until finally inspected, tested, and accepted. The contractor shall protect any material that is not immediately installed. The contractor shall close all open ends of work with temporary covers or plugs during storage and construction to prevent entry of foreign objects.

3.4 COORDINATION

A. Site:

1. Where the mechanical work will be installed in close proximity to, or will interfere with, work of other trades, the contractor shall assist the working out space conditions to make a satisfactory adjustment. If the contractor installs his/her work before coordinating with other trades, so as to cause any interference with work of other trades, the contractor shall make the necessary changes in his/her work to correct the condition without extra charge.
2. Coordinate and schedule work with all other work in the same area, or with work that is dependent upon other work, to facilitate mutual progress.

B. Submittals. Refer to the "Submittals" article in Part 1 of this specification for requirements.

C. Test and Balance:

1. The contractor shall furnish a single set of all tools necessary to interface to the control system for test and balance purposes.
2. The contractor shall provide training in the use of these tools. This training will be planned for a minimum of 4 hours.
3. In addition, the contractor shall provide a qualified technician to assist in the test and balance process, until the first 20 terminal units are balanced.
4. The tools used during the test and balance process will be returned at the completion of the testing and balancing.

D. Coordination with controls specified in other sections or divisions. Other sections and/or divisions of this specification include controls and control devices that are to be part of or interfaced to the control system specified in this section. These controls shall be integrated into the system and coordinated by the contractor as follows:

1. All communication media and equipment shall be provided as specified in Part 2, "Communication" of this specification.

2. Each supplier of a controls product is responsible for the configuration, programming, startup and testing of that product to meet the sequences of operation described in this section.
3. The Contractor shall coordinate and resolve any incompatibility issues that arise between the control products provided under this section and those provided under other sections or divisions of the specification.
4. The contractor is responsible for providing all controls described in the contract documents regardless of where within the contract documents these controls are described.
5. The contractor is responsible for the interface of control products provided by multiple suppliers regardless of where this interface is described within the contract documents.

3.5 GENERAL WORKMANSHIP

A. Install equipment, piping, and wiring/raceway parallel to building lines (i.e., horizontal, vertical, and parallel to walls) wherever possible.

B. Provide sufficient slack and flexible connections to allow for vibration of piping and equipment.

C. Install all equipment in readily accessible locations as defined by Chapter 1, Article 100, Part A of the National Electrical Code (NEC).

D. Verify integrity of all wiring to ensure continuity and freedom from shorts and grounds.

E. All equipment, installation, and wiring shall comply with acceptable industry specifications and standards for performance, reliability, and compatibility and be executed in strict adherence to local codes and standard practices.

3.6 FIELD QUALITY CONTROL

A. All work, materials, and equipment shall comply with the rules and regulations of applicable local, state, and federal codes and ordinances as identified in Part 1 of this specification.

B. Contractor shall continually monitor the field installation for code compliance and quality of workmanship.

C. Contractor shall have work inspected by local and/or state authorities having jurisdiction over the work.

3.7 EXISTING EQUIPMENT

A. The contractor is not responsible for the repairs or replacement of existing energy equipment and systems, valves, dampers, or actuators that are not required to be replaced as part of the project. Should the contractor find existing equipment that requires maintenance, the district is to be notified immediately. The contractor is responsible for any software upgrades or hardware expansion of the existing Niagara Control system that is required for the new and replaced equipment.

3.8 WIRING

A. All control and interlock wiring shall comply with national and local electrical codes, Division 26, 27 and 28 of this specification. Where the requirements of this section differ from those in Division 26, the requirements of this section shall take precedence.

B. All NEC Class 1 (line voltage) wiring shall be UL Listed in approved raceway according to NEC and Division 26 requirements.

C. All DDC controllers shall have a dedicated 20 amp circuit. Where convenient more than one controller may be fed from the same 20 amp circuit.

D. DDC controller outputs shall be wired normally closed for all equipment with status inputs. Outputs shall be wired normally open for all equipment without status inputs.

E. All low-voltage wiring shall meet NEC Class 2 requirements. (Low-voltage power circuits shall be subfused when required to meet Class 2 current limit.)

1. All DDC controller input/output device wiring is to be run in metallic raceway with the following exceptions:

a. Suspended Ceilings – If such ceiling is a return or supply plenum the cable shall be plenum rated.

b. Chases.

c. Junction Boxes – Mounted within feet of the device. BX or similar may be used between device and junction box.

2. All devices utilizing modular type connectors will utilize factory fabricated cables or a combination of factory fabricated cables and terminal blocks. Field fabrication of modular plug terminated cables is not acceptable.

3. Any fittings, junction boxes, or raceway installed outside will be rated for outside use.

4. All treaded connectors are to be fitted with plastic bushings.

5. Any raceway, through, or junction box containing input/output wiring and/or communications cables shall be dedicated for such use, containing no conductors 40 volts or higher.

F. Do not install Class 2 wiring in raceway containing Class 1 wiring. Boxes and panels containing high-voltage wiring and equipment may not be used for low-voltage wiring except for the purpose of interfacing the two (e.g., relays and transformers).

G. Where Class 2 wiring is run exposed, wiring is to be run parallel along a surface or perpendicular to it and neatly tied at 3 m (10 ft.) intervals.

H. Where plenum cables are used without raceway, they shall be supported from or anchored to structural members. Cables shall not be supported by or anchored to ductwork, electrical raceways, piping, or ceiling suspension systems. I. All wire-to-device connections shall be made at a terminal block or terminal strip. All wire-to-wire connections shall be at a terminal block.

J. All wiring within enclosures shall be neatly bundled and anchored to permit access and prevent restriction to devices and terminals.

K. Maximum allowable voltage for control wiring shall be 120 V. If only high voltages are available, the contractor shall provide step-down transformers.

L. All wiring shall be installed as continuous lengths, with no splices permitted between termination points.

M. Install plenum wiring in sleeves where it passes through walls and floors. Maintain fire rating at all penetrations.

N. Size of raceway and size and type of wire shall be the responsibility of the contractor, in keeping with the manufacturer's recommendations and NEC requirement's except as noted elsewhere.

O. Include one pull string in each raceway 2.5 cm (1 in.) or larger.

P. Use coded conductors throughout with conductors of different colors.

Q. Control and status relays are to be located in designated enclosures only. These enclosures include packaged equipment control panel enclosures unless they also contain Class 1 starters.

R. Conceal all raceways, except within mechanical, electrical, or service rooms. Install raceway to maintain a minimum clearance of 15 cm (6 in.) from high-temperature equipment (e.g., steam pipes or flues).

S. Secure raceways with raceway clamps fastened to the structure and spaced according to code requirements. Raceways and pull boxes may not be hung on flexible duct strap or tie rods. Raceways may not be run on or attached to ductwork.

T. Adhere to this specification's Division 26 requirements where raceway crosses building expansion joints.

U. Install insulated bushings on all raceway ends and openings to enclosures. Seal top end of all vertical raceways.

V. The Contractor shall terminate all control and/or interlock wiring and shall maintain updated (as-built) wiring diagrams with terminations identified at the job site.

W. Flexible metal raceways and liquid-tight, flexible metal raceways shall not exceed 1 m (3 ft.) in length and shall be supported at each end. Flexible metal raceway less than ½ inc. electrical trade size shall not be used. In areas exposed to moisture, including chiller and boiler rooms, liquid-tight, flexible metal raceways shall be used.

X. Raceway must be rigidly installed, adequately supported, properly reamed at both ends, and left clean and free of obstructions. Raceway sections shall be joined with couplings (according to code). Terminations must be made with fittings at boxes, and ends not terminating in boxes shall have bushings installed.

3.9 COMMUNICATION WIRING

A. The contractor shall adhere to the items listed in the "Wiring" article in Part 3 of the specification.

B. All cabling shall be installed in a neat and workmanlike manner. Follow manufacturer's installation recommendations for all communication cabling.

C. Do not install communication wiring in raceway and enclosures containing Class 1 or other Class 2 wiring.

D. Maximum pulling, tension, and bend radius for cable installation, as specified by the cable manufacturer, shall not be exceeded during installation.

E. Contractor shall verify the integrity of the entire network following the cable installation. Use appropriate test measures for each particular cable.

F. When a cable enters or exits a building, a lightning arrestor must be installed between the lines and ground. The lighting arrestor shall be installed according to the manufacturer's instructions.

G. All runs of communication wiring shall be unspliced length when that length is commercially available.

H. All communication wiring shall be labeled to indicate origination and destination data.

I. Grounding of coaxial cable shall be in accordance with NEC regulations article on "Communications Circuits, Cable, and Protector Grounding."

3.10 FIBER OPTIC CABLE SYSTEM

A. Maximum pulling tensions as specified by the cable manufacturer shall not be exceeded during installation. Post-installation residual cable tension shall be within cable manufacturer's specifications.

B. All cabling and associated components shall be installed in accordance with manufacturers' instructions. Minimum cable and unjacketed fiber bend radii, as specified by cable manufacturer, shall be maintained.

3.11 INSTALLATION OF SENSORS

A. Install sensors in accordance with manufacturer's recommendations.

B. Mount sensor rigidly and adequately for the environment within which the sensor operates.

C. Room temperature sensors shall be installed on concealed junction boxes properly supported by the wall framing. If to be mounted on existing walls, surface-mount temperature sensors in locations indicated on plans, and conceal control wiring in surface-mounted raceway or wiremold.

D. All wires attached to sensors shall be air sealed in their raceways or in the wall to stop air transmitted from other areas affecting sensor readings.

E. Sensors used in mixing plenums and hot and cold decks shall be of the averaging type. Averaging sensors shall be installed in a serpentine manner vertically across the duct. Each bend shall be supported with a capillary clip.

F. Low-limit sensors used in mixing plenums shall be installed in a serpentine manner horizontally across duct. Each bend shall be supported with a capillary clip. Provide 1 ft of sensing element for each 1 ft^2 of coil area.

G. All pipe-mounted temperature sensors shall be installed in wells. Install all liquid temperature sensors with heat-conducting fluid in thermal wells.

H. Install outdoor air temperature sensors on north wall, complete with sun shield at designated location.

I. Differential Air Static Pressure:

1. Supply Duct Static Pressure: Pipe the high-pressure tap to the duct using a pitot tube. Pipe the low-pressure port to a tee in the high-pressure tap tubing of the corresponding building static pressure sensor (if applicable) or to the location of the duct high-pressure tap and leave open to the plenum.
2. Return Duct Static Pressure: Pipe the high-pressure tap to the duct using a pitot tube. Pipe the low-pressure port to a tee in the low-pressure tap tubing of the corresponding building static pressure sensor.
3. The piping to the pressure ports on all pressure transducers shall contain a capped test port located adjacent to the transducer.
4. All pressure transducers, other than those controlling VAV boxes, shall be located in field device panels, not on the equipment monitored or on ductwork. Mount transducers in a location accessible for service without use of ladders or special equipment.
5. All air and water differential pressure sensors shall have gauge tees mounted adjacent to the taps. Water gauges shall also have shutoff valves installed before the tee.

3.12 FLOW SWITCH INSTALLATION

A. Use correct paddle for pipe diameter.

B. Adjust flow switch in accordance with manufacturer's instructions.

3.13 ACTUATORS

A. Mount and link control damper actuators according to manufacturer's instructions.

1. To compress seals when spring-return actuators are used on normally closed dampers, power actuator to approximately 5 deg. Open position, manually close the damper, and then tighten the linkage.
2. Check operation of damper/actuator combination to confirm that actuator modulates damper smoothly throughout stroke to both open and closed positions.
3. Provide all mounting hardware and linkages for actuator installation.

B. Electric/Electronic:

1. Dampers: actuators shall be direct-mounted on damper shaft or jackshaft unless shown as a linkage installation. For low-leakage dampers with seals, the actuator shall be mounted with a minimum 5 deg. Available for tightening the damper seals. Actuators shall be mounted following manufacturer's recommendations.
2. Valves: Actuators shall be connected to valves with adapters approved by the actuator manufacturer. Actuators and adapters shall be mounted following the actuator manufacturer's recommendations.

3.14 WARNING LABELS

A. Permanent warning labels shall be affixed to all equipment that can be automatically started by the DDC system.

1. Labels shall use white lettering (12-point type or larger) on a red background.
2. Warning labels shall read as follows:

C A U T I O N

This equipment is operating under automatic control and may start or stop at any time without warning. Switch disconnect to "Off" position before servicing.

3.15 IDENTIFICATION OF HARDWARE AND WIRING

A. All wiring and cabling, including that within factory-fabricated panels, shall be labeled at each end within 5 cm (2 in.) of termination with the DDC address or termination number.

B. Permanently label or code each point of field terminal strips to show the instrument or item served.

C. Identify control panels with minimum 1 cm (1/2 in.) letters on laminated plastic nameplates.

D. Identify all other control components with permanent labels. All plug-in components shall be labeled such that removal of the component does not remove the label.

E. Identify room sensors relating to terminal box or valves with nameplates.

F. Manufacturers' nameplates and UL or CSA labels are to be visible and legible after equipment is installed.

G. Identifiers shall match record documents.

3.16 CONTROLLERS

A. Provide a separate controller for each RTU or other HVAC system. A DDC controller may control more than one system provided that all points associated with the system are assigned to the same DDC controller. Points used for control loop reset, such as outside air or space temperature, are exempt from this requirement.

B. Building Controllers and Custom Application Controller shall be selected to provide a minimum of 15% spare I/O point capacity for each point type found at each location. If input points are not universal, 15% of each type is required. If outputs are not universal, 15% of each type is required. A minimum of one spare is required for each type of point used.

1. Future use of spare capacity shall require providing the field device, field wiring, point database definition, and custom software. No additional controller boards or point modules shall be required to implement use of these spare points.

3.17 PROGRAMMING

A. Provide sufficient internal memory for the specified sequences of operation and trend logging. There shall be a minimum of 25% of available memory free for future use.

B. Point Naming: System point names shall be modular in design, allowing easy operator interface without the use of a written point index. Use the following naming convention:

AA.BBB.CCDDE where:

AA is used to designate the location of the point within the building, such as mechanical room,

wing, or level or the building itself in a multi-building environment.

BBB is used to designate the mechanical system with which the point is associated (e.g., A01, HTG, CLG, LTG).

CC represents the equipment or material referenced (e.g., SF for supply fan, RW for return water, EA for exhaust air, ZN for zone).

D or DD may be used for clarification or for identification if more than one CC exists (e.g., SF10, ZNB).

E represents the action or state of the equipment or medium (e.g., T for temperature, H for humidity, C for control, S for status, D for damper control, I for current).

C. Software Programming:

1. Provide programming for the system and adhere to district sequences of operation. All system programming necessary for the operation of the system, but not pertaining to the district Tridium system, also shall be provided by the contractor.

2. Occupancy Adjustments: When requested by the Owner within one year of the date of Substantial Completion, provide on-site assistance in reprogramming of the BAS to suit actual occupied conditions. Provide up to three visits to the site of this purpose.

3. Room numbers shall match existing/final room numbering plan upon the completion of the project. The room numbers indicated on the drawings are not necessarily the final room numbers and may be subject to change by the Owner.

3.18 CONTROL SYSTEM CHECKOUT AND TESTING

A. Start-up Testing: All testing listed in this article shall be performed by the contractor and shall make up part of the necessary verification of an operating control system. This testing shall be completed before the owner's representative is notified of the system demonstration.

1. The contractor shall furnish all labor and test apparatus required to calibrate and prepare for service of all instruments, controls and accessory equipment furnished under this specification.
2. Verify that all control wiring is properly connected and free of all shorts and ground faults. Verify that terminations are tight.
3. Enable the control systems and verify calibration of all input devices individually. Perform calibration procedures according to manufacturer's recommendations.
4. Verify that all binary output devices (relays, solenoid valves, two-position actuators and control valves, magnetic starters, etc.) operate properly and that the normal positions are correct.
5. Verify that all analog output devices (I/Ps, actuators, etc.) are functional, that start and span are correct, and that direction and normal positions are correct. The contractor shall check all control valves and automatic dampers to ensure proper actions and closure. The contractor shall make any necessary adjustments to valve stem and damper blade travel.
6. Verify that the system operation adheres to the sequences of operation. Simulate and observe all modes of operation by overriding and varying inputs and schedules. Tune all DDC loops and optimum start/stop routines.
7. Alarms and Interlocks:

   a. Check each alarm separately by including an appropriate signal at a value that will trip the alarm.

   b. Interlocks shall be tripped using field contacts to check the logic, as well as to ensure that the fail-safe condition for all actuators is in the proper direction.

   c. Interlock actions shall be tested by simulating alarm conditions to check the initiating value of the variable and interlock action.

3.19 CONTROL SYSTEM DEMONSTRATION AND ACCEPTANCE

A. Demonstration:

1. Prior to acceptance, the control system shall undergo a series of performance tests to verify operation and compliance with this specification. These tests shall occur after the Contractor has completed the installation, started up the system, and performed his/her own tests.
2. The tests described in this section are to be performed in addition to the tests that the contractor performs as a necessary part of the installation, start-up, and debugging process and as specified in the "Control System Checkout and Testing" article in Part 3 of this specification. The engineer will be present to observe and review these tests. The engineer shall be notified at least 10 days in advance of the start of the testing procedures.
3. The demonstration process shall follow that approved in Part 1, "Submittals." The approved checklists and forms shall be completed for all systems as part of the demonstration.
4. The contractor shall provide at least two persons equipped with two-way communication and shall demonstrate actual field operation of each control and sensing point for all modes of operation including day, night, occupied, unoccupied, fire/smoke alarm, seasonal changeover, and power failure modes. The purpose is to demonstrate the calibration, response, and action of every point and system. Any test equipment required to provide the proper operation shall be provided by and operated by the contractor.
5. As each control input and output is checked, a log shall be completed showing the date, technician's initials, and any corrective action taken or needed.
6. Demonstrate compliance with Part 1, "System Performance."
7. Demonstrate compliance with sequences of operation through all modes of operation.
8. Demonstrate complete operation of operator interface.
9. Additionally, the following items shall be demonstrated:
   a. DDC loop response. The contractor shall supply trend data output in a graphical form showing the step response of each DDC loop. The test shall show the loop's response to a change in set point, which represents a change of actuator position of at least 35% of its full range. The sampling rate of the trend shall be from 10 seconds to 3 minutes, depending on the speed of the loop. The trend data shall show for each sample the set point, actuator position, and controlled variable values. Any loop that yields unreasonably under-damped or over-damped control shall required further tuning by the Contractor.
   b. Operational logs for each system that indicate all set points, operating points, valve positions, mode, and equipment status shall be submitted to the architect/engineer. These logs shall cover three 48-hour periods and have a sample frequency of not more than 10 minutes. The logs shall be provided in both printed and disk formats.
10. Any tests that fail to demonstrate the operation of the system shall be repeated at a later date. The contractor shall be responsible for any necessary repairs or revisions to the hardware of software to successfully complete all tests.

B. Acceptance:

1. All tests described in this specification shall have been performed to the satisfaction of both the engineer and owner prior to the acceptance of the control system as meeting the requirements of completion. Any tests that cannot be performed due to circumstances beyond the control of the contractor may be exempt form the completion requirements if state as such in writing by the engineer. Such tests shall then be performed as part of the warranty.
2. The system shall not be accepted until all forms and checklists completed as part of the demonstration are submitted and approved as required in Part 1, "Submittals."

3.20 CLEANING

A. The contractor shall clean up all debris resulting from his/her activities daily. The contractor shall remove all cartons, containers, crates, etc., under his/her control as soon as their contents have been removed. Waste shall be collected and placed in a designated location.

B. At the completion of work in any area, the contractor shall clean all work, equipment, etc, keeping it free from dust, dirt, and debris, etc.

C. At the completion of work, all equipment furnished under this section shall be checked for paint damage, and any factory-finished paint that has been damaged shall be repaired to match the adjacent areas. Any cabinet or enclosure that has been deformed shall be replaced with new material and repainted to match the adjacent areas.

END SECTION 23 09 23

SECTION 23 09 53
SPACE TEMPERATURE CONTROLS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AIR MOVEMENT AND CONTROL ASSOCIATION INTERNATIONAL (AMCA)

AMCA 500-D	(2012) Laboratory Methods of Testing Dampers for Rating

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS (ASHRAE)

ASHRAE FUN IP	(2013; Addenda and Corrigendum 2013) Fundamentals Handbook, I-P Edition

ASME INTERNATIONAL (ASME)

ASME B16.1	(2010) Gray Iron Pipe Flanges and Flanged Fittings Classes 25, 125, and 250
ASME B16.15	(2013) Cast Copper Alloy Threaded Fittings Classes 125 and 250
ASME B16.18	(2012) Cast Copper Alloy Solder Joint Pressure Fittings
ASME B16.22	(2013) Standard for Wrought Copper and Copper Alloy Solder Joint Pressure Fittings
ASME B16.26	(2013) Standard for Cast Copper Alloy Fittings for Flared Copper Tubes
ASME B16.34	(2013) Valves - Flanged, Threaded and Welding End
ASME B16.5	(2013) Pipe Flanges and Flanged Fittings: NPS 1/2 Through NPS 24 Metric/Inch Standard
ASME B31.1	(2014; INT 1-47) Power Piping
ASME B31.5	(2013) Refrigeration Piping and Heat Transfer Components
ASME B40.100	(2013) Pressure Gauges and Gauge Attachments
ASME BPVC	(2010) Boiler and Pressure Vessels Code

ASTM INTERNATIONAL (ASTM)

ASTM A126	(2004; R 2014) Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings

ASTM B32	(2008; R 2014) Standard Specification for Solder Metal
ASTM B75/B75M	(2011) Standard Specification for Seamless Copper Tube
ASTM B88	(2014) Standard Specification for Seamless Copper Water Tube
ASTM D1238	(2013) Melt Flow Rates of Thermoplastics by Extrusion Plastometer
ASTM D1693	(2013) Standard Test Method for Environmental Stress-Cracking of Ethylene Plastics
ASTM D635	(2014) Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Self-Supporting Plastics in a Horizontal Position
ASTM D638	(2014) Standard Test Method for Tensile Properties of Plastics
ASTM D792	(2013) Density and Specific Gravity (Relative Density) of Plastics by Displacement

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA 250	(2014) Enclosures for Electrical Equipment (1000 Volts Maximum)
NEMA ST 1	(1988; R 1994; R 1997) Specialty Transformers (Except General Purpose Type)

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2014; AMD 1 2013; Errata 1 2013; AMD 2 2013; Errata 2 2013; AMD 3 2014; Errata 3-4 2014; AMD 4-6 2014) National Electrical Code
NFPA 90A	(2015) Standard for the Installation of Air Conditioning and Ventilating Systems

SHEET METAL AND AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION (SMACNA)

SMACNA 1780	(2002) HVAC Systems - Testing, Adjusting and Balancing, 3rd Edition
SMACNA 1966	(2005) HVAC Duct Construction Standards Metal and Flexible, 3rd Edition

U.S. FEDERAL COMMUNICATIONS COMMISSION (FCC)

FCC Part 15	Radio Frequency Devices (47 CFR 15)

UNDERWRITERS LABORATORIES (UL)

UL 508	(1999; Reprint Oct 2013) Industrial Control Equipment
UL 916	(2007; Reprint Aug 2014) Standard for Energy Management Equipment

1.2 SUBCONTRACTOR SPECIAL REQUIREMENTS

Perform all work in this section in accordance with Section 01 30 00.

1.3 SYSTEM DESCRIPTION

Provide new, and modify existing, space temperature control systems complete and ready for operation. The system shall provide for a pneumatic interface to local room controls and a wired/wireless DDC interface to the existing JACE.

1.4 SYSTEM REQUIREMENTS

Provide control systems composed of a combination of digital, wireless electronic and pneumatic devices.

Existing DDC control system was manufactured by Niagra. Provide new equipment compatible with the existing control system to the extent that the direct interface uses the same control signal type and level over the same calibrated range as the existing equipment.

Inspect and test reused portions of existing control systems, and furnish a report to the district identifying all inoperative components or system deficiencies. Diagnose and report any malfunctions of existing control system device that occurs after the work commences. The Contractor shall be held responsible for repair costs due to Contractor negligence or abuse of district equipment.

1.5 PERFORMANCE REQUIREMENTS

Provide control systems to maintain the required heating, ventilating, and cooling (HVAC) conditions by performing the functions and sequences of operations indicated. Control systems shall be complete, including all equipment and appurtenances, and ready for operation. Control systems shall be furnished, installed, tested, calibrated, and started up by, or under the supervision of trained technicians certified by the Contractor as qualified and regularly employed in such work. Control system equipment, valves, panels and dampers shall bear the manufacturer's nameplate.

1.6 DESIGN REQUIREMENTS

A. Control System Diagrams

For each system, indicate HVAC process flow and location of devices relative to flow and to the HVAC control panel, the connections of control devices in control loops, references of control device contacts and device operating coils to line numbers of a ladder diagram and sequencing diagrams showing the operation of valves, dampers, and contacts relative to controller output, and HVAC process variables.

B. Ladder Diagram

Indicate connections and interlocks to control system devices and other devices such as starters, drives, HVAC control system panels, and HVAC equipment panels. Diagram shall be coordinated by line number and device number with each control system diagram.

C. Operating Parameters

Indicate operating parameters for devices shown on the control system diagram such as setpoints, ranges, limits, differentials, outside air temperature schedules, contact operating points, and HVAC equipment operating time schedules.

D. Automatic Control Valve Schedules

Indicate valve size, Cv, flow rate, pressure drop, top size, spring range, positioner range, operating signal characteristics, and power source.

E. Damper Schedules

Indicate damper sizes, quantities and sizes of actuators, spring ranges, positioner ranges, operating signal characteristics, and power source.

F. Wiring Diagram

Indicate terminal blocks, wire marker identification, connections to control system devices, external and internal power sources, and connections to external devices, starters, drives, control panels, jumpers, and ground connections.

G. Compressed Air Station Schematic

Indicate compressors, motors and horsepower rating, voltage, starter, isolators, manual bypasses, tubing sizes, drain piping and drain traps, reducing valves, dryer, manufacturers' names and model numbers, mounting, access, and clearance requirements. Also include control panel schematics for pneumatic control.

H. Sequence of Operation

Sequence of operation for each HVAC control system coordinated with device identifiers on control system diagram and ladder diagram.

I. Arrangement Drawing

Arrangement diagram of each HVAC control system panel coordinated with device identifiers on the control system diagram and the ladder diagram.

1.7 SUBMITTALS

Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

Shop Drawings

Control System Diagrams for each HVAC system

Ladder Diagram;

Operating Parameters;

Automatic Control Valve Schedules;

Damper Schedules;

Sequence of Operation;

Arrangement Drawing;

Wiring Diagram;

Compressed Air Station Schematic;

Control Panel Schematics for pneumatic control;

Product Data

Actuators;

Valves;

Dampers;

Fire Protection Devices;

Sensors;

Thermostats;

Pressure Switches;

Indicating Devices;

Controllers;

Pressure Gages;

Control Panels;

Compressed Air Station Specialties;

VAV Terminal Unit Controls;

Test Reports

Commissioning Procedures;

Calibration Adjustment And Commissioning Reports;

Site Testing Procedures Identifying Each Item Tested and Describing Each Test;

Performance Verification Test plans and procedures;

Certificates

Certification of Completion;

Manufacturer's Instructions

Training Course Documentation;

Operation and Maintenance Data

Space Temperature Control System,

Submit in accordance with Section 01 78 23 OPERATION AND MAINTENANCE DATA.

Closeout Submittals

Qualified Service Organization List;

1.8 QUALITY ASSURANCE

A Standard Products

1. Material and equipment shall be standard products of manufacturers regularly engaged in the manufacturing of such products, using similar materials, design and workmanship. The standard products shall have been in satisfactory commercial or industrial use for 2 years prior to bid opening. The 2-year use shall include applications of similarly sized equipment and materials used under similar circumstances.

   The 2 years experience must be satisfactorily completed by a product which has been sold or is offered for sale on the commercial market through advertisements, manufacturers' catalogs, or brochures. Products having less than a 2-year field service record will be acceptable if a certified record of satisfactory field operation, for not less than 6000 hours exclusive of the manufacturer's factory tests, can be shown.

2. The equipment items shall be supported by a service organization.

B. Nameplates and Tags

1. Provide nameplates bearing legends as shown and tags bearing device unique identifiers as shown shall have engraved or stamped characters. Nameplates shall be mechanically attached to HVAC control panel doors.

2. A plastic or metal tag shall be mechanically attached directly to each field-mounted device or attached by a metal chain or wire.

3. Each airflow measurement station shall have a tag showing flow rate range for signal output range, duct size, and device identifier where shown.

C. Verification of Dimensions

Contractor shall become familiar with details of work, shall verify dimensions in the field, and shall advise Engineer of any discrepancy before performing work.

D. Modification of References

Accomplish work in accordance with ASME B31.1, ASME B31.5, NFPA 70, and NFPA 90A, except as modified herein or indicated otherwise for equipment, materials, installation, examination, inspection,

and testing. Consider the advisory or recommended provisions to be mandatory, as though the word "shall" had be substituted for the words "should" or "could" or "may," wherever they appear. Interpret reference to "authority having jurisdiction" and "owner" to mean the Regional Office of Education.

E. Site Testing Procedures

Indicate test equipment to be used including manufacturers' names and model numbers, date of last calibration, and accuracy of calibration.

F. Commissioning Procedures

Define procedures specific to each control system including instructions on how to set control parameters and setpoints, proportional, integral and derivative mode constants, contact output settings, positioner range adjustments, and calibration checks of transmitters

G. Calibration Adjustment and Commissioning Reports

Submit specific to each HVAC control system, including settings adjustments and results of calibration checks

H. Space Temperature Control System

In addition to the requirements specified in the paragraph SUBMITTALS, meet the following requirements. Submit Operation and Maintenance Manuals for items of equipment listed under paragraph PRODUCT DATA. Manual shall contain full hardware support documentation, which shall include but not be limited to the following:

a. General description and specifications

b. Installation and initial checkout procedures

c. Detailed electrical and logical description

d. Troubleshooting procedures, diagrams, and guidelines

e. Alignment and calibration procedures for components

f. Preventive maintenance requirements and a maintenance checklist

g. Detailed schematics and assembly drawings

h. Spare parts list data, including required tool kits and suggested method of repairs such as field repair, factory repair, or item replacement

i. Signal identification and timing diagrams

j. Complete as-built control drawings, schedules, and sequence of operation

k. Controller configuration and parameter setting procedures

l. Step-by-step procedures required for each HVAC control systems startup, operation, shutdown, recovery, and fault diagnosis

m. Manufacturer supplied operator manuals for equipment

n. Qualified service organization list

PART 2 PRODUCTS

2.1 COMPONENTS

Provide components factory ordered for this project. Rebuilt equipment, warehoused equipment, or earlier generation equipment shall not be acceptable. Electrical, electronic, and electropneumatic devices not located within control panels shall have a NEMA 250 Type 1 enclosure in accordance with NEMA 250 unless otherwise specified. Actuators and positive positioners, and transmitters shall operate within temperature limit ratings of plus 35 to 150 degrees F. Panel mounted instruments shall operate within limit ratings of 35 to 120 degrees F and 10 percent to 95 percent relative humidity, noncondensing. Devices installed outdoors shall operate within limit ratings of minus 35 to 150 degrees F.

2.2 ACTUATORS

The system shall operate with existing pneumatic, electric, or electronic actuators.

2.3 AUTOMATIC CONTROL VALVES

System shall interface to existing automatic control valves.

2.4 DAMPERS

System shall interface with existing pneumatic dampers.

2.5 THERMOSTATS

Provide Wireless Pneumatic Thermostat (WPT) System to replace existing pneumatic thermostats and deliver the benefits of traditional Direct Digital Control (DDC) systems.

1. Wireless pneumatic thermostat:
    a. Action: Direct and reverse acting
    b. Number of Pipes: Single and dual pipe
    c. Bimetal strip that provides continuous temperature response and regulation of control air for smooth actuation
    d. Setpoint Temperature Range: 55° F to 85° F
    e. Air connections: 3/32” ID tube fittings
    f. Max pipe operating pressure: 25 psi
    g. Airflow usage: 0.011 scfm
    h. Sensitivity: Factory adjusted to 2.0 – 2.5 psi/F
    i. Operating frequency band: 2.4 GHz ISM Band
    j. Batteries:
        a. Requires CR123 lithium batteries

b. Battery Life: Two years or more (with 4 setpoint changes per day)

i. Must have at least five reference sites of 100 or more thermostats that are at least two years old to demonstrate battery life

c. Fail safe: thermostat must hold the occupied temperature in event of a battery failure

k. Operating Conditions: 32° F to 122° F, 95% RH Maximum, Noncondensing

l. Functional capabilities include:

a. Programmable schedules

b. Programmable occupied and unoccupied setpoints

c. Remote monitoring of branch pressure

d. Remote monitoring of space temperature

e. Remote control and monitoring of setpoint

f. Remote indication of low battery life

g. Capable of self-calibration

h. Occupancy override for up to four hours, including event notification and logging

i. Deadband option to include the following additional features:

i. Deadband Pressure: User adjustable, default 8 psig ± 1 psig

ii. Deadband Range: 0° F (no deadband) to 20° F

2.6 WIRELESS WALL POWERED REPEATER

Provide a complete network of wireless repeaters to support the WPT System. The equipment manufacturer shall complete a wireless survey of the existing building and determine optimal locations and frequencies for wall powered repeaters. Contractor shall ensure the new system does not interfere with, nor be interfered by the district's existing Wireless LAN operating at 2.4 GHz.

a. Supports up to 15 thermostats

b. Power Requirements: 3.3V DC, 3W (powered by DC adapter) OR 24VAC, 5VA

c. Antenna: External rubber dipole, 4dBi gain, omni-directional, 2.4 to 2.5 GHz

d. Operating frequency band: 2.4 GHz ISM Band

e. Operating Conditions: 32° F to 122° F, 95% RH Maximum, Noncondensing

2.7 CONTROLLER

Provide all controllers required to support the WPT System. The equipment manufacturer shall field verify all locations within the existing building and determine optimal locations controllers. Contractor shall complete all wiring and programming to interface to the existing Niagara JACE, to include necessary graphics and initial set points and scheduling.

a. Controller shall support up to 14 repeaters and 225 thermostats

b. User Interface: Built-in web pages for web browser access to data, alarming and trending

c. Controller shall be integrated into the existing building automation system

d. Available Data Protocols: BACnet/IP via building Ethernet LAN and OpenADR

e. Allows user-assignable BACnet Device Identifier for each WPT

f. Provide one BACnet Device Identifier per thermostat for integration with third-party automation systems.

g. BACnet Objects (grouped under the BACnet Device Identifier) will be consistent from one WPT to another.

h. Provide a commissioning diagnostics tool that verifies the overall health of the WPT system. The contractor must verify the following:

    a. Wireless communication success rates and RSSI

    b. Calibration of thermostats

    c. Compressed air

    d. Counts of equipment

    e. Node IDs (all IDs are commissioned, online and no duplicate IDs)

    f. Firmware and software versions are compatible

i. Capable of responding to Auto-Demand Response signals from utilities

j. Mobile Access: Provide Alarm notification via e-mail or SMS text message from cell phone and PDA

k. Power Supply: 100-240VAC, 1.6A, 50-60Hz

l. Humidity: 10% - 90% non-condensing

m. Operating Temperature: 32° F - 113° F

n. Vibration Endurance: 1 Grms (5-500 Hz; X, Y, Z directions)

o. Functional capabilities include:

    a. Programs WPT schedules

    b. Programs WPT occupied and unoccupied setpoints

    c. Reports branch pressures from WPTs

    d. Reports space temperature from WPTs

    e. Reports WPT setpoints

    f. Issues setpoint commands to WPTs

    g. Provides low battery life alarms for WPTs

    h. Logs occupancy overrides

2.8 WIRELESS USB HUB

a. Antenna: External rubber dipole, 4dBi gain, omni-directional, 2.4 to 2.5 GHz

b. Operating frequency band: 2.4 GHz ISM Band

c. Operating Conditions: 32° F to 122° F, 95% RH Maximum, Noncondensing

d. Powered by USB connection to Controller

2.9 CONTROL DEVICES AND ACCESSORIES

Provide all control devices and accessories.

2.10 REGULATED POWER SUPPLIES

Power supplies shall provide a 24-Vdc linear supply at not less than 2 amperes, with regulation to 0.05 percent of output voltage. Power supplies shall have a fused input, and shall be protected from voltage surges and power-line transients. Power supply output shall be protected against overvoltage and short circuits. Power supply loading shall not be greater than 1.2 amperes.

2.11 TRANSFORMERS

UL 508 and NEMA ST 1 as applicable. Transformers, other than transformers in bridge circuits, shall have primaries wound for available voltage and secondaries wound for correct control circuit voltage. Transformers shall be sized so that connected loads equal 80 percent of rated capacity. Transformers shall be enclosed in rustproof, galvanized steel cabinets with conduit connections. Disconnect switch shall be provided on the primary side, and a fuse cutout on the secondary side.

2.12 CONTROL TUBING AND WIRING

Provide HVAC control tubing and wiring.

A. Tube and Fittings

1. Copper Tubing

ASTM B75/B75M or ASTM B88. Tubing 0.375 inch outside diameter and larger shall have a minimum wall thickness equal to ASTM B88, Type M. Tubing less than 0.375 inch outside diameter shall have a minimum wall thickness of 0.025 inch. Concealed tubing shall be hard or soft copper; multiple tubing shall be racked or bundled. Exposed tubing shall be hard copper; rack multiple tubing. Tubing for working pressures greater than 30 psig shall be hard copper. Bundled tubing shall have each tube numbered each six feet minimum. Racked and individual tubes shall be permanently identified at each end. Fittings shall be solder type ASME B16.18 or ASME B16.22, using ASTM B32, Plumbing Code approved lead-free solder, or compression type ASME B16.26.

2. Polyethylene Tubing

Polyethylene tubing shall be provided only for systems with working pressure of 30 psig or less. Provide flame-resistant, multiple polyethylene tubing in flame-resistant protective sheath with Mylar barrier, or unsheathed flame-resistant polyethylene tubing in rigid metal, intermediate metal, or electrical metallic tubing conduit for areas where tubing is exposed. Single, unsheathed, flame-resistant polyethylene tubing may be used where concealed in walls or above ceilings and within control panels, except prohibited in crawl spaces, attics, and above-ceiling spaces that are vented to the outdoors. Do not provide polyethylene tubing for [systems indicated as critical and] smoke removal systems. Number each tube in sheathing each two feet minimum. Permanently identify unsheathed tubing at each end. Provide compression or barbed push-on type fittings. Extruded seamless polyethylene tubing shall conform to the following:

1. Minimum burst pressure requirements: 100 psig at 75 degrees F to 25 psig at 150 degrees F.
2. Stress crack resistance: ASTM D1693, 200 hours minimum.
3. Tensile strength (minimum): ASTM D638, 1100 psi.

4. Flow rate (average): ASTM D1238, 0.30 decigram per minute.

5. Density (average): ASTM D792, 57.5 pounds per cubic feet.

6. Burn rate: ASTM D635.

B. Wiring

1. Terminal blocks shall be insulated, modular, feed-through, clamp style with recessed captive screw-type clamping mechanisms. Terminal blocks shall be rail mounted, and shall have end plates, partition plates or enclosed sides for separation.

2. Control wiring for 24-V circuits shall be 18 AWG minimum and shall be rated for 300-V service.

3. Wiring for circuits operating at more than 100 V shall be 14 AWG minimum and shall be rated for 600-V service.

4. Analog signal wiring circuits within control panels shall not be less than 20 AWG and shall be rated for 300-V service.

5. Instrumentation cable shall be 18 AWG, stranded copper, single or multiple twisted, minimum 2-inch lay of twist, 100 percent shielded pairs, and shall have 300-V insulation. Each pair shall have a 20-AWG tinned copper drain wire, individual pair, and overall insulation. Cables shall have an overall aluminum polyester or tinned overall copper cable shield tape, 20-AWG tinned-copper cable drain wire, and overall cable insulation.

6. Nonconducting wiring ducts in control panels shall have slotted side snap-on covers, fittings for connecting ducts, mounting clips for securing ducts, and wire retaining clips.

PART 3 EXECUTION

3.1 INSTALLATION

Perform installation under the supervision of competent technicians regularly employed in the installation of control systems. Provide components for a complete and operational control system. Provide control system complete and ready for operation, as specified and indicated. Provide dielectric isolation where dissimilar metals are used for connection and support. Penetrations through and mounting holes in the building exterior shall be watertight. Control system installation shall provide adequate clearance for control system maintenance by maintaining access spaces between coils, to mixed-air plenums, and as required to calibrate, remove, repair, or replace control system devices. Control system installation shall not interfere with the clearance requirements for mechanical and electrical system maintenance. Install devices mounted in or on piping or ductwork, on building surfaces, in mechanical and electrical spaces, or in occupied space ceilings in accordance with manufacturer's recommendations and as indicated on contract documents. Provide control devices to be installed in piping and ductwork with required gaskets, flanges, thermal compounds, insulation, piping, fittings, and manual valves for shutoff, equalization, purging, and calibration. Certify that installation of control system is complete and technical requirements of this section have been met.

A. Sensors

Provide sensors in locations to sense the appropriate condition. Install sensor and transmitter where easily accessible and serviceable without special tools. Sensors shall be calibrated to the accuracy

specified in the contract, and operate correctly when installed. Do not install sensors designed for one application in the place of another application (e.g., replacing a duct sensor with a room sensor).

Provide on interior walls to sense average room conditions. Avoid locations which may be covered by office furniture. Do not mount room sensors on exterior walls if other locations are available. Mount centerline of sensor 5 feet above finished floor.

B. Tubing

1. Install control system so that pneumatic lines are not exposed to air temperatures below 25 degrees F. Install tubes and tube bundles exposed to view neatly in lines parallel to lines of the building. Route tubing between panels and actuators in mechanical and electrical spaces so that lines are easily traceable. Tubes shall be permanently tagged on both ends with an identifier indicated on shop drawings. Install concealed tubing in finished areas, and install exposed tubing in unfinished areas such as mechanical equipment rooms.

2. Pneumatic lines in mechanical and electrical spaces shall be plastic tubing or copper tubing. Install horizontal and vertical runs of plastic tubes or soft copper tubing in raceways dedicated to tubing. Dedicated raceways shall be supported every 6 feet of horizontal run and every 8 feet for vertical runs. Tubing not installed in raceways shall be hard-drawn copper tubing with sweat fittings and valves, supported every 6 feet of horizontal run and every 8 feet for vertical runs.

3. Tubing for connecting sensing elements and transmitters to liquid and steam lines shall be copper with brass compression fittings.

4. Tubing for final connection of sensing elements and transmitters to ductwork shall be plastic with a maximum length of 12 inches.

5. Tubing external to mechanical and electrical spaces, where run in plenum ceilings, shall be soft copper with sweat fittings, supported every 8 feet. Tubing not in plenum spaces shall be soft copper with sweat fittings supported every 8 feet or shall be plastic tubing in raceways dedicated to tubing.

6. Provide tubing in concrete in rigid conduit. Install tubing in walls containing insulation, fill, or other packing materials in raceways dedicated to tubing.

7. Final connections to actuators shall be plastic tubing, a maximum of 12 inches long and unsupported at the actuator.

8. Provide a manual valve at each HVAC control panel to allow shutoff of main air. Pneumatic connections to HVAC control panels shall be made using bulkhead fittings except where bundled tubing is being used.

9. Final connections to HVAC control panel bulkhead fittings shall be exposed tubing approximately 12 inches long.

10. Tubing and two insulated copper phone wires for installation checkout may be run in the same conduit. Tubing and electrical power conductors shall not be run in the same conduit. Control circuit conductors, 24 V or less, may be run in the same conduit as polyethylene tubing.

C. Wiring

a. Provide wiring external to control panels, including low-voltage wiring, in metallic raceways. Install wiring without splices between sensors, transmitters, control devices, and HVAC control panels. Install instrumentation grounding as necessary to prevent ground loops,

noise, and surges adversely affecting operation of the system. Tag cables, conductors, and wires at both ends, with identifiers indicated on shop drawings.

b. Other electrical work shall be specified in Division 26. Provide step-down transformers where control equipment operates at lower than line circuit voltages. Transformers serving individual heating, ventilating, and air-conditioning units shall be fed from fan motor leads, or fed from the nearest distribution panelboard or motor control center, using circuits provided for that purpose.

c. Ground control panels and cabinets as specified in Division. Grounding of the green ac ground wire at the breaker panel alone is not adequate. Install ground wire from each control panel to adequate building ground.

D. Control Drawings

Post laminated copies of as-built control system drawings in the room where the Niagra JACE is located.

3.2 ADJUSTMENTS

Calibrate instrumentation and controls, and verify specified accuracy using test equipment traceable to National Institute for Science and Technology (NIST) standards. Adjust controls and equipment to maintain conditions indicated, to perform the functions indicated, and to operate in the sequence specified.

3.3 FIELD QUALITY CONTROL

a. Demonstrate compliance of HVAC control systems. Furnish personnel, equipment, instrumentation, and supplies necessary to perform calibration and site testing. Calibrate test equipment in accordance with NIST standards. Ensure that tests are performed or supervised by competent employees of the control system installer or the control system manufacturer regularly employed in testing and calibration of control systems.

b. Testing shall include field tests and the performance verification test. Field tests shall demonstrate proper calibration of instrumentation, input and output devices, and operation of specific equipment. The performance verification test shall ensure proper execution of sequence of operation and proper tuning of control loops.

c. The plan for each phase of field acceptance testing shall be approved in writing before beginning that phase of testing. Furnish written notification of planned testing to Contracting Officer at least 21 days prior to testing. Include proposed test procedures with notification. The Contractor will not be allowed to start testing without district approval of test procedures. Test procedures shall consist of detailed instructions for complete testing to prove the performance of heating, ventilating, and air-conditioning system and control system. Include the following tests in test procedures.

d. Submit original copies of data produced, including results of each test procedure, to the district at the conclusion of each phase of testing. Tests are subject to supervision and approval by the engineer. Do not perform testing during scheduled seasonal off-periods of heating and cooling systems.

A. Test Reporting

After completion or termination of field tests and again after the performance verification test, identify, determine causes, replace, repair, or calibrate equipment which fails to meet the specification; and deliver a written report to the district. The report shall document test results, explain in detail the nature of each failure, and corrective action taken. After delivering the performance verification test report, the Contractor shall convene a test review meeting at the job site to present results and recommendations to the district. As a part of the test review meeting, the Contractor shall demonstrate by performing appropriate portions of field tests or the performance verification test that failures have been corrected. Based on Contractor's report and test review meeting, the district will determine either the restart point or successful completion of testing. Do not commence required retesting until after receipt of written notification by the district. At the conclusion of retesting, repeat the assessment.

B. Contractor's Field Testing

Calibrate field equipment and verify equipment and system operation before system is placed on-line. Include the following tests in field testing.

Tubing and Wiring Integrity Tests

Test tubing system pneumatically at 1.5 times the design working pressure for 24 hours. Allowable leakage rate is that which produces a pressure drop 1 psig in 24 hours with compressed air supply turned off. Test wiring for continuity, ground faults, and open and short circuits.

System Inspection

Observe HVAC control system in shutdown condition. Check dampers and valves for proper normal positions. Document positions for the performance verification test report.

Calibration Accuracy and Operation of Input Test

Verify correct calibration and operation of input instrument. For each sensor and transmitter, including for temperature, record the reading at the sensor or transmitter location using calibrated test equipment. Record the output reading provided by that sensor or transmitter. Document each of these location and output readings for the performance verification test report. The test equipment shall have been calibrated within one year of the date of use in the field. Test equipment calibration shall be traceable to the measurement standard of the National Institute of Standards and Technology.

Operation of Output Test

Check the operation of output to verify correct operation. Operate analog device to minimum range (e.g., 4 mA) and maximum range (e.g., 20 mA), and measure and record actual output values.

Actuator Range Adjustment

With the controller, apply a control signal to each actuator and verify that the actuator operates properly from its normal position through to the full range of stroke position. Record actual spring ranges and normal positions for modulating control valves and dampers.

C. Coordination With HVAC System Balancing

Tune the control system after air and hydronic systems have been balanced, minimum damper positions have been set, and a report has been issued.

D. Field Test Documentation

Before scheduling the performance verification test, provide field test documentation and written certification of completion to the district that the installed system has been calibrated, tested, and is ready to begin the performance verification test. Do not start the performance verification test prior to receiving written permission from the district.

E. Performance Verification Test

Conduct the performance verification tests to demonstrate that the control system maintains setpoints and that the control loops are tuned for the correct sequence of operation. Conduct the performance verification test during one week of continuous HVAC and control systems operation and before final acceptance of work. Specifically, the performance verification test shall demonstrate that the HVAC system operates properly through the complete sequence of operation (e.g., seasonal, occupied and unoccupied, warm up, etc.), for specified control sequences. Demonstrate proper control system response for abnormal conditions for which there is a specified system or controls response by simulating these conditions. Demonstrate that hardware interlocks and safety devices work as designed. Demonstrate that the control system performs the correct sequence of control.

F. Opposite Season Test

Repeat the performance verification test during an opposite season to the first performance verification test.

3.4 TRAINING

Provide a qualified instructor to conduct training courses for designated personnel in maintenance and operation of HVAC and control systems. Orientate training to the specific system being installed under the contract. Furnish audiovisual equipment and other training materials and supplies. A training day is defined as 8 hours of classroom or lab instruction, including two 15-minute breaks and excluding lunch time, Monday through Friday, during the daytime shift in effect at the training facility. For guidance, assume that the attendees have a high school education and are familiar with HVAC systems. Submit planned training schedule, agenda, and class materials to the district at least 45 days prior to training.

A. Training Course Documentation

Training shall be based on the operation and maintenance manuals and control system training manual. Deliver manuals for each trainee with two additional sets for archiving at the project site. Include an agenda, defined objectives, and a detailed description of subject matter for each lesson.

B. Operator Training I

The first class shall be taught for a period of 2 consecutive training days at least 1 month prior to the scheduled performance verification test. The first course shall be taught at the facility. Training shall be classroom instruction, but have hands-on operation of similar digital controllers. Upon completion of course, each student, using appropriate documentation, shall be able to perform elementary operations, with guidance, and describe general hardware and functionality of the system. Course shall include but not be limited to description of hardware and operation of the system.

C. Operator Training II

The second course shall be taught in the field, using the operating equipment at project sites for a total of 16 hours of instruction per student, in blocks of 4 hours. Include hands-on training under constant monitoring of instructor. Course content shall duplicate the Operator Training I course as applied to the installed system. Instructor shall determine the level of the password to be issued to each student

before each session. Upon completion of the course, students shall be proficient in system operation. Prepare a written report describing the skill level of each student at the end of the course.

D. Operator Training III

The third course shall be taught in the field, at the project site, for a period of 3 training days no later than 6 months after completion of endurance test. Course shall be structured to address specific topics that the students need to discuss and to answer questions concerning operation of the system. Upon completion of the course, students shall be proficient in system operation and shall have no unanswered questions regarding operation of the installed system.

E. System Maintenance Training

Course shall be taught at the project site within one month after completion of endurance test for a period of 2 training days. Course shall include but not be limited to the following:

a. Physical layout for each piece of hardware

b. Troubleshooting and diagnostics procedures

c. Repair instructions

d. Preventive maintenance procedures and schedule

e. Calibration procedures

3.5 QUALIFIED SERVICE ORGANIZATION LIST

The qualified service organization list shall include names and telephone numbers of organizations qualified to service HVAC control systems.

3.6 COMMISSIONING

Commissioning of control systems is specified in the pre-field TAB engineering report described in Section 23 05 93 TESTING, ADJUSTING AND BALANCING.

END SECTION 23 09 53

SECTION 23 11 25
FACILITY GAS PIPING

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI Z21.1	(2005; Addenda A 2007; Addenda B 2008) Household Cooking Gas Appliances
ANSI Z21.15/CSA 9.1	(2009) Manually Operated Gas Valves for Appliances, Appliance Connector Valves and Hose End Valves
ANSI Z21.24/CSA 6.10	(2006; Addenda 1 2009) Connectors for Gas Appliances
ANSI Z21.41/CSA 6.9	(2003; A 2005; B 2010; Errata 2007) Quick-Disconnect Devices for Use with Gas Fuel Appliances
ANSI Z21.69/CSA 6.16	(2009) Connectors for Movable Gas Appliances
ANSI Z21.78/CSA 6.20	(2005; Addenda A 2007; Addenda B 2008) Standard Specification for Combination Gas Controls for Gas Appliances

AMERICAN PETROLEUM INSTITUTE (API)

API 570	(2009, 3rd Ed) Piping Inspection Code: In-Service Inspection, Rating, Repair, and Alteration of Piping Systems
API RP 2009	(2002; R 2007; 7th Ed) Safe Welding, Cutting, and Hot Work Practices in Refineries, Gasoline Plants, and Petrochemical Plants
API Spec 5CT	(2005; Errata 2006; Errata 2006) Specification for Casing and Tubing
API Spec 6D	(2008; Errata 2008; Errata 2008; Errata 2009; Addendum 2009; Errata 2010) Specification for Pipeline Valves
API Std 598	(2009) Valve Inspecting and Testing
API Std 607	(1998; R 2005; Errata 2008) Testing of Valves: Fire Test for Soft-Seated Quarter-Turn Valves

AMERICAN SOCIETY OF CIVIL ENGINEERS (ASCE)

ANSI/ASCE/SEI 25	(2006; R 2008) Earthquake-Activated Automatic Gas Shutoff Devices

AMERICAN WELDING SOCIETY (AWS)

AWS A5.8/A5.8M	(2004) Specification for Filler Metals for Brazing and Braze Welding
AWS WHB-2.9	(2004) Welding Handbook; Volume 2, Welding Processes, Part 1

ASME INTERNATIONAL (ASME)

ASME A13.1	(2007) Scheme for the Identification of Piping Systems
ASME B1.20.1	(1983; R 2006) Pipe Threads, General Purpose (Inch)
ASME B16.21	(2005) Nonmetallic Flat Gaskets for Pipe Flanges
ASME B16.33	(2002; R 2007) Manually Operated Metallic Gas Valves for Use in Gas Piping Systems Up to 125 psi, Sizes NPS 1/2 - NPS 2
ASME B31.9	(2008) Building Services Piping
ASME BPVC SEC IX	(2010) BPVC Section IX-Welding and Brazing Qualifications

ASTM INTERNATIONAL (ASTM)

ASTM 01.01	(2010) Steel - Piping, Tubing, Fittings
ASTM A 513	(2008a) Standard Specification for Electric-Resistance-Welded Carbon and Alloy Steel Mechanical Tubing
ASTM A 666	(2003) Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate and Flat Bar
ASTM F 2015	(2000; R 2006) Standard Specification for Lap Joint Flange Pipe End Applications

CSA STANDARDS (CSA)

CGA 3.11-M88	(1988; R 2009) Lever Operated Pressure Lubricated Plug Type Gas Shut-Off Valves
CGA 3.16-M88	(1988; R 2009) Lever Operated Non-Lubricated Gas Shut-Off Valves
CGA 9.2-M88	(1988; R 2009) Manually Operated Shut-Off Valves for Gas Piping Systems

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)

MSS SP-25	(2008) Standard Marking System for Valves, Fittings, Flanges and Unions
MSS SP-58	(2009) Pipe Hangers and Supports - Materials, Design and Manufacture, Selection, Application, and Installation
MSS SP-69	(2003) Pipe Hangers and Supports - Selection and Application (ANSI Approved American National Standard)

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 54	(2015) National Fuel Gas Code
NFPA 70	(2014) National Electrical Code

SHEET METAL AND AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION (SMACNA)

SMACNA 1650	(2008) Seismic Restraint Manual Guidelines for Mechanical Systems, 2nd Edition

THE SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC SP 6/NACE No.3	(2007) Commercial Blast Cleaning

UNDERWRITERS LABORATORIES (UL)

UL Gas&Oil Dir	(2009) Flammable and Combustible Liquids and Gases Equipment Directory

1.2 SYSTEM DESCRIPTION

The gas piping system includes piping and appurtenances from point of connection with supply system, as indicated on site plans, to gas operated equipment within the facility. Submit operation and maintenance data in accordance with Section 01 78 23 OPERATION AND MAINTENANCE DATA, in three separate packages.

1.2.1 Gas Facility System and Equipment Operation

Include shop drawings showing piping layout, locations of system valves, gas line markers; step-by-step procedures for system start up, operation and shutdown (index system components and equipment to the system drawings); isolation procedures including valve operation to shutdown or isolate each section of the system (index valves to the system maps and provide separate procedures for normal operation and emergency shutdown if required to be different).

1.2.2 Gas Facility System Maintenance

Include maintenance procedures and frequency for system and equipment; identification of pipe materials and manufacturer by locations, pipe repair procedures, and jointing procedures at transitions to other piping material or material from a different manufacturer.

1.2.3 Gas Facility Equipment Maintenance

Include identification of valves, shut-offs, disconnects, and other equipment by materials, manufacturer, vendor identification and location; maintenance procedures and recommended tool kits for valves and equipment; recommended repair methods (i.e., field repair, factory repair, or replacement) for each valve and piece of equipment; and preventive maintenance procedures, possible failure modes and troubleshooting guide.

1.3 SUBMITTALS

Submit the following in accordance with Section 01 30 00 ADMINISTRATIVE REQUIREMENTS:

Product Data

Pipe and Fittings
Gas equipment connectors
Gas Piping System
Pipe Coating Materials and application procedures
Pressure regulators
Risers
Transition fittings
Valves
Valve box
Warning and identification tape

Test Reports

Testing
Pressure Tests
Test With Gas

Operation and Maintenance Data

Gas facility system and equipment operation
Gas facility system maintenance
Gas facility equipment maintenance

1.4 QUALITY ASSURANCE

Submit manufacturer's descriptive data and installation instructions for approval for compression-type mechanical joints used in joining dissimilar materials and for insulating joints. Mark all valves, flanges and fittings in accordance with MSS SP-25.

1.4.1 Welding Qualifications

Weld piping in accordance with qualified procedures using performance qualified welders and welding operators in accordance with API RP 2009, ASME BPVC SEC IX, and ASME B31.9. Welding procedures qualified by others, and welders and welding operators qualified by another employer may be accepted as permitted by ASME B31.9. Notify the Architect at least 24 hours in advance of tests, and perform at the work site if practicable.

1.4.2 Jointing Thermoplastic and Fiberglass Piping

Perform all jointing of piping using qualified joiners and qualified procedures in accordance with AGA XR0603. Furnish the Architect with a copy of qualified procedures and list of and identification symbols of qualified joiners. Submit manufacturer's installation instructions and manufacturer's visual joint appearance chart, including all PE pipe and fittings.

1.5 DELIVERY, STORAGE, AND HANDLING

Handle, transport, and store plastic pipe and fittings carefully. Plug or cap pipe and fittings ends during transportation or storage to minimize dirt and moisture entry. Do not subject piping to abrasion or concentrated external loads. Discard PE pipe sections and fittings that have been damaged.

PART 2 PRODUCTS

2.1 MATERIALS AND EQUIPMENT

Provide materials and equipment which are the standard products of a manufacturer regularly engaged in the manufacture of the products and that essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening. Asbestos or products containing asbestos are not allowed. Submit catalog data and installation instructions for pipe, valves, all related system components, pipe coating materials and application procedures. Conform to and with requirements specified herein. Provide supply piping to appliances or equipment at least as large as the inlets thereof.

2.2 GAS PIPING SYSTEM AND FITTINGS

2.2.1 Steel Pipe, Joints, and Fittings

All gas piping shall be Schedule 40 standard weight seamless black steel pipe complying with ANSI B36.10 and ASTM A53 or ASTM A106.

2.2.2 Steel Tubing, Joints and Fittings

Provide steel tubing conforming to ASTM 01.01, and ASTM A 513, with tubing joints made up with gas tubing fittings recommended by the tubing manufacturer.

2.2.3 Sealants for Steel Pipe Threaded Joints

Provide joint sealing compound as listed in UL Gas&Oil Dir, Class 20 or less. For taping, use tetrafluoroethlene tape conforming to UL Gas&Oil Dir.

2.2.4 Warning and Identification

Provide pipe flow markings, warning and identification tape, and metal tags at a minimum of every 20 feet along all gas piping.

2.2.5 Flange Gaskets

Provide gaskets of nonasbestos compressed material in accordance with ASME B16.21, 1/16 inch thickness, full face or self-centering flat ring type, containing aramid fibers bonded with styrene butadiene rubber (SBR) or nitrile butadiene rubber (NBR) suitable for a maximum 600 degree F service, to be used for hydrocarbon service.

2.2.6 Pipe Threads

Provide pipe threads conforming to ASME B1.20.1.

2.2.7 Escutcheons

Provide chromium-plated steel or chromium-plated brass escutcheons, either one piece or split pattern, held in place by internal spring tension or set screw.

2.2.8 Gas Transition Fittings

Provide line size lever operated non-lubricated gas shut-off valves conforming to CGA 3.16-M88 at all equipment connections and for isolation of the gas system as shown on project drawings.

2.2.9 Insulating Pipe Joints

2.2.9.1 Insulating Joint Material

Provide insulating joint material between flanged or threaded metallic pipe systems where shown to control galvanic or electrical action.

2.2.9.2 Threaded Pipe Joints

Provide threaded pipe joints of steel body nut type dielectric unions with insulating gaskets.

2.2.9.3 Flanged Pipe Joints

Provide joints for flanged pipe consisting of full face sandwich-type flange insulating gasket of the dielectric type, insulating sleeves for flange bolts, and insulating washers for flange nuts. Provide lap joint flange pipe ends conforming to ASTM F 2015.

2.2.10 Flexible Connectors

a. Provide flexible connectors for connecting gas utilization equipment to building gas piping conforming to ANSI Z21.24/CSA 6.10 or ANSI Z21.41/CSA 6.9 for quick disconnect devices, and flexible connectors for movable food service equipment conforming to ANSI Z21.69/CSA 6.16.

b. Do not install the flexible connector through the appliance cabinet face. Provide rigid metallic pipe and fittings to extend the final connection beyond the cabinet, except when appliance is provided with an external connection point.

2.3 VALVES

Provide shutoff or service isolation valves as indicated in the drawings conforming to the following:

2.3.1 Valves 2 Inches and Smaller

Provide valves 2 inches and smaller conforming to ASME B16.33 of materials and manufacture compatible with system materials used. Provide manually operated household cooking gas appliance valves conforming to ANSI Z21.1 and ANSI Z21.15/CSA 9.1.

2.4 RISERS

Provide manufacturer's standard riser, use swaged gas-tight construction with O-ring seals, metal insert, and protective sleeve. Provide wall-mounted riser supports.

2.5 PIPE HANGERS AND SUPPORTS

Provide pipe hangers and supports conforming to MSS SP-58 and MSS SP-69.

2.5.1 Roof Supports: Erico Caddy Pyramid ST or MiFab C600 Series

2.6 REGULATORS

Provide a pressure regulator at the main service meter and as required at all equipment connections as to provide the manufacturer's required gas pressure at equipment connections.

PART 3 EXECUTION

3.1 EXAMINATION

After becoming familiar with all details of the work, verify all dimensions in the field, and advise the Architect of any discrepancy or areas of conflict before performing the work.

3.2 GAS PIPING SYSTEM

Provide a gas piping system from the point of delivery, to the connections to each gas utilization device.

3.2.1 Protection and Cleaning of Materials and Components

Protect equipment, pipe, and tube openings by closing with caps or plugs during installation. At the completion of all work, thoroughly clean the entire system.

3.2.2 Workmanship and Defects

Piping, tubing and fittings shall be clear and free of cutting burrs and defects in structure or threading and shall be thoroughly brushed and chip-and scale-blown. Repair of defects in piping, tubing or fittings is not allowed; replace defective items when found.

3.3 PROTECTIVE COVERING

3.3.1 Aboveground Metallic Piping Systems

3.3.1.1 Ferrous Surfaces

Touch up shop primed surfaces with ferrous metal primer. Solvent clean surfaces that have not been shop primed. Mechanically clean surfaces that contain loose rust, loose mill scale and other foreign substances by power wire brushing and prime with ferrous metal primer. Finish all surfaces with two coats of yellow exterior oil of vinyl paint.

3.4 INSTALLATION

Install the gas system in conformance with the manufacturer's recommendations, and as indicated. Perform all pipe cutting without damage to the pipe, with an approved type of mechanical cutter, unless otherwise authorized. Use wheel cutters where practicable. On steel pipe 6 inches and larger, an approved gas cutting and beveling machine may be used.

3.4.1 Metallic Piping Installation

Bury underground piping a minimum of 18 inches below grade. Make changes in direction of piping with fittings only; mitering or notching pipe to form elbows and tees or other similar type construction is not permitted. Branch connection may be made with either tees or forged branch outlet fittings. Provide branch outlet fittings which are forged, flared for improvement of flow where attached to the run, and reinforced against external strains. Do not use aluminum alloy pipe in exterior locations or underground.

3.4.2 Metallic Tubing Installation

Install metallic tubing using gas tubing fittings approved by the tubing manufacturer. Make branch connections with tees. Prepare all tubing ends with tools designed for that purpose. Do not use aluminum alloy tubing in exterior locations or underground.

3.4.3 Piping Buried Under Buildings

Run underground piping installed beneath buildings in a steel pipe casing protected from corrosion with protective coatings. Extend casing at least 4 inches outside the building, and provide the pipe with spacers and end bushings to seal at both ends to prevent the entrance of water and/or the escape of gas. Extend a vent line from the annular space above grade outside to a point where gas will not be a hazard, and terminate in a rain/insect-resistant fitting.

3.4.4 Concealed Piping in Buildings

Do not use combinations of fittings (unions, tubing fittings, running threads, right- and left-hand couplings, bushings, and swing joints) to conceal piping within buildings.

3.4.5 Aboveground Piping

Run aboveground piping as straight as practicable along the alignment and elevation indicated, with a minimum of joints, and separately supported from other piping system and equipment. Install exposed horizontal piping no farther than 6 inches from nearest parallel wall and at an elevation which prevents standing, sitting, or placement of objects on the piping.

3.4.6 Final Gas Connections

Unless otherwise specified, make final connections with rigid metallic pipe and fittings. Flexible connectors may be used for final connections to residential dryers only. Provide accessible gas shutoff valve, sediment catch, and coupling for each gas equipment item.

3.5 PIPE JOINTS

Design and install pipe joints to effectively sustain the longitudinal pull-out forces caused by contraction of the piping or superimposed loads.

3.5.1 Threaded Metallic Joints

Provide threaded joints in metallic pipe with tapered threads evenly cut and made with UL approved graphite joint sealing compound for gas service or tetrafluoroethylene tape applied to the male threads only. Threaded joints up to 1-1/2 inches in diameter may be made with approved tetrafluoroethylene tape. Threaded joints up to 2 inches in diameter may be made with approved joint sealing compound. After cutting and before threading, ream pipe and remove all burrs. Caulking of threaded joints to stop or prevent leaks is not permitted.

3.5.2 Welded Metallic Joints

Conform beveling, alignment, heat treatment, and inspection of welds to NFPA 54. Remove weld defects and make repairs to the weld, or remove the weld joints entirely and reweld. After filler metal has been removed from its original package, protect and store so that its characteristics or welding properties are not affected adversely. Do not use electrodes that have been wetted or have lost any of their coating.

3.5.3 Press Connections

Make press connections in accordance with manufacturer's installation instructions using tools approved by the manufacturer. Fully insert the tubing into the fitting and then mark at the shoulder of

the fitting. Check the fitting alignment against the mark on the tubing to assure the tubing is fully inserted before the joint is pressed.

3.6 PIPE SLEEVES

Provide pipes passing through concrete or masonry walls or concrete floors or roofs with pipe sleeves fitted into place at the time of construction. Do not install sleeves in structural members except where indicated or approved. Make all rectangular and square openings as detailed. Extend each sleeve through its respective wall, floor or roof, and cut flush with each surface, except in mechanical room floors not located on grade where clamping flanges or riser pipe clamps are used. Extend sleeves in mechanical room floors above grade at least 4 inches above finish floor. Unless otherwise indicated, use sleeves large enough to provide a minimum clearance of 1/4 inch all around the pipe. Provide steel pipe for sleeves in bearing walls, waterproofing membrane floors, and wet areas. Provide sleeves in nonbearing walls, floors, or ceilings of steel pipe, galvanized sheet metal with lock-type longitudinal seam, or moisture-resistant fiber or plastic. For penetrations of fire walls, fire partitions and floors which are not on grade, seal the annular space between the pipe and sleeve with fire-stopping material and sealant.

3.7 FIRE SEAL

Fire seal all penetrations of fire rated partitions, walls and floors.

3.8 ESCUTCHEONS

Provide escutcheons for all finished surfaces where gas piping passes through floors, walls, or ceilings except in boiler, utility, or equipment rooms.

3.9 BUILDING STRUCTURE

Do not weaken any building structure by the installation of any gas piping. Do not cut or notch beams, joists or columns. Attach piping supports to metal decking. Do not attach supports to the underside of concrete filled floors or concrete roof decks unless approved by the Architect.

3.10 PIPING SYSTEM SUPPORTS

Support gas piping systems in buildings with pipe hooks, metal pipe straps, bands or hangers suitable for the size of piping or tubing. Do not support any gas piping system by other piping. Conform the selection and application of supports in gas piping and tubing installations to the requirements of MSS SP-69. In the support of multiple pipe runs on a common base member, use a clip or clamp where each pipe crosses the base support member. Spacing of the base support members is not to exceed the hanger and support spacing required for any of the individual pipes in the multiple pipe run, and manufacturer's instructions. Rigidly connect the clips or clamps to the common base member. Provide a clearance of 1/8 inch between the pipe and clip or clamp for all piping which may be subjected to thermal expansion.

3.11 ELECTRICAL BONDING AND GROUNDING

Provide a gas piping system within the building which is electrically continuous and bonded to a grounding electrode as required by NFPA 70.

3.12 SHUTOFF VALVE

Install the main gas shutoff valve controlling the gas piping system to be easily accessible for operation, as indicated, protected from physical damage, and marked with a metal tag to clearly identify the piping system controlled.

3.13 TESTING

Submit test reports in booklet form tabulating test and measurements performed; dated after award of this contract, and stating the Contractor's name and address, the project name and location, and a list of the specific requirements which are being certified. Test entire gas piping system to ensure that it is gastight prior to putting into service. Prior to testing, blow out the system, clean, and clear all foreign material. Test each joint with an approved gas detector, soap and water, or an equivalent nonflammable solution. Inspect and test each valve in conformance with API Std 598 and API Std 607. Complete testing before any work is covered, enclosed, or concealed, and perform with due regard for the safety of employees and the public during the test. Install bulkheads, anchorage and bracing suitably designed to resist test pressures if necessary, and as directed and or approved by the Architect. Do not use oxygen as a testing medium.

3.13.1 Pressure Tests

Submit test reports in booklet form tabulating test and measurements performed; dated after award of this contract, and stating the Contractor's name and address, the project name and location, and a list of the specific requirements which are being certified. Before appliances are connected, test by filling the piping systems with air or an inert gas to withstand a minimum pressure without showing any drop in pressure. Do not use Oxygen for test. Measure pressure with a mercury manometer, slope gauge, or an equivalent device calibrated to be read in increments of not greater than 0.1 pound. Isolate the source of pressure before the pressure tests are made.

3.13.2 Test With Gas

Before turning on gas under pressure into any piping, close all openings from which gas can escape. Immediately after turning on the gas, check the piping system for leakage by using a laboratory-certified gas meter, an appliance orifice, a manometer, or equivalent device. If leakage is recorded, shut off the gas supply, repair the leak, and repeat the tests until all leaks have been stopped.

3.13.3 Purging

After testing is completed, and before connecting any appliances, fully purge all gas piping. Do not purge piping into the combustion chamber of an appliance. Do not purge the open end of piping systems into confined spaces or areas where there are ignition sources unless the proper safety precautions are followed.

3.13.4 Labor, Materials and Equipment

Furnish all labor, materials and equipment necessary for conducting the testing and purging.

3.14 PIPE COLOR CODE MARKING

Provide color code marking of piping conforming to ASME A13.1. All piping to be painted yellow with black text “NATURAL GAS” and directional flow arrow.

END SECTION 23 11 25

SECTION 23 22 13
STEAM TRAPS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM A105/A105M	(2014) Standard Specification for Carbon Steel Forgings for Piping Applications
ASTM A216/A216M	(2014) Standard Specification for Steel Castings, Carbon, Suitable for Fusion Welding, for High-Temperature Service
ASTM A278/A278M	(2001; R 2011) Standard Specification for Gray Iron Castings for Pressure-Containing Parts for Temperatures Up to 650 degrees F (350 degrees C)

1.2 SUBMITTALS

Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

Product Data

Manufacturer's Catalog Data

Shop Drawings

Installation Drawings

Certificates

Listing of Product Installation

Steam Traps

Trap Bodies and Components

1.3 QUALITY ASSURANCE

Submit listing of product installation for steam traps, indicating at least five installed units, similar to those proposed for use, that have been in successful service for a minimum of five years.

PART 2 PRODUCTS

Submit manufacturer's catalog data for steam traps in accordance with referenced standards contained in this section.

2.1 MATERIALS

A. Ensure that traps exposed to weather are freezeproof.

B. Submit certificates for steam traps and trap bodies and components showing conformance with the referenced standards contained in this section.

C. Provide cast iron trap bodies for pressures 125-psi wsp and under in accordance with ASTM A278/A278M, Class 30.

D. Provide welded end connection trap bodies of cast steel in accordance with ASTM A216/A216M, Grade WCB.

2.2 EQUIPMENT

A. Trap Type and Construction

1. Provide trap bodies and components with a primary working steam pressure (wsp)-rating equal to or in excess of the maximum wsp of the steam system to which they are applied.

2. Ensure traps have permanent external identification of service indicating rating and orifice size.

3. Type IB

a. Provide inverted bucket traps with AISI 300 Series corrosion-resistant steel floats and operating mechanisms, and hardened 13 percent chrome corrosion-resistant steel seats and valves.

b. Provide bimetallic type thermostatic elements.

c. Design traps to permit removal and replacement of all operating and wearing parts without disturbing piping connections to trap body.

d. Provide strainers as an integral part of the body.

e. Provide bodies with plugged priming and draining openings.

f. Provide test cocks.

4. Type F&T

a. Provide float and thermostatic traps with AISI 300 series corrosion-resistant steel, heliarc-welded floats and operating mechanisms, with 13 percent chrome corrosion-resistant hardened steel seats and valves.

b. Balance pressure type thermostatic elements, with corrosion-resistant alloy bellows charged with a fluid that provides the most rapid response to changes in temperature.

c. Make bellows suitable for service with condensate having a pH of 6.0.

d. Design traps to permit removal and replacement of all operating and wearing parts without disturbing piping connections to trap body.

e. Design bellows to permit removal while hot without overexpansion and shield from direct blast of steam and condensate.

f. Fit bodies with drain plug.

5. Type T

a. Balance thermostatic traps, pressure type, with corrosion-resistant alloy bellows charged with a fluid that provides the most rapid response to change in temperature.

b. Make bellows suitable for service with a condensate having a pH of 6.0. Shield bellows from direct blast of steam and condensate and design to permit removal while hot without overexpansion.

c. Provide hardened valves and valve seats made of 13 percent chrome corrosion-resistant steel.

d. Design traps to permit removal and replacement of all operating and wearing parts without disturbing piping connections.

PART 3 EXECUTION

3.1 INSTALLATION

Submit installation drawings for steam traps in accordance with the manufacturer's published instructions.

Install traps and trap components in accordance with the manufacturer's instructions.

A. Trap Application

SERVICE	TRAP TYPE
Steam mains, risers, branches	Type IB, inverted bucket with thermostatic air vent where necessary.
Steam mains, risers, and branches, weather-exposed and subject to freezing	Refer to drawings
Steam coils associated with fans	Type F&T, float and thermo-static
Steam coils not associated with fans and not subject to freezing	Type T, thermostatic
Hot-water converter	Type F&T, float and thermo-static
Flash tank	Type IB, inverted bucket

B. Trap-Sizing Criteria

1. Size traps in steam mains, risers, and branches to provide an actual capacity, under normal operating conditions, of not less than three times the normal condensing rate.

2. Size traps draining underground steam mains to provide an actual capacity, under normal operating conditions, of not less than four times the normal condensing rate.

3. Size traps in steam mains, risers, and branches, weather-exposed and subject to freezing, to provide an actual capacity, under normal operating conditions, of two times normal condensing rate and duplex. Provide two identical traps, sized appropriately at each drainage point.

4. Size traps draining steam coils under modulating control to provide an actual capacity, under conditions normal to the system and including 1/2-pound per square inch (psi) coil pressure, of two times normal condensing rate and capable of opening at maximum coil steam pressure.

5. Size traps in all other services to provide an actual capacity, under normal operating conditions, of three times normal condensing rate.

6. Trap safety factors are minimal. Increase safety factor where necessary to ensure proper system drainage for a given application.

END SECTION 23 22 13

SECTION 23 22 26
STEAM SYSTEM PIPING

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AIR-CONDITIONING, HEATING AND REFRIGERATION INSTITUTE (AHRI)

AHRI 410	(2001; Addendum 1 2002; Addendum 2 2005; Addendum 3 2011) Forced-Circulation Air-Cooling and Air-Heating Coils

AMERICAN WELDING SOCIETY (AWS)

AWS Z49.1	(2012) Safety in Welding and Cutting and Allied Processes

ASME INTERNATIONAL (ASME)

ASME A13.1	(2007; R 2013) Scheme for the Identification of Piping Systems
ASME B1.1	(2003; R 2008) Unified Inch Screw Threads (UN and UNR Thread Form)
ASME B1.20.1	(2013) Pipe Threads, General Purpose (Inch)
ASME B16.11	(2011) Forged Fittings, Socket-Welding and Threaded
ASME B16.18	(2012) Cast Copper Alloy Solder Joint Pressure Fittings
ASME B16.20	(2012) Metallic Gaskets for Pipe Flanges - Ring-Joint, Spiral Wound, and Jacketed
ASME B16.21	(2011) Nonmetallic Flat Gaskets for Pipe Flanges
ASME B16.22	(2013) Standard for Wrought Copper and Copper Alloy Solder Joint Pressure Fittings
ASME B16.24	(2011) Cast Copper Alloy Pipe Flanges and Flanged Fittings: Classes 150, 300, 600, 900, 1500, and 2500
ASME B16.3	(2011) Malleable Iron Threaded Fittings, Classes 150 and 300
ASME B16.34	(2013) Valves - Flanged, Threaded and Welding End
ASME B16.39	(2009) Standard for Malleable Iron Threaded Pipe Unions; Classes 150, 250, and 300

ASME B16.5	(2013) Pipe Flanges and Flanged Fittings: NPS 1/2 Through NPS 24 Metric/Inch Standard
ASME B16.9	(2012) Standard for Factory-Made Wrought Steel Buttwelding Fittings
ASME B18.2.1	(2012; Errata 2013) Square and Hex Bolts and Screws (Inch Series)
ASME B18.2.2	(2010) Nuts for General Applications: Machine Screw Nuts, Hex, Square, Hex Flange, and Coupling Nuts (Inch Series)
ASME B31.1	(2014; INT 1-47) Power Piping
ASME B40.100	(2013) Pressure Gauges and Gauge Attachments
ASME BPVC	(2010) Boiler and Pressure Vessels Code
ASME BPVC SEC IX	(2010) BPVC Section IX-Welding and Brazing Qualifications
ASME BPVC SEC VIII D1	(2010) BPVC Section VIII-Rules for Construction of Pressure Vessels Division 1

ASTM INTERNATIONAL (ASTM)

ASTM A106/A106M	(2014) Standard Specification for Seamless Carbon Steel Pipe for High-Temperature Service
ASTM A194/A194M	(2014) Standard Specification for Carbon and Alloy Steel Nuts for Bolts for High-Pressure or High-Temperature Service, or Both
ASTM A307	(2014) Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength
ASTM A53/A53M	(2012) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM B32	(2008; R 2014) Standard Specification for Solder Metal
ASTM B88	(2014) Standard Specification for Seamless Copper Water Tube

COPPER DEVELOPMENT ASSOCIATION (CDA)

CDA A4015	(2010) Copper Tube Handbook

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)

MSS SP-45	(2003; R 2008) Bypass and Drain Connections
MSS SP-58	(1993; Reaffirmed 2010) Pipe Hangers and Supports - Materials, Design and Manufacture, Selection, Application, and Installation

MSS SP-69	(2003; Notice 2012) Pipe Hangers and Supports - Selection and Application (ANSI Approved American National Standard)
MSS SP-80	(2013) Bronze Gate, Globe, Angle and Check Valves

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA ICS 2	(2000; R 2005; Errata 2008) Standard for Controllers, Contactors, and Overload Relays Rated 600 V
NEMA ICS 6	(1993; R 2011) Enclosures
NEMA MG 1	(2011; Errata 2012) Motors and Generators

1.2 GENERAL REQUIREMENTS

This section includes steam and condensate piping used for heating within the building. Steam boilers, feedwater treatment equipment, process steam terminal units, boiler feed piping, and blow-off piping are not covered in this section.

A. Classes and Maximum Working Pressures

1. Equipment, piping, and piping components shall be suitable for use under the maximum working pressure indicated. Except as modified herein, the pressure temperature limitations shall be as specified in the referenced standards and specifications.

B. Standard Commercial Product

1. The terminal units provided shall, as a minimum, comply with the features specified herein and shall be the manufacturer's standard commercial product. Additional or better features which are not specifically prohibited herein but which are a part of the manufacturer's standard commercial product, shall be included in the terminal units being furnished. A standard commercial product is a product which has been sold or is currently being offered for sale, on the commercial market through advertisements or manufacturer's catalogs or brochures. Provide Institute of Boiler and Radiator Manufacturer (IBR) or Steel Boiler Institute (SBI) rating for required capacity.

C. Welding Safety

1. AWS Z49.1.

D. Definitions

1. High Pressure Piping System

a. A system whose pressure is greater than 15 psig and shall conform to ASME B31.1.

2. Low Pressure Piping System

a. A system whose pressure is 15 psig or less.

3. Terminal Unit

a. An enclosed unit that provides heated air from a steam coil and includes natural convection units, radiation, and forced air units.

4. Piping and Piping System

a. Includes pipe, tubing, flanges, bolting, gaskets, valves, safety valves, fittings, and pressure containing parts of other piping components, hangers, supports, guides, expansion joints, anchors, and other equipment items necessary to prevent overstressing the pressure containing parts.

1.3 SUBMITTALS

Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

Product Data

Unit heaters

Convertors

Condensate return pumping units

Finned tube radiation units

Cast iron baseboard radiation units

Convectors

Steam to air heating coils

Valves

Valve operating mechanism

Steam meters

Traps

Strainers

Flash Tanks

Expansion joints

Instrumentation

Test Reports

Steam piping tests

Copper tubing test

Valves tests

Expansion joints tests

Instrumentation tests

Pipe and pipe system

Unit heaters tests

Convertors tests

Condensate return pumping units tests

Radiation units tests

Steam to air heating coils tests

Submit reports of tests required by the reference specification and standards.

Certificates

Welding procedure

Welder's Performance Qualification Record

List of welders and welder's symbols

Manufacturer's Instructions

Unit heaters

Convertors

Condensate return pumping units

Include manufacturer's recommendations for equipment foundations.

1.4 QUALITY ASSURANCE

A. Welding Procedure

1. Submit welding procedure specification for metals included in the work, together with proof of the procedure's qualifications as outlined in ASME B31.1.

B. Welder's Performance Qualification Record

1. Submit the Welder's Performance Qualification Record in conformance with ASME B31.1 for each welder, showing that the welder was tested under the approved procedure specification submitted by the Contractor. In addition, the Contractor shall submit list of welders and welder's symbols, assigned number, or letter which shall be used to identify the work of the welder which shall be affixed immediately upon completion of the weld. Welders making defective welds after passing a qualification test shall be required to take a requalification test. Welders failing the requalification tests will not be permitted to work under this contract.

C. Previous Qualifications

1. Welding procedures, welders, and welding operators previously qualified by test may be accepted for this contract without requalification subject to approval if the conditions specified in ASME B31.1 are met before a procedure can be used.

PART 2 PRODUCTS

2.1 PIPE AND PIPE SYSTEM

A. Low Pressure Steam Piping System

1. ASME B31.1 for a steam working pressure of 15 psig or less, a condensate pressure of 125 psig, and a temperature of 212 degrees F.

2. Low Pressure Steam Piping

a. Steel Piping: ASTM A53/A53M, Schedule 40, black, electric-resistance welded or seamless. Use ASTM A53/A53Mpipe for bending.

b. Copper Tubing: ASTM B88, Type K.

B. Condensate Return Piping (100 psig or Less)

1. Steel Piping

a. ASTM A106/A106M or ASTM A53/A53M, Grade B, Schedule 80, black, electric-resistance welded or seamless.

2. Copper Tubing (15 psig or Less)

a. ASTM B88, Type K.

C. Fittings

1. Provide fittings compatible in all respects (material, size, pressure, and temperature limitations) with the pipe being used and within any further limitations of ASME B31.1.

2. Fittings for Steel Pipe

a. Sizes 1/8 to 2 inches:

1) Steel Fittings: ASME B16.11, socket welding or threaded. Where pressure exceeds 15 psig, provide socket-welding type only.

2) Malleable Iron Fittings: ASME B16.3, threaded.

b. Sizes 2 1/2 inches and larger:

1) Steel Fittings: ASME B16.9, buttwelding or ASME B16.5, flanged.

2) Bronze Fittings: ASME B16.24, flanged. Sizes larger than 8 inches are not permitted.

3. Fittings for Copper Tubing

    a. ASME B16.18, cast copper alloy or ASME B16.22, wrought copper, solder joint type. Flared or compression joint type fittings for tube sizes not exceeding 2 inches outside diameter (O.D.) may be provided as permitted in ASME B31.1.

D. Unions

1. Unions for Steel Pipe

    a. ASME B16.39, threaded.

2. Unions for Copper Tubing

    a. CID A-A-59617, solder joint end type.

E. Flanges

1. Remove the raised faces on flanges when used with flanges having a flat face.

2. Steel Flanges

    a. ASME B16.5, forged steel, welding type.

3. Bronze Flanges

    a. ASME B16.24, threaded.

F. Valves

1. Shall conform to the following paragraphs. End connections shall conform to paragraph entitled "End Connections."

2. Gate Valves

    a. Bronze Gate Valves: MSS SP-80, Type 2 (solid wedge, inside screw, rising stem), 2 inches and smaller, threaded or solder joint ends, and not less than Class 150.

    b. Steel Gate Valves: ASME B16.34. Provide outside screw and yoke type with solid wedge or flexible wedge disc, and with trim suitable for the service temperature and pressure.

    c. Provide corrosion resistance epoxy coated chain operators when valves are located 6’-0” or more above finished floor.

    d. Provide flanged body end connections for all valves larger than 2-inches. Ensure flange faces have concentric serrated finish.

3. Globe and Angle Valves

a. Bronze Globe and Angle Valves: MSS SP-80, Type 1 (metal disc, integral seat) or Type 3 (metal disc, renewable seat), 3 inches and smaller, threaded or solder joint ends, Class 200 except that Class 150 with solder joint ends may be used for copper tubing. Valves shall have renewable seats and discs, except solder joint end valves which shall have integral seats.

b. Steel Globe and Angle Valves: ASME B16.34, with trim suitable for the service temperature and pressure.

4. Check Valves

a. Bronze Lift Check Valves: Class 125, Lift Check Valves with Bronze Disc, MSS SP-80, Type 1, 200 psig. CWP Rating, ASTM B 61 or ASTM B 62 bronze, threaded ends, bronze disc, with trim suitable for the service temperature and pressure. Crane.

b. Center-Guided Check Valves:

1) A. Class 125, Iron, Compact-Wafer, Center-Guided Check Valves with Resilient Seat, MSS SP-125, 200 psig. CWP Rating, ASTM A-536 iron, compact wafer style, Type 304 stainless steel disc and spring, EPDM Seat, with trim suitable for the service temperature and pressure. Henry Pratt.

2) B. Class 125, Iron, Globe, Center-Guided Check Valves with Resilient Seat, MSS SP-125, 200 psig. CWP Rating, ASTM A-536 iron, Globe, spring loaded style with Type 304 stainless steel disc and spring, flanged ends, EPDM Seat, with trim suitable for the service temperature and pressure. Henry Pratt.

5. Steam Pressure Reducing Valves

a. CID A-A-50558, cast iron prohibited.

6. Temperature Regulating Valves

a. CID A-A-50559, cast iron prohibited.

7. Air Vent Valves

a. FS F-V-2906, with vacuum holding device, pressure rated for the intended service, and with a capacity based on manufacturer's standard for the connection size, cast iron prohibited.

8. Radiator Valves

a. Provide angle or straightway pattern with packed or packless bonnet shutoff globe type designed especially for steam heating system. Valve shall be constructed of copper alloy conforming to ASTM specifications for materials with non-metallic renewable disc and plastic wheel handle for shutoff service.

9. Valve Operating Mechanism

a. Floor Stands: Shall be cast iron or steel, constructed for bolting to the floor and shall include an extension stem, an operating handwheel, and a position indicator for non-rising stems. Floor stand shall be not less than 30 inches high. Handwheel shall identify rotation direction for closing the valve and shall be of such diameter as to permit operation of the valve with a force of not more than 40 pounds.

b. Chainwheel Operator: Shall be fabricated of cast iron or steel and shall include a wheel, an endless chain, and a guide to keep the chain on the wheel. Provide galvanized steel endless chain extending to within 3 feet of the floor. Wheel shall be epoxy coated, corrosion resistant.

c. Power Operators: Shall be electric. Power operated valves shall open and close at rates no slower than 10 inches per minute for gate valves and 4 inches per minute for globe and angle valves. Valves shall open fully or close tightly without requiring further attention when the actuating control is moved to the open or close position. A predetermined thrust exerted on the stem during operation resulting from an obstruction in the valve shall cause the motor to automatically stop. Power operators shall be complete with all gearing and controls necessary for the size of valve being provided. Power operators shall be designed to operate on the electric power supply indicated.

d. Extension Stem: Shall be corrosion resisting steel designed for rising and non-rising stems, as applicable, and for connection to the valve stem by a sleeve coupling or universal joint. Provide in length required to connect the valve stem and the operating mechanism and of sufficient cross section to transfer the torque required to operate the valve.

10. Safety Valves

a. MIL-V-18436, Type 1, sized in accordance with ASME BPVC. Set point shall be as indicated, cast iron prohibited.

G. End Connections

1. Steel Piping

a. Sizes 2 inches and smaller threaded or socket welded; sizes 2 1/2 inches and larger flanged or butt welded.

b. Threaded Joints: ASME B1.20.1.

c. Flanged Joints: Flanges shall conform to paragraph entitled "Flanges." Bolting and gaskets shall be as follows:

1) Bolting: Material used for bolts and studs shall conform to ASTM A307, Grade B; and material for nuts shall conform to ASTM A194/A194M, Grade 2. Dimensions of bolts, studs, and nuts shall conform to ASME B18.2.1 and ASME B18.2.2 with threads conforming to ASME B1.1coarse type, with Class 2A fit for bolts and studs, and Class 2B fit for nuts. Bolts or bolt-studs shall extend completely through the nuts and may have reduced shanks of a diameter not less than the diameter at root of threads. Carbon steel bolts shall have American Standard regular square or heavy hexagon heads and shall have American Standard heavy semifinished hexagonal nuts, conforming to ASME B18.2.1 and ASME B18.2.2.

2) Gaskets: Gaskets shall be as follows:

Working Conditions	Material
Saturation	

Working Conditions	Material
[_____] psig [_____] degrees F	Composition or Copper
Superheated Steam, Less Than 750 degrees F	
[_____] psig [_____] degrees F	Metal-Jacketed Composition, Monel, Steel, or Soft Steel

3) Gaskets shall be as thin as the finish of surfaces will permit. Metal or metal-jacketed non-asbestos gaskets shall be used with small male and female or small tongue-and-groove flanges or flanged fittings; they may be used with steel flanges with lapped, large male and female, large tongue-and-groove, or raised faces. Full faced gaskets shall be used with flat-faced bronze flanges. Lapped steel flanges, or raised-face steel flanges shall have ring gaskets with an outside diameter extending to the inside of the bolt holes. Widths of gaskets for small male and female and for tongue-and-groove joints shall be equal to the widths of the male face or tongue. Gaskets shall have an inside diameter equal to or larger than the port openings. Rings for ring joints shall be in accordance with dimensions in ASME B16.20, suitable for the service conditions encountered, and shall be softer than the flanges. Dimensions for non-metallic gaskets shall be in accordance with ASME B16.21.

d. Butt Weld Joints: ASME B31.1. The use of backing rings shall conform to ASME B31.1. Ferrous rings shall be of good weldable quality and shall not exceed 0.05 percent sulfur; for alloy pipe, backing rings shall be of material compatible with the chemical composition of the parts to be welded and preferably of the same composition. Backing rings shall be continuous machined or split band type.

e. Socket Weld Joints: ASME B31.1.

2. Joints for Copper Tubing

a. Solder Joints: ASTM B32, alloy grade Sb5 solder for steam pressure 15 psig or less.

b. Brazed Joints: FS QQ-B-654 for steam pressure 120 psig or less.

H. Expansion Joints

1. Packless Type

MIL-DTL-17813. Bellows material shall be 304 stainless steel.

2. Guided Slip-Tube Type

MIL-E-17814.

I. Instrumentation

1. Pressure and Vacuum Gages

ASME B40.100 with restrictor, locate as indicated. Provide scale range for intended service. Scale range not to exceed two times (2X) the indicated pressure of piping.

2. Tank Gages

   CID A-A-50568, locate as indicated.

3. Indicating Thermometers

   Thermometers shall be dial type with an adjustable angle suitable for the service. Provide thermowell sized for each thermometer in accordance with the thermowell specification. Fluid-filled thermometers (mercury is not acceptable) shall have a nominal scale diameter of 5 inches. Construction shall be stainless-steel case with molded glass cover, stainless-steel stem, and bulb. Stem shall be straight, length as required to fit well. Bimetal thermometers shall have a scale diameter of 3 1/2 inches. Case shall be hermetic. Case and stem shall be constructed of stainless steel. Bimetal stem shall be straight and of a length as required to fit the well.

J. Miscellaneous Pipeline Components

1. Air Traps

   CID A-A-60001 for float-operated steam traps (non-thermostatic), except that the valve mechanism shall be inverted so as to be closed, not opened, by rising water. Arrange float-controlled valves to close promptly when water enters the traps. Locate traps as indicated.

2. Steam Traps

   CID A-A-60001, thermostatic and non-thermostatic steam traps. Provide traps with separate strainers and locate as indicated.

3. Strainers

   FS WW-S-2739, Style Y (Y pattern) for Class 125 and 250 piping in sizes 1/2 to 8 inches, inclusive, locate as indicated, cast iron prohibited.

4. Exhaust Heads

   CID A-A-50494, for atmospheric discharge of exhaust steam.

5. Hangers, Supports, Spacing Requirements, and Attachments

   MSS SP-58 and ASME B31.1 for materials, design, and manufacture. MSS SP-69 for selection and application.

6. Flash Tanks

   Construct of steel for a minimum working pressure of 125 psig. Provide the tank with a vent and valved drain.

PART 3 EXECUTION

3.1 INSTALLATION

A. Work material and equipment into a complete, convenient, and economical system or systems; and provide apparatus, parts, materials, and accessories which are necessary to accomplish this result.

B. Piping

1. Fabricate, assemble, weld, solder, braze, and install piping and pipe system in accordance with ASME B31.1 and as further qualified herein. Piping shall follow the general arrangement shown. Cut piping accurately to measurements established, for the work shown, by the Contractor, and work into place without springing or forcing, except where cold-springing is indicated. Locate piping and equipment within buildings entirely out of the way of lighting fixtures, conduit, and doors, windows, and other openings. Run overhead piping in buildings in the most inconspicuous positions. Provide adequate clearances from walls, ceilings, and floors to permit the welding of joints; at least 6 inches for pipe sizes 4 inches and smaller, 10 inches for pipe sizes larger than 4 inches, and in corners provide sufficient clearance to permit the welder to work between the pipe and one wall. Make provision for expansion and contraction of pipe lines. Do not bury, conceal, or insulate piping until it has been inspected, tested, and approved. Do not conceal piping in walls, partitions, underground, or under the floor except as indicated. Where pipe passes through building structure, do not conceal pipe joints, but locate where they may be readily inspected and not weaken building structure. Run insulated pipe as shown and as required with sufficient clearance to permit application of insulation. Use flanged joints only where necessary for normal maintenance and where required to match valves and equipment. Gaskets, packing, and thread compounds shall be suitable for the service. Apply joint compound or tape on male thread only. Use long radius ells wherever possible to reduce pressure drops. Pipe bends may be used in lieu of welding fittings where space permits. Pipe bends shall have a uniform radius of at least five times the pipe diameter and shall be free from any appreciable flattening, wrinkling, or thinning of the pipe. Mitering of pipe to form elbows, notching straight runs to form full sized tees, or any similar construction shall not be used. Make branch connections with welding tees except factory made forged welding branch outlets or nozzles having integral reinforcements conforming to ASME B31.1 may be used, provided the nominal diameter of the branch is at least one pipe size less than the nominal diameter of the run. Run piping as indicated, and avoid interference with other piping, conduit, or equipment. Run vertical piping plumb and straight and parallel to walls, except where specifically shown otherwise. Do not trap lines, except where indicated. Use reducing fittings for changes in pipe sizes. The use of bushings is prohibited. In horizontal lines 2 1/2 inches and larger, use reducing fittings of the eccentric type to maintain the bottom of the lines in the same plane for steam lines and to maintain the top of the lines in the same plane for condensate lines except where a trap or pocket would result. Provide suitable size sleeves for lines passing through building structure. Install piping connected to equipment to provide flexibility for thermal stresses and for vibration. Support and anchor pipe so that strain from weight and thermal movement of piping is not imposed on the equipment. Thoroughly clean each section of pipe, fittings, and valves of foreign matter before erection. Before placing in position, clean the inside of black steel pipe by rapping along its full length to loosen sand, mill scale, and other foreign matter; pipe 2 inches and larger shall have a wire brush of a diameter larger than that of the inside of the pipe drawn through its entire length several times. Before final connections are made to the apparatus, thoroughly wash out the piping interior with water. Blow out steam piping with high-pressure steam, if available, or compressed air, removing rust, oil, chips, sand, and other material. Plug or cap open ends of mains during shutdown periods. Do not leave lines open at any place where any foreign matter might accidentally enter pipe.

2. Welding

a. Welding of Piping: Welding of joints in piping, butt welds, fillet welds, bends, loops, offsets, and preparation and cleaning of pipe shall be in accordance with ASME B31.1. Welds shall be visually examined and meet acceptance standards indicated in Chapter VI of ASME B31.1.

b. Quality of Welds: Quality of welds, correction of defects, stress relieving, and preheating shall be in accordance with ASME B31.1.

c. Arc Welding and Gas Welding: In accordance with ASME BPVC SEC IX.

3. Brazing and Soldering

a. and soldering procedure qualification shall conform to ASME B31.1. Brazing procedure for joints shall be as outlined in the CDA A4015.

b. Soldering, soldering preparation, and procedures for joints shall be in accordance with ASME B31.1 and as outlined in the CDA A4015.

c. Copper Tube Extracted Joint: An extracted mechanical tee joint may be made in copper tube. Make joint with an appropriate tool by drilling a pilot hole and drawing out the tube surface to form a collar having a minimum height of three times the thickness of the tube wall. To prevent the branch tube from being inserted beyond the depth of the extracted joint, provide dimpled depth stops. Notch the branch tube for proper penetration into fitting to ensure a free flow joint. Braze extracted joints using a copper phosphorous classification brazing filler metal. Soldered joints shall not be permitted.

4. Hangers and Supports

a. Unless otherwise indicated, horizontal and vertical piping attachments shall conform to MSS SP-58. Continuous inserts and expansion bolts may be used.

5. Grading and Venting of Pipe Lines

a. Unless otherwise indicated, install horizontal lines of steam and return piping to grade down in the direction of flow with a pitch of not less than one inch in 30 feet, except in loop mains and main headers where the flow may be in either direction. When counterflow of condensate within the steam pipe occurs in a portion of a pipeline, pitch up in the direction of steam flow a minimum of 6 inches per 100 feet and increase pipe diameters by one standard pipe size. Steam mains pitched away from the boiler shall contain drip connection and air vent valves at the extreme end. Air vents shall be provided at the highest point of any vertical riser. Drip connections shall not be interconnected above the water line of the boiler.

6. Pipe Sleeves

a. Provide pipe sleeves where pipes and tubing pass through masonry or concrete walls, floors, roofs, and partitions. Use Schedule 40 galvanized steel pipe sleeves in outside walls below and above grade, in floor, and in roof slabs. Sleeves in partitions shall be zinc-coated sheet steel having a weight of not less than 0.907 psf. Space between pipe, tubing, or insulation and the sleeve shall be not less than 1 inch. Hold sleeves securely in proper position and location before and during construction. Sleeves shall be of sufficient length to pass through entire thickness of walls, partitions, or slabs. Sleeves in floor slabs shall extend 2 inches above the finished floor. Pack space between the pipe or tubing and the sleeve firmly with oakum and caulk both ends of the sleeve with elastic cement.

7. Floor, Wall, and Ceiling Plates

    a. Secure plates to the pipe with enough clearance for thermal expansion of pipe. Use chromium-plated steel or nickel-plated cast iron plates on pipes passing through floors and partitions of toilet rooms and where indicated; use painted cast iron, malleable iron, or steel for all other plates.

8. Flashing for Buildings

    a. Provide tight waterproof flashing where pipes pass through building roofs and outside walls.

9. Unions and Flanges

    a. Provide unions and flanges where necessary to permit easy disconnection of piping and apparatus, and as indicated. Provide a union for each threaded end valve Place unions or flanges as indicated. Use unions on piping smaller than 2 inches in diameter, and use flanges on piping 2 inches and larger in diameter. Provide dielectric unions or flanges between ferrous and non-ferrous piping, equipment, and fittings; except that bronze valves and fittings may be used without dielectric couplings for ferrous-to-ferrous or non-ferrous to non-ferrous connections. Dielectric fittings shall utilize a non-metallic filler which will prevent current flow. The spacer shall be suitable for the pressure and temperature of the service. The fittings shall otherwise conform to the requirements of paragraph entitled "Fittings."

10. Traps and Connections

    a. Traps shall be of the type and capacity for the service and shall be properly supported and connected. Except for thermostatic traps in pipe coils, radiators, and convectors, install traps with a dirt pocket and strainer between it and the piping or apparatus it drains. When necessary to maintain in continuous service apparatus or piping which is to be drained, provide a three-valve bypass so that the trap may be removed and repaired and condensate may drain through the throttled bypass valve. Provide a check valve on the discharge side of the trap whenever the trap is installed for lift or operating against a back pressure, or discharges into a common return line. When a thermodynamic trap is used, a check valve is not required or recommended. Provide test connections on the discharge side of the high and medium pressure traps when they are specifically required. The test connection shall include a 1/2 inch globe valve with uncapped nipple.

11. Connections for Future Equipment

    a. Locate capped or plugged outlets for connections to future equipment as indicated.

C. Valves

1. General

    a. Install valves in conformance with ASME B31.1, ASME BPVC SEC VIII D1, and as required herein, at the locations indicated and elsewhere as required for the proper functioning of the system. Use gate valves unless otherwise directed. Install stop valves in the supply lines equipped or located so as to permit operation from floor level, or provided with safe access in the form of walkways or ladders. Install valves in positions accessible for operation and repair. Provide gate valves 8 inches and larger with globe-valved bypass in accordance with MSS SP-45.

2. Globe Valves

    a. Install globe valves so that the pressure shall be below the disk. Install globe valves with the stems horizontal on steam and exhaust lines.

3. Steam Pressure-Reducing Valves

    a. Provide the steam line entering each pressure-reducing valve with a strainer. Provide each pressure-reducing valve unit with two cutout valves and with a globe or angle bypass valve and bypass piping. Provide each pressure-reducing valve unit with an indicating steam gage to show the reduced pressure, and a safety valve on the low pressure side with sufficient capacity to relieve the high pressure steam.

4. Valves for Radiators

    a. Install a radiator valve on each radiator.

5. Safety Valves

    a. Provide with drip pan elbows.

D. Pressure Gages

1. Install a shutoff valve or petcock between each pressure gage and the line, and gages on steam lines shall have a syphon installed ahead of the gage.

E. Thermometers

1. Provide thermometers and thermal sensing elements of control valves with a separable socket. Install separable sockets in pipe lines in such a manner to sense the temperature of the flowing fluid and minimize obstruction to flow.

F. Steam Meters

1. Provide steam meters with a suitable three-valve bypass to permit dismantling and inspection without interference with the service.

G. Strainers

1. Provide strainers with meshes suitable for the services where indicated, and where dirt might interfere with the proper operation of valve parts, orifices, and moving parts of equipment.

H. Equipment Foundations

1. Design equipment foundations of sufficient size and weight to provide isolation and to preclude shifting of equipment under operating conditions. Foundations shall meet the requirements of the equipment manufacturer. When required by the Owner, the equipment manufacturer's approval of the foundation design and construction for the equipment involved shall be obtained.

I. Equipment Installation

1. Install equipment as specified and in accordance with the manufacturer's installation instructions. Grout equipment mounted on concrete foundations before piping is installed. Install piping in such a manner as not to place a strain on any of the equipment. Do not bolt flanged joints tight unless they match. Adequately extend expansion bends before installation. Grade, anchor, guide, and support piping without low pockets.

J. Cleaning of System

1. As installations of the various system components are completed, clean before final closing. Remove foreign matter from equipment and surrounding areas. Preliminary or final tests shall not be performed until the cleaning is approved.

K. Cleaning and Painting of Piping and Equipment

1. Clean and paint piping and equipment in accordance with Section 09 90 00 PAINTS AND COATINGS.

L. Identification of Piping

1. Labels for pipes 3/4 inch diameter and larger shall bear printed legends to identify contents of pipes and arrows to shown direction of flow. Labels shall have color coded background to signify levels of hazard in accordance with ASME A13.1. Legends and type and size of characters shall also conform as ASME A13.1. Make labels of plastic sheet CID A-A-1689 with pressure sensitivity suitable for the intended applications, or they may be premolded of plastic to fit over pipe. For pipe smaller than 3/4 inch diameter, provide brass identification tags 1 1/2 inches in diameter with legends in depressed black filled characters.

3.2 FIELD TESTS AND INSPECTIONS

Field tests, and trial operations specified in this section shall be performed by the Contractor. The Contractor shall provide gas, labor, equipment, and incidentals required for testing. The Contractor shall give the Owner 5 days advance written notice of the dates and times scheduled for tests and trial operations.

A. Field Inspections

1. Inspect piping system prior to initial operation, for conformance to drawings, specifications, and ASME B31.1. Equipment, material, or work rejected because of defects or non-conformance with drawings, specifications, and ASME B31.1 shall be replaced or corrected by the Contractor, as directed by the Owner.

B. Field Tests

Conduct the following tests after completion of the piping installation and prior to initial operation.

1. Piping System

Test piping system hydrostatically using water not exceeding 100 degrees F. Conduct tests in accordance with the requirements of ASME B31.1 and as follows. Test the piping system after the lines have been cleaned as herein specified and before any insulation covering has been applied. Test piping system at 1 1/2 times the system pressure or 50 psig whichever is greater. Before performing tests, remove or valve off from the system, gages, traps, and other apparatus which may be damaged by the test pressure. Install a calibrated test pressure gage in the system to observe any loss in pressure. Maintain the required test pressure for a sufficient length of time to enable an inspection to be made of joints and connections. Perform tests after installation and prior to acceptance.

2. Start-Up and Operational Test

   Start-up the system and initially operate with components operating. During the test, periodically clean the various strainers until no further accumulation of foreign material occurs. Exercise care so that minimum loss of steam occur when strainers are cleaned. Adjust safety and automatic control instruments as necessary to place them in proper operation and sequence.

3. Extent of Field Tests

   After installation and before acceptance, subject the work of this section to necessary field tests.

END SECTION 23 22 26

SECTION 23 52 49
STEAM BOILERS AND EQUIPMENT

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ACOUSTICAL SOCIETY OF AMERICA (ASA)

ASA S1.4	(1983; Amendment 1985; R 2006) Specification for Sound Level Meters (ASA 47)

AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)

AISC 360	(2010) Specification for Structural Steel Buildings

AMERICAN WELDING SOCIETY (AWS)

AWS D1.1/D1.1M	(2010; Errata 2011) Structural Welding Code - Steel
AWS Z49.1	(2012) Safety in Welding and Cutting and Allied Processes

ASME INTERNATIONAL (ASME)

ASME B40.100	(2013) Pressure Gauges and Gauge Attachments
ASME BPVC SEC I	(2010) BPVC Section I-Rules for Construction of Power Boilers
ASME BPVC SEC VIII	(2010) Boiler and Pressure Vessel Codes: Section VIII Rules for Construction of Pressure Vessel
ASME BPVC SEC VIII D1	(2010) BPVC Section VIII-Rules for Construction of Pressure Vessels Division 1
ASME CSD-1	(2012) Control and Safety Devices for Automatically Fired Boilers
ASME PTC 4	(2013) Fired Steam Generators

ASTM INTERNATIONAL (ASTM)

ASTM B111/B111M	(2011) Standard Specification for Copper and Copper-Alloy Seamless Condenser Tubes and Ferrule Stock
ASTM B395/B395M	(2013) Standard Specification for U-Bend Seamless Copper and Copper Alloy Heat Exchanger and Condenser Tubes
ASTM B75/B75M	(2011) Standard Specification for Seamless Copper Tube

ASTM B88	(2014) Standard Specification for Seamless Copper Water Tube
ASTM D396	(2014a) Standard Specification for Fuel Oils
ASTM D888	(2012; E 2013) Dissolved Oxygen in Water

FM GLOBAL (FM)

FM APP GUIDE	(updated on-line) Approval Guide http://www.approvalguide.com/

NATIONAL BOARD OF BOILER AND PRESSURE VESSEL INSPECTORS (NBBI)

NBBI NB-27	(1991) National Board Rules and Recommendations for the Design and Construction of Boiler Blowoff Systems

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 211	(2013) Standard for Chimneys, Fireplaces, Vents, and Solid Fuel-Burning Appliances
NFPA 70	(2014; AMD 1 2013; Errata 1 2013; AMD 2 2013; Errata 2 2013; AMD 3 2014; Errata 3-4 2014; AMD 4-6 2014) National Electrical Code
NFPA 85	(2011; Errata 2011; AMD 1 2014) Boiler and Combustion Systems Hazards Code

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1910	Occupational Safety and Health Standards

WATER QUALITY ASSOCIATION (WQA)

WQA S-100	(2000) Standard for Household, Commercial and Portable Exchange Water Softeners

1.2 SYSTEM DESCRIPTION

A. Heating Surface and Volume Measurements

Submit heating surface and volume measurements, including heat release calculations and performance data at minimum, 25 percent, 50 percent, 75 percent, and 100 percent load sufficient to establish compliance of boilers with heat release requirements. Base calculations on the specified efficiency and capacity.

1.3 SUBMITTALS

Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

Shop Drawings

Steam boiler system

Design Data

Performance data at minimum, 25 percent, 50 percent, 75 percent, and 100 percent load

Test Reports

Boiler system start-up tests

Submit test reports in accordance with section entitled "Field Quality Control." Submit a detailed written record of the start-up performance, including burner setting data over the entire load range, before the Contractor's and sub-contractor's test personnel leave the site.

Certificates

Report of prior installations

Qualifications of engineer

Start-up plan

Start-up certification

Boilers

Submit evidence that boilers meet requirements of standards specified. Include with the certificate of compliance acceptable evidence that standards are met. Acceptable evidence will be the official UL listing mark prescribed in the UL gas and oil equipment list for oil-fired, gas-fired, or gas and oil-fired boiler assemblies, as applicable plus the appropriate official ASME symbol stamp. In lieu of the above certification, acceptable evidence will be a test report from an independent testing laboratory, indicating that the boilers and accessories have been inspected and tested and meet requirements of the applicable standards specified.

Operation and Maintenance Data

Boilers

Submit in accordance with Section 01 78 23 OPERATION AND MAINTENANCE DATA.

1.4 QUALITY ASSURANCE

A. Report of Prior Installations

Boilers shall be shipped to the site of installation as a knockdown boiler unit. A competent installation engineer or technician as stated in paragraph entitled "Qualifications of Engineer" shall assemble an unassembled boiler-burner package in strict accordance with the manufacturer's instructions. Boilers and feedwater equipment installed shall be of proven design which has been tested, successfully installed, and operated in commercial or industrial installations. Submit a certified written report from the boiler and feedwater equipment manufacturer indicating date of installation, type, model, capacity, and address location of installed boilers along with maintenance records and operating conditions including operating load and load swings. Show that substantially identical equipment of comparable capacity, within 20 percent, has been successfully installed and operated in not less than three installations under similar operating conditions for a period of not less than 2 years.

B. Start-Up and Installation Engineer

Provide the services of a qualified engineer or technician for start-up and tests and installation of equipment as specified below. More than one engineer or technician may be employed based on the types of specific equipment. One engineer or technician appointed by the Contractor shall supervise and be responsible for the overall installation, start-up, test, and checkout of systems.

C. Qualifications of Engineer

Submit a printed certified qualification resume of the engineer or technician. The engineer's or technician's resume shall list applicable experience related to installation, start-up, and testing of equipment and applicable factory training and education. Qualifications require the engineer to have supervised two installations of similar size and type which are operating satisfactorily. If more than one engineer or technician is employed, provide a certified resume for each one indicating their specific specialty and item of work.

D. Installation

Provide an installation engineer or technician to install and supervise the installation of steam boiler system including instrumentation and boiler controls. Provide the technician or engineer until the installation of equipment is coordinated and checkout completed.

E. Start-Up Plan

Submit a written schedule with dates of start-up tests, installation, and checkout of equipment.

F. Start-Up and Test

Start-up and test engineer or technician shall be approved by the manufacturer of the specific piece of equipment including boiler, boiler controls, boiler instrumentation, and feedwater equipment. The start-up and test engineer or technician shall remain on the job until the unit has been in successful operation for 5 days, and has been accepted by the Engineer.

G. Start-Up Certification

After installation of equipment, the engineer or technician shall submit a signed certificate or certified written statement that the equipment is installed in accordance with the manufacturer's recommendations.

PART 2 PRODUCTS

2.1 FORCED DRAFT FIRETUBE STEAM BOILERS

Boilers shall comply with local, state, and federal emission regulations for the fuel being used. Smoke emission shall not exceed Ringlemann No. 1, except during start-up, cleaning, or soot blowing. Boiler furnaces shall be equipped with combustion control safety devices conforming to ASME CSD-1. Burners and controls for boilers conforming to MIL-B-18897 shall conform to FS F-B-2910. Burners of the rotary type are not acceptable.

A. Acceptable Manufacturers

1. Basis of design shall be Burnham C Series firetube steam boilers meeting the requirements for physical size, heating surface area and capacity as described herein and as shown on plan drawings. Design shall include forced draft combustion burners as manufactured by Power Flame.
2. Equivalent units and manufacturers must meet all performance criteria, and must be approved by the School District during bidding phase.

B. Steam Boiler Trim

1. Furnish and install forced draft firetube boiler(s) for natural gas complete with fuel burning equipment, safety and operating controls, and appurtenances as herein specified. The boiler(s) shall be fully assembled and wired at the manufacturer's factory, requiring only connection to power, fuel supply and system piping to be ready for operation.
2. Boiler unit(s) shall be Burnham C Series as manufactured by Burnham Commercial for 15 PSIG steam service.
3. Gas fired boilers shall have a steady state combustion efficiency of at least 80 percent when fired at the maximum and minimum rated capacities which are provided and allowed by the controls.
4. Boiler pressure vessel shall be constructed, tested and marked in accordance with Section IV of the ASME code for low pressure heating boilers and shall be registered with the National Board of Pressure Vessel Inspectors.
5. Units shall fit through a 36" x 80" doorway with trim and controls removed.
6. Units shall be of modified Scotch design with two passes of horizontal firetubes and cylindrical horizontal furnace tube. Unit(s) shall be sealed for pressurized firing and shall have a welded on structural steel base with extension beyond boiler front for protection of the burner. Units(s) shall have a gas tight seal welded front flue door with insulated lining keyed in place, and gas tight bolted-on rear smokebox with top outlet. Connections shall be provided for trim and controls, supply and return, washouts and bottom drain.
7. Hot gas rear reversing chamber shall be watercooled side walls and light weight target wall; use of cast refractory will not be permitted. Reversing chamber cover shall have a Pyrex glass observation port. Removal and reinstallation of the rear cover door shall be easily accomplished by one person using ordinary hand tools. Removing the rear access door and rear smokebox shall provide full access to the tube sheets without disconnecting any fuel lines or electrical wiring.
8. Unit(s) shall be provided with factory-installed enamel finish jacket and not less than 1" thick fiberglass insulation.
9. Trim and controls for steam units shall consist of steam pressure gauge, water gauge set, ASME safety valve, combination low water cutoff and pump control with alarm contacts and quick opening blowoff valve, probe type manual reset auxiliary low water cutoff operating pressure control, high limit pressure control, firing rate control when firing with low-high-low or modulating sequences.
10. 10. Electrical supply to the boiler burners will be 208 volts 60 hz 3 phase. All control circuits shall be 120 volts, 60 hz, 1 phase with all switches in the ungrounded leg. Fuse protection for the control circuit shall be provided.

C. Boiler Connections

Requirements for interconnecting piping, insulation, fuel supply, vibration isolation, and other related work necessary to provide a complete and operable steam system, whether or not specifically mentioned above, shall conform to applicable requirements of other UFGS sections.

D. Boiler Instrumentation

1. In addition to the instruments required by the boiler specifications referenced above, provide the following instruments and locate where shown and where recommended by instrument manufacturer:

   a. A flue gas temperature gage.
   b. A draft gage, single point, conforming to ASME B40.100.
   c. Volumetric fuel flow meters.

   d. Master Combustion Control: Provide a common boiler master controller on the free standing boiler instrument and control panel to control all boilers with each individual boiler controller acting as a submaster controller. Boiler master control system shall provide for base loading one or more boilers. Base loaded boiler(s) shall be selected manually by an externally accessible switch. On call for heat, lead boiler shall cut in and moderate firing rate to satisfy demands. When maximum desired firing rate is reached, lag boiler or boilers shall cut in. Only one boiler shall be on modulating firing at one time. Maximum desired firing rate for base loaded boiler shall be adjusted initially for boiler peak efficiency and shall be capable of easy manual adjustment by operating engineer. Make adjustments at front of panel and no linkage adjustment shall be necessary. Combustion control system shall be capable of maintaining the plant steam pressure at the main header. Combustion efficiency shall not be less than that specified in the boiler specifications.

   e. Pressure gage conforming to ASME B40.100 or indicating steam pressure in main steam header.

E. Boiler Control Panel

1. Basis of design: Fulton ModSync Sequencing Control Panel. Contractor may submit equal for owner approval during bidding process.
2. When multiple boilers are to be installed in a common steam system, a sequencing control system shall be provided to stage and control firing rate of the boilers. The steam boilers shall be sequenced as follows to maximize their operating efficiency:

    a. The ModSync monitors the steam header pressure using a pressure transducer. A PID Control Variable determines when the steam boilers will begin sequencing based on the difference between the actual header pressure and the steam pressure setpoint.

    b. When a request for steam is determined by the ModSync, the Lead Steam Boiler is energized. The initial firing rate (if applicable) is determined by the Lead Start Firing Rate variable set in the Lead/Lag configuration section.

    c. If the steam pressure continues to decrease, the PID Control Variable will increase. The Lead Steam boiler's firing rate will reach 100% before the Lag Start CV value programmed. The ModSync will enable a Lag Boiler when the Lag Boiler Start control variable value has been reached.

    d. If additional steam is required, the ModSync will enable each additional Lag Boiler stage determined by the Lag Stage Start CV value. Each Lag Stage will reach a 100% firing rate before the next stage is enabled.

    e. As the steam pressure increases, the ModSync will begin to decrease the firing rate and number of Steam boilers required to maintain the steam pressure

    f. The Lead Boiler is disabled when the steam pressure reaches a selectable value referenced around the steam header setpoint.
3. The ModSync Sequencing Control System will be a microprocessor based Programmable Logic Controller with a Graphical User Interface and Touch Screen capabilities. Active display area will be a minimum of 4.7" with a display resolution of 320 x 240 pixels. Multiple Status and Configuration Screens will be available for easy interpretation of the steam loop status and configuration. The ModSync enclosure will be NEMA 4X construction. Power required for the ModSync will be 120/60/1.
4. The ModSync will have the ability to communicate to a Building Management System using Modbus (RS-485) or accept a 4-20mA Remote Setpoint signal. BacNet and LonWorks protocols can be used through a gateway, if requested.
5. The ModSync Sequencing Control shall include automatic rotation of the lead boiler based on a user configured cycle count.
6. Steam Header Pressure sensors are supplied with the ModSync.
7. Multiple setback schedules shall be available based on whether Normal or Setback mode is active. Mode selection shall be determined by a user defined Time of Day / Day of Week Touchscreen entry. The System Mode will automatically change between Normal and Setback based on the user programmed day and times. Manual Building Mode control shall also be available via a Setup menu. System Mode shall be indicated on the Loop Status Screen for ease of reference.
8. The ModSync Sequencing Control will provide alarm annunciation of each Boiler connected to the network. The ModSync will automatically adjust the boiler sequencing schedule and

remove the boiler from the sequencing logic if an alarm occurs. The boiler will automatically be added back into the rotation loop as soon as the ModSync senses that the alarm has been cleared.

9. The ModSync will stage the boilers based on a PID generated value. The Proportional, Integral and Derivative values shall be user defined through the Lead/Lag Configuration Screen. Each boiler stage will be enabled based on a user defined “Percentage from Setpoint” control variable. Boiler Sequencing Start and Stop parameters shall be user defined through the operator interface. A Manual Reset parameter will be provided to allow the Proportional Band to be shifted around setpoint.
10. The ModSync shall provide capabilities to Enable/Disable the boilers through the operator interface. Boilers that are disabled will not be included in the sequencing logic.
11. A user defined time delay parameter will be provided that delays enabling of the next boiler stage. This helps to decrease cycling of the boilers when the steam load is close to being met.
12. Contractor be responsible for tie in of new boiler control panel into existing Niagara Controls building control system.

F. Noise Levels

Noise measurements and exposure analyses should be conducted under the overall supervision of an industrial hygienist or suitably qualified medical officer from the Navy Regional Medical Center (NRMC). Safety personnel, engineers and others who have been certified by the Chief, Bureau of Medicine and Surgery (BUMED) also may supervise the work. Exposure limits for potentially hazardous noise levels of 85 dBA, continuous or intermittent, and 140 dB peak sound pressure, impulse or impact, shall be maintained. The sound level meter shall conform as a minimum to the Type 2 requirements cited in ASA S1.4.

G. Gas Burner

1. Basis of design: Powerflame burner. Contractor may submit equal for owner approval during bidding process.
2. Power Flame forced draft burner designed to burn the specified quantity of gas fuel without objectionable vibration, noise or pulsation, with no more than 20% excess air and no CO in the products of combustion as determined by a Testo Electronic Analyzer. The burner air louvers and butterfly valve shall be operated simultaneously by a modutrol motor controlling both fuel and air supply by means of a mechanical leakage. The fuel air drive shall be interlocked with the flame safeguard system to assure starting in the low fire position. Burner shall automatically modulate from boiler firing rate controller.
3. Boiler/burner units having a firing rate greater than 2500 MBH must be supplied with high turndown combustion head assembly. Assembly shall allow for independent adjustment of the fuel/air ratio at five degree increments across the entire modulation range.
    a. Sequence of burner operation shall be controlled by Siemens LMV37 Fuel air Ratio control shall be complete with UV scanner to monitor the interruptible gas pilot and the main flame of burner. Manual reset of burner shall be necessary in the event of pilot or main flame failure. Other conditions requiring manual reset are high or low gas pressure, high temperature, high operating pressure, and low air flow.

4. The burner pilot ignition will be of the gas-electric type with 10,000-volt ignition transformer, gas valve, high-pressure switch and gas pressure regulator. An observation port will be provided through which both the pilot and main flame can be observed.
    a. All gas trim on boiler shall meet the requirements of UL/FM/IRI and CSD-1.
    b. Burner shall be supplied with a gas control train sized for inlet pressure of 12.1" w.c. gas pressure. The gas train will have two low pressure drop motorized gas valves and one normally open solenoid safety gas valve, a lubricated plug shutoff cock, gas regulator, gas pressure (high/low) switches and a second lube cock. All PRV valves shall be rated for the inlet gas pressure and shall be tight shutoff. Provide leak test cocks and gas pressure gauges.
5. The burner(s) shall incorporate all necessary devices and controls to make a complete fuel burning system for the type of fuel specified herein, and bear the listing label of UL evidencing compliance with requirements of UL-296 for oil burners, and/or UL-795 for gas burners.
6. Gas burners shall be of the forced draft multi-jet type suitable for burning natural gas with heat content of 7,840,000 BTU delivered to the gas train inlet. Burner shall be complete with integral motor driven blower, ignition assembly, combustion flame safeguard, motor starter, complete gas train, including gas pressure regulator and dual gas valves, and all necessary controls for safe and efficient operation in accordance with UL requirements.
7. Control Panel
    a. Provide burners with NEMA 250 Type 12, burner mounted control panel. Panel shall have a hinged metal door with key lock and a window for viewing diagnostic display on microprocessor based flame safeguard. Panel shall contain programming relays, main start switch, blower motor starter, step down transformer, fuses, terminal strip, relays and specified lamps.
    b. Panels shall be constructed of 12 gauge enameled steel with round corners, secondary standoff panel back for mounting of equipment. All wiring within the panel shall be color coded and run in plastic raceways utilizing numbered terminal strips. Terminal strip shall be angled at 45 degrees to facilitate field interlock wiring.
    c. Program relay to control ignition, starting and stopping or burner and provide pre-combustion purge and post combustion purge.
    d. Manual/automatic selector switch and damper motor positioning potentiometer to permit automatic firing in accordance with load demand or manual control of fire rate throughout the range.
    e. Electronic detector to prevent primary fuel valves from opening until flame is established.
    f. Burner modulating circuit shall be provided to accept both 4-20ma and 0-135 ohm signal. Provide on control panel a "Remote-Local" switch that will allow for burner to modulate off of a 4-20ma signal from remote source. When in "local" burner shall modulate local control.
    g. Provide four indicating lights on each panel with individual nameplates to indicate power on, call for heat, ignition, fuel on, and alarm. Provide a 4" diameter alarm bell with silencing acknowledgment switch.
    h. Dry contacts shall be provided for remote enable/disable from the building DDC temperature control system. Dry contacts will be provided to send DDC boiler alarm condition.
    i. Provide relay and dry contact for combustion air damper interlock with feedback loop to prove combustion air damper open before firing.
    j. Electric Supply

k. Primary power shall be as scheduled. Boiler manufacturer to provide all magnetic motor starters with overload protection as well as step-down transformers for 120/60/1 control voltage.

2.2 BOILER BREECHING

A. Round Breeching

Construct round breeching of category 3, double wall, positive pressure, 304 stainless inner wall and aluminized outer wall with 1" air gap for metal connectors for medium-heat appliances and shall be constructed with welded beams and joints. Round breechings also may consist of approved factory-built chimney sections for medium-heat appliances if the sections are joined together with continuous welds, flanges, or couplings. Provided suitable cleanouts that will permit cleaning the entire breeching without dismantling.

B. Breeching Hangers

Design breeching hangers to carry not less than five times the breeching weight. Hangers for round breeching shall be of the band type with hanger rods. Provide steel trapeze type hangers for rectangular breeching with angle support member and hanger rods.

C. Doors

Secure cleanout doors to the ends and sides of the breeching where indicated or where required to effectively clean the breeching. Construct cleanout doors of a gage steel not less than that of the breeching and secure to a 1 1/4 by 1 1/4 inch angle frame not less than 1/8 inch in thickness with mounting bolts welded to the angle frame and spaced not over 6 inches on center; provide 1/16 inch thick long fiber non-asbestos gasket between cleanout doors and frames. Doors shall be squared and shall be full height of diameter or side of breeching up to a size of 24 inches by 24 inches maximum, except that cleanout doors less than 12 inches in height shall be rectangular and shall be 12 inches in length. Plug type cleanouts are not acceptable.

2.3 BLOWDOWN EQUIPMENT

Furnish with all equipment, tanks, and controls necessary for bottom blowdown of the boilers. The equipment for bottom blowdown systems shall include a blowdown tank and cooling kit. Install and pipe blowdown equipment as indicated, and conform to recommendations of the NBBI NB-27, Recommended Rules for National Board Boiler Blowoff Equipment.

A. Quality Assurance

1. The entire Blow-off Separator system and its installation shall conform to the manufacturer's instructions, applicable codes, and associated National Board requirements.
2. The equipment shall be in strict compliance with the requirements of this specification and shall be the manufacturer's standard industrial product unless specified otherwise. Additional equipment features, details, accessories, etc. which are not specifically identified but which are a part of the manufacturer's standard industrial product, shall be included in the equipment being furnished.
3. The equipment shall be of the type, design, and size that the manufacturer currently offers for sale and appears in the manufacturer's current catalog.
4. The equipment shall fit within the allocated space, leaving ample allowance for maintenance and inspection.
5. The equipment shall be new and fabricated from new materials. The equipment shall be free from defects in materials and workmanship.
6. All units of the same classification shall be identical to the extent necessary to ensure interchangeability of parts, assemblies, accessories, and spare parts wherever possible.
7. In order to provide unit responsibility for the specified capacities, efficiencies, and performance, the Blow-off Separator manufacturer shall certify in writing that the equipment being submitted shall perform as specified.

B. Warranty

1. Fulton Steam Solutions will repair or replace F.O.B. factory any part of the equipment of our manufacture that is found to be defective in workmanship or material within one (1) year of shipment from the factory provided this equipment has been installed, operated and maintained by the buyer in accordance with approved practices and recommendations made by both Fulton and the component manufacturers.
2. Fulton shall be notified in writing as soon as any defect becomes apparent. This warranty does not include freight, handling or labor charges of any kind. These warranties are contingent upon the proper sizing, installation, operation and maintenance of the boiler and peripheral components and equipment. Warranties valid only if installed, operated, and maintained as outlined in the Fulton Installation and Operation Manual. No Sales Manager or other representative of Fulton other than the Quality Manager or an officer of the company has warranty authority. Fulton will not pay any charges unless they were pre-approved, in writing, by the Fulton Quality Manager. This warranty is exclusive and in lieu of all other warranties, expressed or implied, including but not limited to the implied warranties of merchantability and fitness for a particular purpose. Fulton shall in no event be liable for any consequential or incidental damages arising in any way, including but not limited to any loss of profits or business, even if the Fulton Companies has been advised of the possibility of such damages. Fulton's liability shall never exceed the amount paid for the original equipment found to be defective.

C. Acceptable Manufacturers

1. This specification is based on the F Series Blow-off Separators as manufactured by Fulton Steam Solutions, Inc. Equivalent units and manufacturers must meet all performance criteria, and must be approved by the School District during bidding phase.
2. Basis of Design: Fulton Steam Solutions, Inc. Model:
   a. F-150

D. Blow-Off Separators Construction

1. The blow-off separator shall be constructed and tested in accordance with ASME Code Section VIII, Division I of the Boiler and Pressure Vessel Code for a design pressure of 75 PSIG at 400°F and hydrostatically tested to 113 PSIG for standard products. Minimum operating temperature is 50°F at 75 PSIG. Upon completion, the pressure vessel is inspected, and stamped with a registered National Board number and a “U” stamp. Higher pressure units may be ordered.
2. The Full Capacity of the Blow-off Separator shall not be less than:

    a. F-150 – 70.5 Gallons

3. The dimensions of the Blow-off Separator shall not be less than (Height X Diameter):

    a. F-150 – 50 in x 24 in

4. The dry weight of the Blow-off Separator shall not be less than:

    a. F-150 – 450 lb

E. Blow-Off Separators Design

1. The blow-off separator shall utilize flat heads (not dished) and be vertically oriented to conserve floor space. The Blowoff separator shall be constructed of heavy steel and equipped with a baffled steam vent, and a 3 x 4 hand hole for internal inspection f the pressure vessel. The blow-off separator shall have a large open vent to prevent pressure from building up in the tank. The unit shall have a primer coat and a finish coat of paint. The pressure vessel shell shall be constructed of SA53B pipe or SA516 Grade 70 plate. The heads shall be SA516 Grade 70 plate, and the stays shall be SA36 solid round bar.

2. Fulton blow-off separators are constructed with an internal baffle plate on the blow-off inlet to take the blow-off flow and absorb steam flash and pressure. The cold water inlet allows positive temperature control of the blow-off water to the drain and Fulton blow-off separators can be fitted with a cooling kit.

F. Blow-Off Separators Fittings & Trim

1. The blow-off separator shall have:
    a. Handhole(s) for inspection
    b. A blow-off inlet
    c. A blow-off outlet
    d. Thermometer
    e. An Aquastat opening
    f. A cold water inlet (include optional cooling kit)
    g. A steam vent
    h. A drain
    i. Connection for Sight Glass (include optional sight glass)
    j. Connection for Pressure Gauge (include optional pressure gauge)

G. Installation

1. Equipment and materials shall be installed in an approved manner and in accordance with the Blow-off Separator manufacturer's installation requirements.
2. The installer shall construct a flat, level foundation designed to support the entire load. Calculations shall be based upon the maximum or filled weight of the system.
3. Assemble unit sections and parts shipped loose or unassembled for shipment purposes. Follow manufacturer's installation recommendations and instructions.
4. Install any electrical control items furnished by manufacturer per wiring diagram provided by manufacturer.
5. Complete system piping installation as required by manufacturer for operation of system.

H. Field Quality Control

1. After Blow-off Separators installation is completed, the manufacturer shall provide the services of a field representative for starting the unit and training the operator.
2. Arrange with National Board of Boilers and Pressure Vessel Inspectors for inspection of boilers, blowdowns, tanks, piping, and any other applicable system components. Obtain applicable certifications for completed blow-off separators units, deliver to Owner, and obtain receipt.

2.4 VACUUM PUMP AND FEEDWATER EQUIPMENT

A. Acceptable Manufacturers

1. Basis of Design: Shipco Pumps.
2. Equivalent units and manufacturers must meet all performance criteria, and must be approved by the School District during bidding phase.

B. Vacuum Pump System

1. Furnish and install according to drawings and manufacturer's instructions the quantity of BVC-DUPLEX vacuum heating pump(s) as shown on the drawings. Each unit shall consist of (1) cast iron condensate receiver, (1) black steel vacuum separation chamber, (2) water pumps, (1) mechanical alternator, (2) vacuum pumps, (2) vacuum switches, electrical controls and accessories.

2. The condensate receiver shall be manufactured close-grained cast iron with 20 year warranty against corrosion failure. The receiver shall be equipped with (1) inlet basket strainer, (1) externally adjustable 2-pole mechanical alternator, top and bottom shut-off water level gauge with automatic shut-off if glass is broken, dial thermometer, vacuum compound gauge, (2) pressure gauges for boiler feed pump discharge and (2) bronze suction isolation valves between pump and receiver plus a valve in each bleed line installed for maintenance. The vacuum air separation chamber shall be manufactured of close-grained cast iron with 20 year warranty against corrosion failure and be equipped with a solenoid fresh water make-up valve and float switch with an air gap assembly for anti-siphon, top and bottom shut-off water level gauge with automatic shut-off if glass is broken, dial thermometer, suction check valves, vent and overflow connections.

3. All controls switches and valves to have a NEMA 2 rating.
4. An adjustable temperature limit switch set to cut off air pumps in case of excess temperature.

5. A cast iron inlet basket strainer with vertical self-cleaning bronze screen shall be provided for the condensate receiver inlet.
6. The centrifugal water pumps and vacuum pumps shall be flange mounted on their respective receivers. The pumps shall be of close coupled vertical design, and shall have a cast bronze impeller that is bronze fitted to the cast iron pump housing with a renewable bronze wearing ring. The mechanical seal shall be rated for 250°F service. The entire pump assembly shall be permanently aligned and dynamically balanced to deliver its full rated capacity of air and water at a test point of 5½" Hg vacuum and 160°F in accordance to the latest ASHRAE Standard Code for Return Line Low Vacuum Heating Pumps. The pump shall be driven by an industry standard motor available "off the shelf." The motor shall have a NEMA standard shaft. The horsepower and electrical characteristics shall be as shown on the drawings.
7. The pump manufacturer shall furnish, mount on the pump unit, and wire a U.L. labeled NEMA 2 control cabinet with hinged door, containing:
   a. 4 Combination magnetic starters (having 3 overload relays) with circuit breakers and cover interlock
   b. 2 “Automatic-Off” selector switches (water pumps)
   c. 2 “Lead-off Lag Continuous” selector switches (air pumps)
   d. 4 Pilot run lights
   e. 4 Momentary contact “Test” push buttons
   f. 1 Numbered terminal strip
   g. 1 Removable control mounting plate
8. The unit shall have a single point power connection.
9. Each pump control circuit shall be completely independent of the other. The mechanical alternator in the condensate pump chamber shall (1) change the operating sequence automatically after each cycle, (2) provide simultaneous operation under peak load conditions, and (3) operate the second pump automatically, should the active pump or its control fail.
10. A control circuit transformer for each circuit shall be provided when the motor voltage is three phase or code requires 115 volt controls. All factory installed wiring shall be numbered for easy identification and the numbers shall coincide with those shown on the wiring diagrams.
11. The entire pump package will be U.L. labeled when a control panel is furnished.
12. The unit shall be factory tested as a complete unit. The manufacturer shall furnish a certified pump performance test. The pump manufacturer shall furnish complete elementary and connection wiring diagrams, piping diagrams, and installation and operation instructions.

C. Boiler Feed System

1. Furnish and install according to drawings and manufacturer’s instructions the quantity of SHM boiler feed units as shown on the drawings. The unit shall consist of (1) black steel receiver minimum $^{3}/_{16}$" thick, with a quantity of 3 boiler feed pumps, electrical controls and accessories.
2. The boiler feed receiver shall be of welded steel minimum $^{3}/_{16}$" thick construction, horizontal with convex flanged and dished heads, supported on saddles and have a capacity as shown on the drawings. Receiver material and thickness shall be as shown on the drawings. The boiler feed receiver shall be equipped with the following: (1) inlet cascade baffle, (1) top and bottom shut-off water level gauge with automatic shut-off if glass is broken, (1) dial thermometer, (1) make-up water assembly consisting of a 2-pole externally adjustable float switch and electric solenoid valve, (1) high water float switch alarm, (1) low water float switch alarm, (1) manhole for tank inspection, (1) low water cut-off float switch, and (1) magnesium

anode. A bronze butterfly suction isolation valve between receiver and pump plus a valve in each bleed line installed for maintenance to permit servicing the pumps without draining the receiver. A discharge pressure gauge shall also be provided for each pump.

3. All controls switches and valves to have a NEMA 4 rating.
4. A cast iron basket inlet strainer with vertical self-cleaning bronze screen shall be provided for the receiver inlet.
5. The make-up water assembly shall be sized to equal the capacity of one of the boiler feed pumps. The solenoid valve shall be packless, piston pilot operated with cushioned closing and have an epoxy resin molded waterproof coil. The valve shall be equipped with a wye strainer, a 3-valve manual bypass and an air gap assembly for anti-siphon.
6. The boiler feed pumps shall be flange mounted on the receiver suction piping. The pump shall be close coupled vertical design, and have a cast bronze impeller that is bronze fitted to the cast iron pump housing with a renewable bronze wearing ring. The mechanical seal shall be rated for 250°F service. The entire pump assembly shall be permanently aligned and dynamically balanced to deliver its full rated capacity. The pump shall be driven by an industry standard motor available "off the shelf." The motor shall have a NEMA standard shaft. The horsepower and electrical characteristics shall be as shown on the drawings.
7. The manufacturer shall furnish a certified pump performance test. The pump manufacturer shall furnish complete elementary and connection wiring diagrams and installation and operation instructions.
8. The entire pump package will be U.L. labeled when a control panel is furnished.

2.5 ELECTRIC MOTORS

Motors which are not an integral part of a packaged boiler shall be rated for high efficiency service per Section 26 29 13 ENCLOSED CONTROLLERS. Motors which are an integral part of the packaged boiler system shall be the highest efficiency available by the manufacturer of the packaged boiler.

PART 3 EXECUTION

3.1 INSTALLATION

Arrange work in a neat and orderly manner so that minimum storage of equipment and material is required at the project site. Install equipment and material in accordance with the best commercial practices. A competent installation engineer or technician as stated in paragraph "Qualifications of Engineer" shall assemble an unassembled boiler-burner package in strict accordance with the manufacturer's instructions. Systems shall be neat in appearance, compact, adequate in construction and assembly, and installed for long and continuous service. Parts shall be readily accessible for inspection, repair, and renewal. Inspect equipment and material upon delivery and test after installation. Protect material and equipment from the weather. Repair damage caused by the Contractor in execution of the work and leave in a condition equal to that existing before work was started.

A. Equipment Foundations

Provide equipment pads to the dimensions shown or, if not shown, to conform to the shape of each piece of equipment served with a minimum 6-inch margin around the equipment and supports. Locate as shown and construct of sufficient size and weight and of proper design to preclude shifting of equipment under operating conditions or under abnormal conditions that could be imposed upon the equipment. Foundations shall meet requirements of equipment manufacturer. Grout equipment mounted on concrete foundations before installing piping. Concrete shall conform to Section 03 30 00 CAST-IN-PLACE CONCRETE, and grout shall be

non-shrinkable type approved by the Engineer. Install piping in such a manner so as not to place a strain on equipment.

B. Welding

Work shall be in accordance with the applicable sections of the ASME BPVC SEC I and AWS Z49.1.

C. Painting

Equipment shall be factory finished to withstand the intended end use environment in accordance with the specifications for the particular end item. Field paint equipment not factory finished as specified herein. Retouch damaged areas of factory-finished equipment on which the finish has been damaged and then give a complete finish coat to restore the finish to its original condition. The finish coat shall be suitable for exposure in the intended end use environment. Spray painting shall comply with OSHA 29 CFR 1910.

1. Cleaning and Application

Remove dirt, rust, oil, and grease by wire brushing and solvent degreasing prior to application of paint. Apply paint to clean and dry surfaces only. Where more than one coat of paint is specified, apply the second coat after the first coat is thoroughly dry. Retouch damaged painting before applying the succeeding coat. Finished surfaces shall be smooth. The painting of zinc coated and other corrosion-resistant metal surfaces is not required unless otherwise specified herein.

2. Smoke Flues, Boiler Casing, and Draft Ducts

Paint smoke flues, boiler casing, and black steel draft ducts with heat-resisting aluminum paint, two coats on the inside of flues and ducts and one coat on the outside, each coat to a minimum dry film thickness of one mil applied directly to clean bare metal surfaces. Paint exposed surfaces of protective metal covering over insulation, including zinc-coated surfaces, with two coats of heat-resisting black paint to a minimum dry film thickness of two mils applied directly to the clean bare metal surfaces. Do not paint zinc-coated ducts.

3. Gratings, Pipe Railings, and Pit Covers

Apply a pre-treatment coating to gratings, pipe railings, pit covers, and similar plant appurtenances to a dry film thickness of 0.3 to 0.5 mil. After installation, touch up damaged surfaces with then paint with two coats of finish paint matching type and color of adjacent areas. Do not paint zinc-coated surfaces.

D. Boiler Cleaning

After installation, the boiler shall be boiled out, under supervision of the manufacturer, with soda ash or equivalent solution to clean internal surfaces of oil, grease, mill scale, and dirt. Following treatment, the boiler(s) shall be flushed, drained and then opened and washed down and inspected to ensure that no traces of oil or foreign matter are present. The boiler and associated piping shall then be drained and refilled with treated softened water. At all times after initial cleaning, the Contractor shall protect the boiler, tanks, and piping against internal corrosion until testing is completed and the boiler(s) is accepted. Chemical contractor to provide chemicals, labor for introducing chemicals, and professional services for control and supervision of the treatment process.

E. Piping

Material and installation requirements including welding shall be as specified in Section 23 11 25 FACILITY GAS PIPING, and Section 23 22 26 STEAM SYSTEM PIPING.

F. Condensate Drain Lines

Provide water seals in the condensate drain from all units. Provide a depth of each seal of 2 inches plus the number of inches, measured in water gauge, of the total static pressure rating of the unit to which the drain is connected. Provide water seals that are constructed of 2 tees and an appropriate U-bend with the open end of each tee plugged. Provide pipe cap or plug cleanouts where indicated. Connect drains indicated to connect to the sanitary waste system using an indirect waste fitting. Insulate air conditioner drain lines as specified in Section 23 07 00 THERMAL INSULATION FOR MECHANICAL SYSTEMS.

3.2 FIELD QUALITY CONTROL

Perform inspections and tests as specified herein to demonstrate that the boiler(s) and auxiliary equipment, as installed, are in compliance with contract requirements. During boiler system start-up tests, factory-trained engineers or technicians employed by individual suppliers of such components as the burner, flame safeguard and combustion controls, feedwater treatment equipment, and other auxiliary equipment shall be present, as required, to ensure the proper functioning, adjustment, and testing of individual components and systems. No bypassing, use of jumpers, or other disablement of control systems will be allowed unless specified elsewhere. Labor, equipment, fuel, and test apparatus required for testing shall be furnished by the Contractor. Rectify defects disclosed by the tests by the Contractor within time period specified by the Engineer.

A. Inspections and Test

1. Make inspections and tests at the site under the direction of and subject to the approval of the Engineer. The Contractor shall operate the boiler and appurtenances prior to final testing and shall ensure that necessary adjustments have been made. Provide testing equipment, including gages, thermometers, calorimeter, Orsat apparatus, thermocouple pyrometers, fuel flow meters, water meters, and other test apparatus and set up and calibrate prior to the test. Draft, fuel pressure, and steam flow may be measured by permanent gages and meters installed under the contract. Provide an analysis of the fuel being used for tests. Control of noise levels developed by exhaust steam including muffler, globe, and gate valves shall be conducted in such a manner as not to create a nuisance or hazard and shall be subject to the approval of the Engineer. Tests shall include the following, and shall be performed when feasible, in the sequence listed:

    a. Strength and tightness tests
    b. Standards compliance tests
    c. Combustion tests
    d. Operational tests
    e. Capacity and efficiency tests
    f. Tests of auxiliary equipment
    g. Feedwater equipment test

B. Strength and Tightness Tests

Subject boiler to the following strength and tightness tests:

1. Hydrostatic Test

   After installation and connection, subject the boiler to an inspection and hydrostatic test to determine that the boiler and appurtenances have not been damaged in transit or handling. The hydrostatic test shall be in accordance with the ASME Code. This test shall be in addition to the hydrostatic tests performed at the factory. The hydrostatic test at the site shall be certified by an inspector holding an authorized commission from the National Board of Boiler and Pressure Vessel Inspectors.

2. Pneumatic Tests

   Pneumatically test air casing and ducts exterior to the furnace at the maximum working pressure. Use the soap bubble method to verify tightness. Test gas sides of boilers normally operated under pressure for tightness at 10 inches water gage. For this test, tightly seal the boiler with a suitable means to blank off openings. Admit air to the boiler until test pressure is reached and then hold. If in a 10-minute period the pressure drop does not exceed one inch water gage, the casing shall be regarded as tight and accepted. Use air pressure and soap bubble tests or comparative carbon dioxide readings for induced draft boilers.

C. Combustion Tests

Test the fuel burning and combustion control equipment with the specified fuel at the minimum limit of the turndown range and at increments of 50, 75, and 100 percent of full rated load. Tests shall be conducted by factory-trained combustion equipment engineers as previously specified. The combustion control system shall demonstrate that equipment installed will meet the requirements of the specification, and that an overall efficiency as specified, with not over 15 percent excess air, can be obtained with boiler operating at 100 percent capacity. Analyze test data and graphically present to show for the boiler at tested loads: rates of steam flow; flue gas temperature; percent excess air; steam quality; and percentages of carbon dioxide, carbon monoxide, and oxygen in the flue gas. Monitor concentrations of sulfur oxides, particulate, and nitrogen oxides in the flue gas to ensure compliance with environmental requirements. Run tests on each fuel until stack temperatures are constant and conformance with the combustion requirements of this specification has been verified and recorded. Verify proper operation of instrumentation and gauges in the control panel during the test.

D. Operational Test

Continuously test the boiler(s) under varying load conditions to demonstrate proper operability of the combustion control, flame safeguard control, programming control, and safety interlocks. Conduct this test after the adjustment of the combustion controls has been completed under the combustion test. The operational test shall continue for a period of at least 8 hours and shall include the following:

1. Sequencing

   The boiler shall start, operate, and stop in strict accordance with the specified operating sequence.

2. Flame Safeguard

   Verify the operation of the flame safeguard controls by simulated flame and ignition failures. Test burners having intermittent pilots by simulating main flame failure while the pilot is burning. Verify by stop watch the trial-for-pilot ignition, trial-for-main flame ignition, combustion control reaction, and valve closing times.

3. Immunity to Hot Refractory

   Operate the burner at high fire until the combustion chamber refractory reaches maximum temperature. Then manually close the main fuel valve. The combustion safeguard shall drop out immediately causing the safety shutoff valves to close within the specified control reaction and valve closing times.

4. Pilot Intensity Required

   Gradually reduce the fuel supply to the pilot flame to the point at which the combustion safeguard begins to drop out (sense "no flame") but holds in until the main fuel valve opens. At this point of reduced pilot fuel supply, the pilot flame shall be capable of safely igniting the main burner. If the main fuel valve can be opened on a pilot flame of insufficient intensity to safely light the main flame, readjustment of fire eye is required.

5. Immunity to Ignition Spark

   Where ultra violet flame detectors are employed, the pilot and main burner manual safety shut off valves shall be closed. The burner shall then be operated through the trial for pilot ignition period. The flame safeguard relay shall not respond to the presence of electric spark. If the flame safeguard relay responds to the presence of electric spark, reject the boiler.

6. Boiler Limit and Fuel Safety Interlocks

   Safety shutdowns shall be caused by simulating interlock actuating conditions for each boiler limit and fuel safety interlock. Safety shutdowns shall occur in the specified manner.

7. Combustion Controls

   Demonstrate the accuracy, range, and smoothness of operation of the combustion controls by varying the steam demand through the entire firing range required by the turndown ratio specified for the burner.

8. Safety Valves

   The high-pressure limit switch shall be locked out or otherwise made inoperative, and the boiler safety valves shall be lifted by steam. Determine the relieving capacity, popping pressure, blowdown, and reseating pressure by observation and measurement to be in accordance with the ASME Boiler and Pressure Vessel Code. The ASME standard symbol will be accepted only as indicating compliance with the design and material requirements of the code.

E. Capacity and Efficiency Tests

   Perform the capacity and efficiency tests after satisfactory completion of all tests previously specified herein and after the boilers have been operating continuously for one day with no nuisance shutdowns and without the necessity for frequent or difficult adjustments. Perform these tests on each boiler. Conduct tests using the specified fuels. Test procedures shall be in accordance with the heat loss method of the ASME PTC 4 and shall be reported on the ASME Test Form for Abbreviated Efficiency Test. The duration of the tests shall be sufficient to record necessary data but in no case shall test duration be less than 8 hours.

F. Auxiliary Equipment and Accessory Tests

Observe and check blowdown valves, stop valves, try cocks, draft fans, fuel oil heaters, pumps, electric motors, and other accessories and appurtenant equipment during the operational and capacity tests for leakage, malfunctions, defects, noncompliance with referenced standards, or overloading, as applicable.

G. Feedwater Equipment Tests

Conduct feedwater treatment test concurrently with either the combustion test or the capacity and efficiency test. Test shall determine compliance with the limits for oxygen content and hardness concentrations of this specification. Equipment for taking samples and the test kit for analyzing the samples shall be supplied by Geen Industries.

H. Preliminary Operational Test

Operate each boiler and appurtenances prior to final testing and insure that necessary adjustments have been made. Provide testing equipment required to perform tests. During this testing period, provide operating instructions and training to persons tasked with operation of the boiler. Tests shall be accomplished with both fuel on dual fuel units.

I. Startup Report

The boiler-burner manufacturer's representative, upon completion and start-up of the system, shall submit to this Engineer and the Owner a written certified report that the installation of the new boilers is in accordance with the specifications and is in proper operating condition. The combustion report shall have readings taken and recorded at a minimum of four (4) different firing points across the modulation range of each boiler. The report shall include the following information.

1. School Name_____
2. Date Start Up Test Was Performed_____
3. Total Hours Spent On Job Site_____
4. Service Technician Name_____
5. Boiler Model & Serial Number_____
6. Burner Model & Serial Number_____
7. Pilot Flame Signal_____
8. Main Flame Signal_____
9. Manifold Pressure_____
10. Stack Temperature_____
11. Boiler Back Pressure_____
12. Gas Pressure_____
13. Efficiency_____
14. Oxygen_____
15. CO2_____
16. CO_____
17. Draft_____
18. Nox_____
19. Operationally check for safety the low water cutoff and all other operating and limit controls as specified on boiler.
20. Operationally simulate pilot failure to check electronic flame safeguard control.
21. Record settings of all controls and safety lockout controls.

J. Owner Training by Manufacturer's Representative

1. Prior to boilers being filled with water the manufacturer's representative shall demonstrate simple tube removal and replacement.
2. At the completion of the project, the manufacturer's representative shall provide one (1) day of field training for the Owner's staff at site. Training shall consist of two parts. Part one is a classroom situation which describes the equipment's operation, maintenance, and repair requirements. Part Two will be on-site (hands-on) training which will show the location of all devices and the operation of all controls, devices, motors, etc.

END SECTION 23 52 49

SECTION 23 82 23
UNIT VENTIALTORS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ACOUSTICAL SOCIETY OF AMERICA (ASA)

ASA S12.11/Part 1	(2013) Acoustics-Measurement of Noise and Vibration of Small Air-Moving Devices, Part 1: Airborne Noise Emission
ASA S12.11/Part 2	(2013) Acoustics-Measurement of Noise and Vibration of Small Air-Moving Devices, Part 2: Structure-borne Vibration
ASA S12.30	(1990; R 2002) Standard Guidelines for the Use of Sound Power Standards and for the Preparation of Noise Test Codes
ASA S12.53/1	(2011) Acoustics- Determination of Sound Power Levels of Noise Sources - Engineering Methods for Small, Movable Sources in Reverberant Fields - Part1: Comparison Method for Hard-Walled Test Rooms
ASA S12.53/2	(1999; R 2015) Acoustics- Determination of Sound Power Levels of Noise Sources Using Sound Pressure - Engineering Methods for Small, Movable Sources in Reverberant Fields - Part2: Methods for Special Reverberation Test Rooms

ALUMINUM ASSOCIATION (AA)

AA DAF45	(2003; Reaffirmed 2009) Designation System for Aluminum Finishes

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI Z83.8/CSA 2.6	(2013 American National Standard/CSA Standard for Gas Unit Heater, Gas Packaged Heaters, Gas Utility Heaters and Gas-Fired Duct Furnaces

ASTM INTERNATIONAL (ASTM)

ASTM A568/A568M	(2014) Standard Specifications for Steel, Sheet, Carbon, Structural, and High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, General Requirements for

ASTM A653/A653M	(2015) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM F1040	(1987; R 2007) Standard Specification for Filter Units, Air Conditioning, Viscous - Impingement and Dry Types, Replaceable

INTERNATIONAL CODE COUNCIL (ICC)

ICC IFGC	(2012) International Fuel Gas Code
ICC IMC	(2012) International Mechanical Code

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA MG 1	(2014) Motors and Generators

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 54	(2015) National Fuel Gas Code
NFPA 70	(2014; AMD 1 2013; Errata 1 2013; AMD 2 2013; Errata 2 2013; AMD 3 2014; Errata 3-4 2014; AMD 4-6 2014) National Electrical Code
NFPA 90A	(2015) Standard for the Installation of Air Conditioning and Ventilating Systems

U.S. DEPARTMENT OF DEFENSE (DOD)

DOD-G-24508	(1977; Rev A; Am 4 1998) Grease, High Performance, Multipurpose (Metric)

1.2 SUBMITTALS

Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Material, Equipment, and Fixture List

Listing of Product Installations

SD-02 Shop Drawings

Controls

Unit Ventilators

SD-03 Product Data

Unit Ventilators

Controls

SD-05 Design Data

Connection Diagrams

Control Diagrams

SD-10 Operation and Maintenance Data

Operation and Maintenance Manuals

SD-11 Closeout Submittals

Record Drawings

1.3 QUALITY ASSURANCE

Submit records of existing conditions consisting of the results of survey of work area conditions and features of existing structures and facilities within and adjacent to the jobsite. Commencement of work constitutes acceptance of existing conditions.

Provide listing of product installations that includes identification of at least 5 installed units, similar to those proposed for work, that have been in successful service for a minimum period of 5 years. Provide list that includes purchaser, address of installation, service organization, and date of installation.

PART 2 PRODUCTS

2.1 CABINET AND CHASIS

A. Unit frames shall be of unitized, welded construction, with structural elements aligned in an assembly jig prior to welding, to insure proper dimensions, rigidity, and squareness. Frames assembled with mechanical fasteners shall not be acceptable.

B. Internal sheet metal parts shall be constructed of galvanized steel to inhibit corrosion.

C. Exterior cabinet panels shall be fabricated from furniture grade steel of not less than 18 gauge steel with no sharp edges and shall receive an electrostatically applied powder paint, and be oven baked with environmentally friendly thermosetting urethane powder finish to provide a high quality appearance. Finish color shall be off- white.

D. The interior areas of the unit ventilator shall be insulated for sound attenuation and to provide protection against condensation of moisture on or within the unit. The unit shall be provided with an ultra-quiet sound package consisting of acoustically matched low speed fans to fan housing, sound barrier insulation material (non-fiberglass) adhered to the bottom underside of the unit top panel, sides of the fan section and sound absorbing insulation (non-fiberglass) material applied to the unit front panel.

E. Each unit shall be provided with a non-fused power interrupt switch that disconnects the main power to the unit for servicing or when the unit is to be shut down for an extended period of

time. The fan motor and controls shall have the hot line(s) protected by factory installed cartridge type fuse(s).

F. The manufacturer shall have published cataloged sound data available for the engineer's review. Sound data shall have been conducted using a qualified reverberant room per ANSI S1.31 and ANSI S12.32. Sound test data shall be based on standard cfm at standard air (fixed density of air at 70F) in accordance with ARI procedures based upon ARI 350. The engineer shall have the right to reject equipment not conforming to the specified manufacturer's sound data, as a minimum. Sound levels shall not exceed those shown below:

Octave Band and Center Frequency (Hz)								
UNIT CFM	Speed	2 125	3 250	4 500	5 1000	6 2000	7 4000	8 8000
	High	57.3	51.1	50.6	47.9	45.3	40.4	28.4
750	Med.	56.0	50.8	48.8	45.8	42.6	37.0	23.9
	Low	57.0	47.5	46.2	41.6	38.6	31.4	18.7
	High	55.6	54.2	52.9	49.6	45.7	39.9	28.4
1000	Med.	57.9	49.7	50.4	46.6	42.1	35.3	22.1
	Low	54.2	50.8	52.4	48.2	43.6	38.6	33.4
	High	60.6	54.8	53.8	51.0	47.8	42.3	31.6
1250	Med.	60.8	53.2	51.9	48.1	44.1	37.1	27.1
	Low	55.1	52.6	50.3	46.6	41.8	34.7	24.5
	High	66.6	55.4	54.2	51.5	51.1	44.5	31.9
1500	Med.	64.9	53.7	52.5	49.2	48.2	41.1	27.8
	Low	62.0	51.7	50.1	46.1	42.7	35.6	23.1
	High	63.8	62.8	65.5	61.6	58.8	54.6	46.4
2000	Med.	61.2	60.2	62.5	57.6	56.1	51.3	42.9
	Low	59.0	57.3	58.8	54.0	53.3	48.2	39.7
Sound Power Levels - dB re 10 -12 watt								

- Test data based on a valve control unit having 3 rows of coil, no outdoor air, and standard static motor. Sound Power data may vary based on the type of unit, number of coil rows, and other external factors.

2.2 CEILING UNITS

A. The unit shall be of modular construction so that the fan, coil and damper sections are removable for service and maintenance.

B. Three bottom panels, two of which are hinged, shall be provided for ease of service access and handling. Retainer chains shall be provided to prevent sudden release of the hinged bottom panels. End panels shall be secured to the unit with recessed, tamper resistant, Allen head fasteners. Slots for flat head screwdrivers shall not be acceptable as tamper resistant.

C. Ceiling mounted units shall have a built-in metal wire raceway from right end compartment to left end compartment to contain any line voltage electrical wiring separate from the air stream. Line voltage wiring shall not be touchable in the air stream of the unit during normal maintenance procedures of oiling bearings or motors.

D. The discharge opening of the unit shall be fitted with an adjustable four-way deflection grille with the outer blades horizontal.

E. A ceiling trim flange shall be provided for recessed units. The trim flange shall be 3-sided or 4-sided as required.

F. The centerline of the cooling condensate drain shall be a minimum of 4" above the bottom of the unit to allow for appropriate trapping of the condensate disposal line.

2.3 COILS

A. Coil assembly shall be of a modular construction so that it is removable from the bottom of the unit.

B. All coils shall be installed in a draw through position to assure uniform air distribution over the full-face area of the coil, and an even unit discharge temperature.

C. All heating and cooling coils shall be constructed with copper tubes and mechanically bonded aluminum corrugated plate type fins. All coils shall have aluminum individual unshared fin surfaces. An air break shall exist between coils.

D. Cooling coils shall be furnished with a threaded drain plug at the lowest point and a manual air vent at the high point of the coil. A factory installed low temperature freezestat shall be provided on the leaving edge of the water heating coil in a wave-like configuration to sense multiple locations and shall react to possible freezing conditions. The unit-mounted controls shall incorporate this device.

E. Steam heating exchanger elements shall be double tube (DT) steam distributing, freeze resistant type with same end, as indicated on the plans. A pressure equalizing device (vacuum breaker) shall be factory installed to prevent the retention of condensate in the coil. The installing contractor shall connect the equalizing device to the return line beyond the trap using the tubing provided.

2.4 DRAIN PAN

A. All units shall come furnished with an insulated drain pan constructed of galvanized steel. A drain outlet shall be provided on both ends of the drain pan with one outlet capped. The drain hand of connection shall be easily field-reversed by relocating the cap to the opposite end without disassembly of the unit or movement of the unit drain pan.

B. The drain pan shall be able to be sloped in either direction for proper condensate removal.

2.5 FANS AND MOTOR

A. The fan and motor assembly shall be of a low speed design to assure maximum quietness and efficiency.

B. Fans shall be double-inlet, forward-curved, centrifugal type with offset aerodynamic blades. Fans and shaft shall be statically and dynamically balanced as an assembly in the unit before shipment.

C. Fan housings shall be constructed of galvanized steel incorporating logarithmic expansion for quiet operation. Fan and motor assembly shall be of the direct drive type. Belt drive fans shall not be allowed.

D. Motors shall be 115 volt, single phase, 60 Hz, NEMA permanent split capacitor (PSC), plug-in type with auto reset internal thermal overload device designed specifically for unit ventilator operation. Motors shall be located out of the conditioned air stream.

E. High Static units with external static pressures (ESP) up to 0.45 shall utilize an Electrically Commutated Motor (ECM).

F. All components of the fan/motor assembly shall be removable from the bottom of ceiling mounted units.

G. Units shall have sleeve type motor and fan shaft bearings, and shall not reqiure oiling more than annually. All bearings shall be located out of the airstream. Bearings in the air stream are not acceptable.

H. ECM Motor speed shall be factory programed for three (3) speeds, HIGH-MEDIUM-LOW-OFF (not accessible from the exterior of the unit). Fan motor shall have hot leg protected by a factory installed cartridge fuse.

2.6 FACE & BYPASS DAMPER

A. Each unit shall be provided with a factory-installed face and by-pass damper, constructed of aluminum. The long sealing edges of the damper shall have silicone rubber impregnated cloth seals for long life and positive sealing. Face and bypass dampers without sealing edges to prevent air bypass shall not be acceptable. The damper ends shall have blended mohair seals along the ends glued to the damper end for a positive seal. Plastic clip-on brush end seals shall not be acceptable as an end seal. The unit design shall incorporate the face and bypass damper to prevent coil surface wiping and be before the fan in a draw-thru configuration. The face and by-pass damper shall be arranged to have a dead air space to minimize heat pick-up in the by-pass position.

2.7 OUTDOOR & ROOM DAMPERS

A. Each unit shall be provided with separate room air and outdoor air dampers.

B. The room air damper shall be two-piece, double-wall construction fabricated from aluminum, and be counterbalanced against backpressure to close by gusts of wind pressure, thereby preventing outdoor air from blowing directly into the room.

C. The outdoor air damper shall be two piece, double wall construction fabricated from galvanized steel, with ½" thick, 1½ lb. density glassfiber insulation encapsulated between the welded blade halves for rigidity and to inhibit corrosion. The outdoor air damper shall have additional foam insulation on the exterior surface damper blade and on the ends of the outdoor air chamber. A single blade damper, which can be twisted and will leak air, will not be considered.

D. Dampers shall be fitted with blended mohair seals along all sealing edges. Pressure adhesive sponge neoprene or plastic clip-on brush type sealers for damper seals are not acceptable. Rubber type gasket using pressure adhesive for fastening to metal and exposed to the outside air is not acceptable.

E. Dampers shall use the turned-metal principle on long closing ends with no metal-to-metal contact for proper sealing.

F. The damper shaft shall be mechanically fastened to the blade, and shall operate in bearings made of nylon or other material which does not require lubrication.

2.8 FILTER

A. Each unit ventilator shall be equipped with a one-piece filter located to provide filtration of the return air/outdoor air mixture, in lieu of separate filters for each air stream. The entire filter surface must be useable for filtration of 100% room air or 100% of outdoor air. The filter shall be easily accessible from the bottom, and removable in one piece without removal of the unit return air damper stop. The unit shall ship with a factory installed 1" thick fiberglass, single-use type.

1. Spare filters shall be 1" thick fiberglass, single-use type.

2.9 CONTROL COMPONENTS

A. Each unit ventilator shall be furnished with a factory installed and wired, microprocessor based DDC Unit Ventilator Controller (UVC), by the manufacturer of the unit ventilator, which is pre-programmed, factory pre-tested prior to shipment, and capable of complete, stand-alone unit control or incorporation into a building-wide network using an optional plug-in communication module. The UVC shall be preprogrammed with the application code required to operate the unit using ASHRAE Cycle II. The unit control system shall include all required temperature sensors, input/output boards, main microprocessor modules, Local User Interface (referred to as LUI) Touch Pad with Digital LED Display, wiring, 24 volt power and direct coupled damper actuators. The UVC shall support up to 6 analog inputs, 12 binary inputs, and 9 binary outputs plus additional I/O points of 4 analog inputs and 8 binary outputs.

B. All units shall be Face & Bypass Damper Control. The Face and Bypass Damper Actuator shall be direct coupled, floating point actuator that is non-spring returned.

C. The Outdoor Air/Return Air Damper Actuator shall be direct coupled, floating point actuator that spring returns the outdoor air damper shut upon a loss of power.

D. The steam heating coil shall use a factory furnished, field installed, two position End Of Cycle (EOC) control valve to shut off the heating medium at the end of the heating cycle. Upon a power failure, the heating EOC valve shall spring return to the normally open position for flow of water. End of cycle valves without spring return to the normal position upon a power failure shall not be acceptable.

E. The LUI shall provide a unit mounted interface which indicates the current unit operating state, room temperature set point, and can be used to adjust the unit ventilator operating parameters (operating mode, fan speed and occupancy mode). The LUI shall have a digit display, 7 keys (1 key hidden for parameter menu access), 9 individual LED indicators and 4-level password protected security feature.

F. The unit controller shall monitor room conditions, and automatically adjust unit operations (fan speed, temperatures, etc.) to maintain pre-programmed temperature setting selection ranges and ventilation requirements. The control sequence shall be on the basis of ASHRAE Cycle II for normal classroom locations, but shall have exhaust fan interlock for override to bring in full outside air for laboratory/science room applications. The fan speeds shall be high constant, medium constant, low constant and auto, which shall vary the air flow in direct relation to the room load. The fan shall not change speeds in less than ten minutes in any one mode. Two constant fan speed operation shall not be acceptable.

G. Each Local User Interface (LUI) Touch Pad shall have a Digital LED Display status/fault indication. Communication ports shall allow monitoring and adjustment from a portable IBM compatible PC using RS-232 protocol for service or monitoring using the applicable software computer or future connection to a network control and monitoring system. When using this PC, the unit shall be capable of reacting to commands for changes in control sequence and set points.

H. All units shall come equipped with a factory mounted room temperature sensor located in a sampling chamber (front, center panel) where room air is continuously drawn through for fast response to temperature changes in the room. When using a remote wall-mounted temperature sensor the ability shall exist to simply disconnect the unit-mounted temperature sensor using the provided quick disconnect plug.

I. A discharge air temperature sensor shall be factory located on the second fan from the right to constantly sense unit discharge air temperatures. The unit's discharge air temperature sensor shall work in conjunction with the room temperature sensor to provide for stable discharge air temperatures, even in the event of rapid changes in outdoor air quantities.

J. An outdoor air temperature sensor shall be factory located in the outside air prior to the outside air damper to continually sense outdoor air temperature.

K. Night set-back/set-up control shall be provided by a factory mounted and wired digital time clock (optional for standalone operation) which shall cycle the unit ventilator through occupied and unoccupied modes in accordance with one of twenty (20) user programmed time schedules and a remote mounted time clock as described in the temperature control specification and provided by the automatic temperature controls contractor.

L. The unit shall have three (3) multi-pin External Signal Connection Plugs factory provided and pre-wired with short wire whips that are capped for field wiring of:

1. A Remote Wall Mounted Temperature Sensor.

2. External Input Signals (by others): unoccupied, remote shutdown, ventilation lockout, dewpoint/humidity, or exhaust interlock signals.

3. External Output Options (by others): lights on/off, motorized water valve open/close, fault indication signal, pump restart, exhaust fan on/off or auxiliary heat signal.

M. The unit ventilator shall come with a factory installed pre-wired control package (called DigitalReady) of Direct Digital Control (DDC) control components which facilitates field hook up of DDC Unit Ventilator Controllers (UVC) by others which are compatible with the factory installed sensors and actuators and capable of providing standard ASHRAE II cycle control sequence. Electrical wiring shall be isolated from the airstream. It shall be the entire responsibility of the Automatic Temperature Control (ATC) supplier to ensure the controls operate correctly and protect the unit. DigitalReady shall consist of the following components which are factory wired and powered:

1. 75 VA 24-volt NEC Class 2 transformer (50 VA or less is not acceptable) for 24-volt power supply with a complete 24-volt power wiring harness terminating in the left-hand end compartment at three 10-pole Europa type 16 awg terminal blocks rated for 10 amps at 300 volts;

2. Terminal strips hooked up with the fan motor start/stop relay;

3. A factory installed Low Air Temperature Limit (Freezestat);

4. Unit mounted 10K NTC (negative temperature coefficient) and 1K PTC (positive temperature coefficient) Discharge Air Temperature Sensors;

5. Unit mounted 10K NTC and 1K PTC Outdoor Air Temperature Sensors;

6. 24 VAC power wired to the damper actuators;

7. Direct coupled, proportional control (0 to 10 Vdc, or 4 to 20 mA), 35 inch-pounds of torque Outdoor Air/Return Air Damper Actuator that spring-returns the outdoor air damper shut upon a loss of power;

8. Direct coupled proportional control (0 to 10 Vdc, or 4 to 20 mA) Face and Bypass Damper Actuator, non-spring returned;

9. Terminal locations for 24-volt power to one or two End of Cycle valves (by ATC control contractor);

10. Direct coupled floating point (tri-state) Modulating Valve Actuator, non-spring returned;

11. Terminal connectors for interface with a DDC UVC Controller (by ATC control contractor).

2.10 CONTROL FUNCTIONS

A. The Unit Ventilator Digital Controller (here after referred to as UVC) shall support ASHRAE Cycle II operation. The control cycle shall be used to maintain the required minimum amount of ventilation whenever possible, which can be increased during normal operation for economizer cooling, but can also be reduced to prevent excessively cold discharge air temperatures.

B. A discharge air temperature sensor shall be installed in all unit ventilators. The ASHRAE II control algorithm shall override room control and modify the heating, ventilating, and cooling functions (as available) to prevent the discharge air temperature from falling below the Ventilation Cooling Low Limit (here after referred to as VCLL) setpoint.

C. Description of Operation

1. The Unit Ventilator UVC shall use State Machine programming concepts to define and control unit ventilator operation. This shall eliminate the possibility of simultaneous heating and cooling, rapid cycling, etc. and simplify sequence verification during unit commissioning or troubleshooting.

2. Super States shall group two or more related states into a single control function such as cooling, or heating, etc. States shall be where all the actual work takes place. Thus within each state the UVC shall enable PI loops and other logic sequences required to control unit ventilator operation within that particular state, while other functions and PI-loops not needed during that state may be disabled. Transitions shall be the logic paths used to determine which State should be made active. These shall be the “questions” the UVC will continually consider/determine for which path is followed and which state is active.

3. The UVC States and Super States shall be used to define the “normal” unit modes, such as Off, Fan Only, Heat, Emergency Heat, Cool, Auto, Night Purge, and Dehumidification. The UVC shall support several “non-normal” unit modes such as Purge, Pressurize, De-pressurize, and Shutdown, which can be forced via a network connection and override typical UVC operation.

D. Modes of Operation

1. The UVC shall provide several “normal” Modes of unit operation, these shall include Off, Fan Only, Heat, Emergency Heat, Cool, Heat and Cool, Auto, and Night Purge.

E. Off Mode

1. An Off Mode shall be provided so that the UVC can be forced into a powered off condition. The Off mode shall be a “stop” state for the unit ventilator; it shall not be a power off state. The Local User Interface module (here after referred to as LUI) or a network connection shall be able to force the unit into the Off mode.
2. Non-normal unit modes (i.e. Purge, Pressurize, and De-pressurize modes) accessed via a network connection shall be able to force the UVC to perform “special” functions during which the UVC shall appear to be in the Off mode.

3. When Off Mode becomes active, the UVC shall stop all normal heating, cooling, ventilation (OA damper shall be closed), and fan operation. The UVC shall continue to monitor space conditions, indicate faults, and provide network communications (if connected to a network) as long as power is maintained to the unit.

F. Fan Only Mode

1. A Fan Only Mode shall be provided so that the UVC can be forced into a Fan Only operation. The LUI or a network connection shall be able to force the unit into the Fan Only Mode.

G. Heat Mode

1. A Heat Mode shall be provided to force the UVC shall use primary heat (wet heat) as needed to maintain the effective heating setpoint. The LUI or a network connection shall be able to force the unit into the Heat mode.

2. When the Heat mode super state becomes active, the UVC shall automatically determine which UVC State to make active; Heat, Low Limit, or Cant Heat based upon the transitions for each of those states. The UVC shall remain in this super state until one of the transition out conditions become true.

3. The Heat State shall be the “normal” state that the UVC will go into when Heat mode is active. When the Heat State becomes active, the UVC shall continually calculate the Discharge Air Temperature Setpoint (here after referred to as DATS) required to maintain the effective heat setpoint (Space Temperature Setpoint). The calculated DATS shall not be allowed to go above Discharge Air High Limit (here after referred to as DAHL). The face and bypass damper shall be positioned to maintain the classroom temperature setpoint. The UVC shall use primary heat (wet heat) as needed to maintain the current DATS. The UVC shall monitor the wet heat coil leaving air temperature thermostat (if provided) in order to prevent coil freezing conditions (see Wet Heat Coil Leaving Air Temperature Thermostat).

4. The Heat State shall be the “normal” state that the UVC will go into when Heat mode is active. When the Heat State becomes active, the UVC shall continually calculate the Discharge Air Temperature Setpoint (here after referred to as DATS) required to maintain the effective heat setpoint (Space Temperature Setpoint). The calculated DATS shall not be allowed to go above Discharge Air High Limit (here after referred to as DAHL). The modulating valve shall be positioned to maintain the classroom temperature setpoint. The UVC shall use primary heat (wet heat) as needed to maintain the current DATS. The UVC shall monitor the wet heat coil leaving air temperature thermostat (if provided) in order to prevent coil freezing conditions (see Wet Heat Coil Leaving Air Temperature Thermostat).
5. A Low Limit Heat State shall be a “non-normal” state that shall become active if during Heat mode the unit reaches 100% heating and is unable to meet the current Discharge Air Temperature Setpoint required to maintain the effective heating setpoint.

6. The Cant Heat State shall be a “non-normal” state that the UVC can go into when Heat mode is active. Sensor faults, etc. during the Heat mode shall cause the UVC to make the Cant Heat State active. When the Cant Heat State becomes active, no heating or ventilation shall take place. The OA damper shall be closed. The UVC shall monitor the wet heat coil leaving air temperature thermostat (if provided) in order to prevent coil freezing conditions.

H. Cool Mode (future):

1. A Cool mode shall be provided to force the UVC into Cool Only operation. The Cool mode shall use primary cooling (economizer) and secondary cooling (mechanical type) as needed to maintain the effective cooling setpoint. The LUI or a network connection shall be able to compel the unit into the Cool mode. Additionally, the UVC when set to Auto mode shall automatically compel the unit into the Cool mode as needed. The face and bypass damper shall be positioned to maintain the classroom temperature setpoint.

2. A Cool mode shall be provided to force the UVC into Cool Only operation. The Cool mode shall use primary cooling (economizer) and secondary cooling (mechanical type) as needed to maintain the effective cooling setpoint. The LUI or a network connection shall be able to compel the unit into the Cool mode. Additionally, the UVC when set to Auto mode shall automatically compel the unit into the Cool mode as needed. The face and bypass damper shall be positioned to the full face position during compressor cooling (mechanical cooling) to maintain the classroom temperature setpoint.

3. When the Cool mode super state becomes active, the UVC shall automatically determine which UVC state to make active, Econ, Econ Mech, Mech, DA Heat, Low Limit, Cant Cool, or Dehumidify based upon the transitions for each of those states.

4. An Econ State shall be provided as a “normal” state that the UVC can go into when Cool mode is active. The Econ State shall be typically active in the Cool mode when primary cooling (economizer) is available and adequate to meet the cooling requirements. When the Econ State becomes active, the UVC shall use economizer cooling as needed to maintain the effective cooling setpoint. The UVC shall monitor the DAT to ensure it does not fall below Ventilation Cooling Low Limit (here after referred to as VCLL) setpoint. The UVC shall monitor the wet heat coil leaving air temperature thermostat (if provided) in order to prevent coil freezing conditions.

5. An Econ Mech State shall be provided as a “normal” state that the UVC can go into when Cool mode is active. The Econ Mech state shall typically be active in the Cool mode when primary cooling (economizer) alone is not adequate to meet the cooling requirements and both primary cooling and secondary cooling are available. When the Econ Mech State becomes active, the OA damper shall be set to 100% open, and the UVC shall use the unit's mechanical cooling capabilities as needed to maintain the effective cooling setpoint. The UVC shall monitor the DAT to ensure it does not fall below the Mechanical Cooling Low Limit (here after referred to as MCLL) setpoint. The UVC shall monitor the wet heat coil leaving air temperature thermostat (if provided) in order to prevent coil freezing conditions.

6. A Mech State shall be provided as a “normal” state that the UVC can go into when Cool mode is active. The Mech State shall be typically active in the Cool mode when primary cooling (economizer) is not available and secondary cooling (compressor) is available. When the Mech State becomes active, the UVC shall use the unit's mechanical cooling capabilities as needed to maintain the effective cooling setpoint. The UVC shall be configured to operate the compressor as secondary (mechanical) cooling when the economizer is available, when the economizer is not available and the compressor is available then the UVC shall use the compressor when cooling is required. A compressor envelope shall be established using a sensor on the indoor air coil to monitor refrigeration temperature conditions. This envelope shall protect the compressor from adverse operating conditions which can damage or shorten compressor life by ending compressor operation if coil temperatures exceed the defined operating envelope.

7. A DA Heat State shall be provided as a “normal” state that the UVC can go into when Cool mode is active. The DA Heat State shall be typically active when reheat is required to maintain VCLL while maintaining the required OA damper position. When DA Heat State is active, then the UVC shall use the unit's heating capability as needed to maintain the VCLL setpoint. The Heat Timer (3-minutes fixed) shall begin counting. The UVC shall monitor the wet heat coil leaving air temperature thermostat (if provided) in order to prevent coil freezing conditions. The CO2 Demand Controlled Ventilation function shall be active, if the unit is equipped for CO2 Demand Controlled Ventilation control, and the OAD shall be adjusted as needed to maintain the CO2 setpoint. The UVC shall remain in this state until one of the transition out conditions become true, or until one of the super state transition out conditions becomes true.

8. A Low Limit State shall be provided as a “non-normal” state that the UVC can go into while Cool mode is active. The Low Limit state shall typically follows the DA Heat state when the UVC has reached 100% heat and still cannot maintain VCLL. When the Low Limit State becomes active, the Low Limit PI-loop shall override the OAD minimum position and adjust the OAD toward closed as necessary to maintain the DAT setpoint.

I. Auto Mode

1. An Auto mode shall be provided so that the UVC can be set to automatically determine if heating, cooling or dehumidification is required. The Auto mode shall be the default start-up UVC mode. Auto mode shall be made up of the Heat, Cool and Dehumidify modes. With the UVC set to auto mode, the UVC shall determine which mode (Heat, Cool and Dehumidify) to use.

J. Emergency Heat Mode

1. An Emergency Heat mode shall be provided for situations where the UVC is in a mode that does not normally allow heating, such as Off, Cool, Fan Only, Night Purge, etc. If Emergency Heat mode is enabled and the space temperature falls below the EHS, the UVC shall automatically force itself into the Emergency Heat mode from Off, Cool, Night Purge, Fan Only, Purge, Pressurize, De-pressurize, and Shutdown. Additionally, the LUI or a network connection shall be used to force the unit into the Emergency Heat mode. Emergency Heat mode shall consists of two UVC states: Full Heat and Cant Heat.

2. A Full Heat State shall be provided as the “normal” state that the UVC will go into when Emergency Heat mode is active. When Emergency Heat (EHS) mode becomes active, the UVC shall go into 100% heating until the space temperature raises to the EHS plus a fixed differential (9OF / 5OC). In the Emergency Heat mode the space fan shall be set to high speed, and the OA damper will operate normally.

3. The Cant Heat State shall be a “non-normal” state that the UVC can go into when Emergency Heat mode is active. Sensor faults, etc. during the Heat mode shall cause the UVC to make the Cant Heat State active. When the Cant Heat State becomes active, no heating or ventilation shall take place. The OA damper shall be closed. The UVC shall monitor the wet heat coil leaving air temperature thermostat (if provided) in order to prevent coil freezing conditions.

K. Night Purge Mode

1. A Night Purge mode shall be provided to quickly ventilate a space. Night purge shall be used to remove odor build up at the end of each day, or after cleaning, painting, or other odor generating operations occur within the space. Night Purge shall be full ventilation with exhaust mode, during which room comfort will be compromised. The LUI or a network connection shall be able to force the unit into the Night Purge mode.

2. When Night Purge mode becomes active, the UVC shall stop all normal heating and cooling as any new energy used to treat the incoming air would be wasted in the purging process. In the Night Purge mode the unit classroom air fan shall be set to high speed, the OA damper will be set to 100% open, and the Exhaust Fan binary output shall be set to On. If not set to another mode within 1-hour, the UVC shall force itself into the Fan Only mode. If the space temperature drops below the EHS, and the Emergency Heat function is enabled, the UVC shall be forced into the Emergency Heat mode. The UVC shall continue to monitor the wet heat coil leaving air temperature thermostat (if provided) in order to prevent coil freezing conditions.

L. Non-Normal Unit Modes

1. Additional UVC modes shall be provided that are considered non-normal unit modes. These shall include Pressurize, Depressurize, Purge, Shutdown and Energy Hold Off. These modes shall force the UVC to perform very specific and limited functions and shall be used with caution and only for short periods as needed. These modes shall be accessed only via a network connection.

2. In each of these non-normal UVC modes, if the space temperature drops below EHS, and the Emergency Heat function enables, the UVC shall be forced into the Emergency Heat Super State mode and then return once the Emergency Heat function is satisfied.

3. A Shutdown mode shall be provided that is the equivalent of the Off mode, but shall be an Off mode forced by a network connection. When in Shutdown mode the UVC shall stop all normal heating, cooling, ventilation (OA damper shall be closed), and fan operation. By default, emergency heat shall not be used during the shutdown mode,

however, the UVC can be configured (Emergency Heat Shutdown Configuration) to allow emergency heat operation during shutdown mode. The Shutdown mode shall be accessed via a network connection and a binary input to the UVC.

4. The UVC shall support an Energy Hold Off state, which when active forces the UVC to stop all normal heating, cooling and ventilation. This shall typically be used by a network connection to force the UVC to cease heating, cooling and ventilation when conditions exist where heating, cooling and ventilation are not required or desired. Energy Hold Off mode shall be similar to Shutdown mode except that Energy Hold Off always allows Emergency Heat, if required. The Energy Hold Off mode shall be only accessed via a network connection.

5. The UVC shall in the Purge mode use the unit Classroom or Indoor Air Fan (here after referred to as IAF), OAD, and exhaust output as needed to purge the space. The UVC shall stop all normal heating and cooling but allow Emergency Heat if required. The purge mode shall be only accessed via a network connection.

6. The UVC shall in the Pressurize mode use the IAF, OAD, and exhaust output as needed to pressurize the space. The UVC shall stop all normal heating and cooling but shall allow Emergency Heat if required. The Pressurize Mode shall be accessed only via a network connection.

7. The UVC shall in the Depressurize mode use the IAF, OAD, and exhaust output as needed to depressurize the space. The UVC shall stop all normal heating and cooling but does allow Emergency Heat if required. The Depressurize Mode shall only be accessed via a network connection.

M. Occupancy Modes

1. The UVC shall be provided with four occupancy modes: Occupied, Standby, Unoccupied, and Bypass. The Occupancy mode shall effect which heating and cooling temperature setpoints shall be used, IAF operation, and OAD operation. The Manual Adjust Occupancy and Networked Occupancy Sensor network variables, along with the Unoccupied and Tenant Override binary inputs, shall be used to determine the Effective Occupancy.

2. The Occupied mode shall be the normal daytime mode of UVC operation. During Occupied mode the UVC shall use the occupied heating and cooling setpoints, the OAD shall operate normally, and by default the IAF shall remain on. A Networked Occupancy Sensor shall be able to interfaced with the Occupancy Sensor Input variable to select occupancy modes. When the Occupancy Sensor Input variable is used, it shall automatically override any hard-wired unoccupied binary input signal.

3. The Unoccupied Occupancy mode shall be the normal nighttime mode of UVC operation. During Unoccupied mode the UVC shall use the Unoccupied heating and cooling setpoints, the OAD shall remain closed, and the IAF shall cycle as needed for heating or cooling. The IAF shall remain off when there is no need for heating or cooling. A Unit-mounted factory-installed electronic 24-hour/7-day Time Clock shall be provided when

the unit operates in Stand-alone or no Network is available. This time clock shall be factory wired to the UVC Unoccupied binary input and shall be settable to automatically place the unit into Occupied and Unoccupied modes based upon its user-configured schedule.

4. The Standby mode shall be a non-normal daytime mode of UVC operation. During Standby mode the UVC shall use the standby heating and cooling setpoints, the OAD shall remain closed, and by default the IAF shall remain on.

5. The Bypass mode (also called Tenant Override) shall be the equivalent of a temporary occupied mode. Once the Bypass mode is initiated it shall remain in effect for a set period of time (120-minutes default). During the Bypass mode the UVC shall use the occupied heating and cooling setpoints, the OAD shall operate normally, and by default the IAF shall remain on. The optional field-installed Remote Wall-mounted Sensors shall include a Tenant Override Switch. This Tenant Override Switch shall provide a momentary contact closure that can be used by room occupants to temporarily force the UVC into the Bypass Occupancy mode from Unoccupied mode. The optional field-installed Remote Wall-mounted Sensors shall each indicate a UVC status LED. This status LED shall aid in diagnostics by indicating the UVC Occupancy mode and Fault condition.

N. Space Temperature Setpoints

1. The UVC shall use the six occupancy-based temperature setpoints for heating and cooling, Occupancy mode, and the value of the Network variables Space Temp Setpoint Input, Setpoint Offset Input and Setpoint Shift Input as the basis to determine the Effective Setpoint Output. The UVC shall calculate the effective setpoint based upon the unit mode, the occupancy mode, and the values of several network variables. The effective setpoint shall then be used as the temperature setpoint that the UVC will maintain.

O. LUI Setpoint Offset Adjustment

1. The LUI shall be used to make adjustments to the value of the Setpoint Offset Input variable.

P. Indoor Air Fan Operation

1. The UVC shall support a three-speed IAF with Low, Medium, and High speed. The UVC will calculate the effective fan speed and operation based upon the unit mode, the occupancy mode, and the values of several network variables.

2. The UVC shall be provided with a user selectable Auto Fan Mode feature. When in auto fan mode, the UVC shall use the space temperature PI loop to automatically adjust the fan speed as needed to maintain space temperature. This shall ensure that the UVC will maintain the lowest and quietest fan speeds whenever possible. When in Auto Fan Mode, a maximum of 6 fan speed changes per hour shall be allowed (by default), this shall prevent frequent automatic fan speed changes from disturbing room occupants. During occupied, standby and bypass modes the IAF shall, by default, remain On.

During unoccupied mode the IAF shall typically remain off and shall cycle with calls for heating and cooling. The UVC shall be provided with a Fan Cycling Configuration variable that can be used to force the IAF to cycle with calls for heating and cooling during the Occupied, Standby and Bypass Occupancy modes. When the fan is off, the OA damper shall be closed. This feature shall only be used when it is acceptable that normal ventilation is not required. When the IAF is set to cycle, or during the Unoccupied mode, or when the UVC is placed into Off mode, the UVC shall be configured to continue fan operation for a time period (30-seconds default) after heating or cooling is complete.

Q. Outdoor Air Damper Operation

1. The UVC shall be configured for an Outdoor Air Damper operated by a floating-point actuator. The OA damper actuator shall contain a spring to ensure that the OA damper is closed upon loss of power. The OA damper shall be typically open to the current minimum position during the Occupied and Bypass occupancy modes, and closed during the Unoccupied and Standby Occupancy modes.

2. The UVC shall be configured to maintain three Outdoor Air Damper minimum positions based upon the operation of the IAF. This shall allow the ability for each unit to be job site configured to provide the amount of fresh air required to the space at each of the three IAF speeds.

3. The Economizer function shall be used by the UVC to determine if the OA is adequate for economizer (primary) cooling. When both the economizer and mechanical cooling are available, the economizer shall be used as primary cooling and the UVC shall add mechanical cooling only if the economizer is not adequate to meet the current cooling load (i.e. the OA damper reaches 100% and cooling is still required). The UVC shall be configured to support the economizer type of Temperature Comparison Economizer (default) for which the UVC shall use two configuration variables for the Temperature Comparison Economizer: Economizer OA Temp Setpoint and Economizer Temp Differential. The Economizer Temperature Differential shall compare the classroom air temperature to the OA temperature. If the difference is greater than the economizer temperature differential and the Economizer OAT is below the temperature setpoint then the Economizer function shall be energized.

R. Face & Bypass Damper Control

1. The UVC shall be configured for a Face and Bypass damper operated by a floating-point actuator.

S. Actuator Auto-Zero, Overdrive and Sync

1. The UVC at power-up shall auto-zero all actuators (OA damper, F&BP damper and Valve) before going into normal operation to ensure proper positioning, this may take as long as 150-seconds after power-up.

2. The UVC shall be configured such that whenever an actuator is commanded to go to 0% or 100%, the UVC shall overdrive the actuator one full stroke period past the 0% or 100% position to ensure proper positioning

3. Additionally, the UVC shall be configured to sync all actuators once every 12-hours of operation.

T. External Binary Inputs

1. The UVC shall be provided with three (3) binary inputs that can provide the following functions. These inputs each shall allow a single set of dry-contacts (no voltage source) to be used as a signal to the UVC, multiple units can be connected to a single set of dry-contacts.

2. External Binary Input 1 shall be able to be configured as an Unoccupied (default) or dewpoint/humidity signal. The Unoccupied Input Signal shall allow a single set of dry-contacts to be used to signal the UVC to go into Unoccupied or Occupied mode. When the contacts close (Unoccupied) the UVC shall go into Unoccupied mode, when the contacts open (Occupied) the UVC shall go into Occupied mode. The (optional) Dewpoint/Humidity Input Signal shall allow a single set of dry-contacts to be used to signal the UVC to go into Active or Passive Dehumidification. When the contacts close (High Humidity) the UVC shall go into Dehumidification, when the contacts open (Low Humidity) the UVC shall stop dehumidification. The device used must incorporate its own differential dewpoint or differential humidity.

3. External Binary Input 2 shall only be used for remote shutdown. The Remote Shutdown Input Signal shall allow a single set of dry-contacts to be used to signal the UVC to go into Shutdown mode. When the contacts close (Shutdown) the UVC shall go into Shutdown mode, when the contacts open the UVC shall return to Normal operation. See Non-Normal Unit Modes.

4. External Binary Input 3 shall be able to be configured as a Ventilation Lockout (default) or Exhaust Interlock Signal. The Ventilation Lockout Input Signal shall allow a single set of dry-contacts to be used to signal the UVC to close the OA damper. When the contacts close (Ventilation Lockout Signal) the UVC shall close the OA damper, when the contacts open the UVC shall return to normal OA damper operation. The Exhaust Interlock Input Signal shall allow a single set of dry-contacts to be used to signal the UVC that an Exhaust Fan within the space has been energized, the UVC shall reposition the OA damper to a user adjustable minimum position (Exhaust Interlock OA Damper Min Position Setpoint). When the contacts close (Exhaust fan on signal) the UVC shall use the value defined by the Exhaust Interlock OA Damper Min Position Setpoint as the minimum OA damper position regardless of IAF speed, when the contacts open the UVC shall return to normal OA damper operation.

5. The UVC shall be provided with three (3) External Binary Outputs that can provide the following functions. These outputs shall be relay type outputs that shall be used with signal level voltages (24vac max) only. External Binary Output 1 shall be only able to be used as a signal for Space Lights. The Lights On/Off Signal relay output shall provide

one set of NO dry-contacts that shall be used to signal the operation of the Space Lights. When the UVC is in Occupied, Standby or Bypass Occupancy modes the relay output shall signal the lights on (contacts closed), when the UVC is in Unoccupied occupancy mode the relay output shall signal the lights off (contacts open). External Binary Output 2 shall only be able to be used as a fault signal. A Fault Signal relay output shall provide a NO, NC, and Common connections that can be used to signal a fault condition. When a fault exists, the UVC shall energize this relay output, when the fault or faults are cleared the UVC shall de-energize this relay output. External Binary Output 3 shall only be able to be used to operate an Auxiliary Heat device (default) or signal Exhaust Fan operation. The Auxiliary Heat Signal relay output shall provide one set of NO dry-contacts that can be used to operate an Auxiliary Heat device. The UVC shall be by default configured to operate a NO Auxiliary Heat device (de-energize when heat is required) such as a wet heat valve actuator with a spring setup to open upon power failure. However, the Auxiliary Heat Configuration variable shall be able to be used to set the UVC to use a NC Auxiliary Heat device (energize when heat is required) such as electric heat. An Exhaust Fan On/Off Signal relay output shall provide one set of NO dry-contacts that can be used to signal the operation of an Exhaust Fan. When the OA damper opens more than the Energize Exhaust Fan OA Damper Setpoint then the relay output shall signal the Exhaust Fan on (contacts closed), when the OA damper closes below this setpoint the relay output shall signal the Exhaust Fan off (contacts open).

2.11 BASIS OF DESIGN

A. By AAF-HermanNelson.

B. Acceptable Alternates:

1. Submit detailed listing of all variations in form, fit, or function, in addition to specified submittal data for approval by school district during bidding phase.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install all equipment in strict accordance with manufacturer's instructions and so as to be compatible with the intent of the respective system performance requirement.

B. The System Integrator/Controls contractor shall be responsible for the integration of all factory provided unit mounted controls and unit communications as required/specified for unit integration into the Building Automation System and proper unit operation.

C. Contractor shall clean each unit and accessory section of construction dust and debris, prior to turning systems over to the owner.

D. Contractor shall install clean filters in each unit at time of system commissioning, and shall deliver to the owner one complete set of spare filters, and one spare motor of each type used in the project.

E. System Integrator/Controls contractor shall be responsible for the integration of all factory provided unit mounted controls and unit communications as required/specified for unit integration into the Building Automation System and proper unit operation.

F. Installer shall engage the services of manufacturer's factory trained service technician to provide check, test, and start-up of each unit ventilator system.

G. Contractor shall provide one-year warranty for furnishing parts and labor for replacing any part of the unit ventilator or accessory sections, which becomes defective in operation. Unit ventilator manufacturer's representative shall maintain a local stock of replacement parts to support the systems specified herein.

H. Contractor shall submit a completed “Check Test and Start Sheet" for each Unit Ventilator installed for verification of proper installation and start up.

END SECTION 23 82 23

SECTION 23 99 00
VARIABLE FREQUENCY MOTOR CONTROLLERS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE 519	(2014) Recommended Practices and Requirements for Harmonic Control in Electrical Power Systems
IEEE C62.41.1	(2002; R 2008) Guide on the Surges Environment in Low-Voltage (1000 V and Less) AC Power Circuits
IEEE C62.41.2	(2002) Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and Less) AC Power Circuits

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA 250	(2014) Enclosures for Electrical Equipment (1000 Volts Maximum)
NEMA ICS 1	(2000; R 2008; E 2010) Standard for Industrial Control and Systems: General Requirements
NEMA ICS 3.1	(2009) Guide for the Application, Handling, Storage, Installation and Maintenance of Medium-Voltage AC Contactors, Controllers and Control Centers
NEMA ICS 6	(1993; R 2011) Enclosures
NEMA ICS 7	(2014) Adjustable-Speed Drives

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2014; AMD 1 2013; Errata 1 2013; AMD 2 2013; Errata 2 2013; AMD 3 2014; Errata 3-4 2014; AMD 4-6 2014) National Electrical Code

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

47 CFR 15	Radio Frequency Devices

UNDERWRITERS LABORATORIES (UL)

UL 489	(2013; Reprint Mar 2014) Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures
UL 508C	(2002; Reprint Nov 2010) Power Conversion Equipment

1.2 RELATED REQUIREMENTS

Section 26 00 00 BASIC ELECTRICAL MATERIALS AND METHODS, and Section 23 01 30 HVAC REFURBISHING AND CLEANING apply to this section with additions and modifications specified herein.

1.3 SYSTEM DESCRIPTION

A. Performance Requirements

1. Electromagnetic Interference Suppression

Computing devices, as defined by 47 CFR 15, MIL-STD-461 rules and regulations, shall be certified to comply with the requirements for class A computing devices and labeled as set forth in part 15.

2. Electromechanical and Electrical Components

Electrical and electromechanical components of the Variable Frequency Drive (VFD) shall not cause electromagnetic interference to adjacent electrical or electromechanical equipment while in operation.

B. Electrical Requirements

1. Power Line Surge Protection

IEEE C62.41.1 and IEEE C62.41.2, IEEE 519 Control panel shall have surge protection, included within the panel to protect the unit from damaging transient voltage surges. Surge arrestor shall be mounted near the incoming power source and properly wired to all three phases and ground. Fuses shall not be used for surge protection.

2. Sensor and Control Wiring Surge Protection

I/O functions as specified shall be protected against surges induced on control and sensor wiring installed outdoors and as shown. The inputs and outputs shall be tested in both normal mode and common mode using the following two waveforms:

a. A 10 microsecond by 1000 microsecond waveform with a peak voltage of 1500 volts and a peak current of 60 amperes.

b. An 8 microsecond by 20 microsecond waveform with a peak voltage of 1000 volts and a peak current of 500 amperes.

1.4 SUBMITTALS

Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

Shop Drawings

Schematic diagrams;

Interconnecting diagrams;

Installation drawings;

Product Data

Variable frequency drives;

Wires and cables

Equipment schedule

Include data indicating compatibility with motors being driven.

Test Reports

VFD Test

Performance Verification Tests

Endurance Test

Manufacturer's Instructions

Installation instructions

Manufacturer's Field Reports

VFD Factory Test Plan;

Factory test results

Operation and Maintenance Data

Variable frequency drives,

Provide service and maintenance information including preventive maintenance, assembly, and disassembly procedures. Include electrical drawings from electrical general sections. Submit additional information necessary to provide complete operation, repair, and maintenance information, detailed to the smallest replaceable unit. Include copies of as-built submittals. Provide routine preventative maintenance instructions, and equipment required. Provide instructions on how to modify program settings, and modify the control program. Provide instructions on drive adjustment, trouble-shooting, and configuration. Provide instructions on process tuning and system calibration.

1.5 QUALITY ASSURANCE

A. Schematic Diagrams

Show circuits and device elements for each replaceable module. Schematic diagrams of printed circuit boards are permitted to group functional assemblies as devices, provided that sufficient information is provided for District maintenance personnel to verify proper operation of the functional assemblies.

B. Interconnecting Diagrams

Show interconnections between equipment assemblies, and external interfaces, including power and signal conductors. Include for enclosures and external devices.

C. Installation Drawings

Show floor plan of each site, with V.F.D.'s and motors indicated. Indicate ventilation requirements, adequate clearances, and cable routes.

D. Equipment Schedule

Provide schedule of equipment supplied. Schedule shall provide a cross reference between manufacturer data and identifiers indicated in shop drawings. Schedule shall include the total quantity of each item of equipment supplied. For complete assemblies, such as VFD's, provide the serial numbers of each assembly, and a sub-schedule of components within the assembly. Provide recommended spare parts listing for each assembly or component.

E. Installation instructions

Provide installation instructions issued by the manufacturer of the equipment, including notes and recommendations, prior to shipment to the site. Provide operation instructions prior to acceptance testing.

F. Factory Test Results

Document test results and submit to District within 7 working days after completion of test.

1.6 DELIVERY AND STORAGE

Equipment delivered and placed in storage shall be stored with protection from the weather, humidity and temperature variations, dirt and dust, or other contaminants.

1.7 WARRANTY

The complete system shall be warranted by the manufacturer for a period of one year, or the contracted period of any extended warrantee agreed upon by the contractor and the District, after successful completion of the acceptance test. Any component failing to perform its function as specified and documented shall be repaired or replaced by the contractor at no additional cost to the District. Items repaired or replaced shall be warranted for an additional period of at least one year from the date that it becomes functional again, as specified in the FAR CLAUSE 52.246-21.

1.8 MAINTENANCE

A. Spare Parts

Manufacturers provide spare parts in accordance with recommended spare parts list.

B. Maintenance Support

During the warranty period, the Contractor shall provide on-site, on-call maintenance services by Contractor's personnel on the following basis: The service shall be on a per-call basis with 36 hour response. Contractor shall support the maintenance of all hardware and software of the system. Various personnel of different expertise shall be sent on-site depending on the nature of the maintenance service required. Costs shall include travel, local transportation, living expenses, and labor rates of the service personnel while responding to the service request. The provisions of this Section are not in lieu of, nor relieve the Contractor of, warranty responsibilities covered in this specification. Should the result of the service request be the uncovering of a system defect covered under the warranty provisions, all costs for the call, including the labor necessary to identify the defect, shall be borne by the Contractor.

PART 2 PRODUCTS

2.1 VARIABLE FREQUENCY DRIVES (VFD)

A. MANUFACTURERS

1. ABB.

2. Danfoss.

3. Equivalent units and manufacturers must meet all performance criteria, and must be approved by the School District during bidding phase.

B. DESCRIPTION

1. Provide frequency drive to control the speed of induction motor(s). The VFD shall include the following minimum functions, features and ratings.

   a. Input circuit breaker per UL 489 with a minimum of 22,000 amps symmetrical interrupting capacity and door interlocked external operator.

   b. A converter stage per UL 508C shall change fixed voltage, fixed frequency, ac line power to a fixed dc voltage. The converter shall utilize a full wave bridge design incorporating diode rectifiers. Silicon Controlled Rectifiers (SCR) are not acceptable. The converter shall be insensitive to three phase rotation of the ac line and shall not cause displacement power factor of less than .95 lagging under any speed and load condition.

   c. An inverter stage shall change fixed dc voltage to variable frequency, variable voltage, ac for application to a standard NEMA design B squirrel cage motor. The inverter shall be switched in a manner to produce a sine coded pulse width modulated (PWM) output waveform.

   d. The VFD shall be capable of supplying 120 percent of rated full load current for one minute at maximum ambient temperature.

   e. The VFD shall be designed to operate from a 208 volt, plus or minus 10 percent, three phase, 60 Hz supply, and control motors with a corresponding voltage rating.

   f. Acceleration and deceleration time shall be independently adjustable from one second to 60 seconds.

   g. Adjustable full-time current limiting shall limit the current to a preset value which shall not exceed 120 percent of the controller rated current. The current limiting action shall maintain the V/Hz ratio constant so that variable torque can be maintained. Short time starting

override shall allow starting current to reach 175 percent of controller rated current to maximum starting torque.

h. The controllers shall be capable of producing an output frequency over the range of 3 Hz to 60 Hz (20 to one speed range), without low speed cogging. Over frequency protection shall be included such that a failure in the controller electronic circuitry shall not cause frequency to exceed 110 percent of the maximum controller output frequency selected.

i. Minimum and maximum output frequency shall be adjustable over the following ranges: 1) Minimum frequency 3 Hz to 50 percent of maximum selected frequency; 2) Maximum frequency 40 Hz to 60 Hz.

j. The controller efficiency at any speed shall not be less than 96 percent.

k. The controllers shall be capable of being restarted into a motor coasting in the forward direction without tripping.

l. Protection of power semiconductor components shall be accomplished without the use of fast acting semiconductor output fuses. Subjecting the controllers to any of the following conditions shall not result in component failure or the need for fuse replacement:

1. Short circuit at controller output
2. Ground fault at controller output
3. Open circuit at controller output
4. Input undervoltage
5. Input overvoltage
6. Loss of input phase
7. AC line switching transients
8. Instantaneous overload
9. Sustained overload exceeding 115 percent of controller rated current
10. Over temperature
11. Phase reversal

m. Solid state motor overload protection shall be included such that current exceeding an adjustable threshold shall activate a 60 second timing circuit. Should current remain above the threshold continuously for the timing period, the controller will automatically shut down.

n. A slip compensation circuit shall be included which will sense changing motor load conditions and adjust output frequency to provide speed regulation of NEMA B motors to within plus or minus 0.5 percent of maximum speed without the necessity of a tachometer generator.

o. The VFD shall be factory set for manual restart after the first protective circuit trip for malfunction (overcurrent,undervoltage, overvoltage or overtemperature) or an interruption of power. The VFD shall be capable of being set for automatic restart after a selected time delay. If the drive faults again within a specified time period (adjustable 0-60 seconds), a manual restart will be required.

p. The VFD shall include external fault reset capability. All the necessary logic to accept an external fault reset contact shall be included.

q. Provide critical speed lockout circuitry to prevent operating at frequencies with critical harmonics that cause resonant vibrations. The VFD shall have a minimum of three user selectable bandwidths.

r. Provide the following operator control and monitoring devices mounted on the front panel of the VFD:

1. Manual speed potentiometer.
2. Hand-Off-Auto (HOA) switch.
3. Power on light.
4. Drive run power light.
5. Local display.

s. Provide properly sized NEMA rated by-pass and isolation contactors to enable operation of motor in the event of VFD failure. Mechanical and electrical interlocks shall be installed between the by-pass and isolation contactors. Provide a selector switch and transfer delay timer.

C. Control Requirements

1. BAS Connectivity

Control panel shall include a BACNET interface for control through the associated AHU Distech controller. See control diagrams for additional requirements.

2.2 ENCLOSURES

Provide NEMA 12 equipment enclosures conforming to NEMA 250, NEMA ICS 7, NEMA ICS 6.

2.3 WIRES AND CABLES

Provide 600V Copper VFD Rated Cable from the controller to the motor connection. All wires and cables shall conform to NEMA 250, NEMA ICS 7, NFPA 70.

2.4 NAMEPLATES

Nameplates external to NEMA enclosures shall conform with the requirements of Division 26. Nameplates internal to enclosures shall be manufacturer's standard, with the exception that they must be permanent.

2.5 SOURCE QUALITY CONTROL

A. VFD Factory Test Plan

To ensure quality, each VFD shall be subject to a series of in-plant quality control inspections before approval for shipment from the manufacturer's facilities. Provide test plans and test reports.

PART 3 EXECUTION

3.1 INSTALLATION

Per NEMA ICS 3.1, install equipment in accordance with the approved manufacturer's printed installation drawings, instructions, wiring diagrams, and as indicated on project drawings and the approved shop drawings. A field representative of the drive manufacturer shall supervise the installation of all equipment, and wiring.

3.2 FIELD QUALITY CONTROL

Specified products shall be tested as a system for conformance to specification requirements prior to scheduling the acceptance tests. Contractor shall conduct performance verification tests in the presence of District representative, observing and documenting complete compliance of the system to the specifications. Contractor shall submit a signed copy of the test results, certifying proper system operation before scheduling tests.

A. VFD Test

A proposed test plan shall be submitted to the contracting officer at least 28 calendar days prior to proposed testing for approval. The tests shall conform to NEMA ICS 1, NEMA ICS 7, and all manufacturer's safety regulations. The District reserves the right to witness all tests and review any documentation. The contractor shall inform the District at least 14 working days prior to the dates of testing. Contractor shall provide video tapes, if available, of all training provided to the District for subsequent use in training new personnel. All training aids, texts, and expendable support material for a self-sufficient presentation shall be provided, the amount of which to be determined by the contracting officer.

B. Performance Verification Tests

"Performance Verification Test" plan shall provide the step by step procedure required to establish formal verification of the performance of the VFD. Compliance with the specification requirements shall be verified by inspections, review of critical data, demonstrations, and tests. The District reserves the right to witness all tests, review data, and request other such additional inspections and repeat tests as necessary to ensure that the system and provided services conform to the stated requirements. The contractor shall inform the District 14 calendar days prior to the date the test is to be conducted.

C. Endurance Test

Immediately upon completion of the performance verification test, the endurance test shall commence. The system shall be operated at varying rates for not less than 192 consecutive hours, at an average effectiveness level of .9998, to demonstrate proper functioning of the complete PCS. Continue the test on a day-to-day basis until performance standard is met. During the endurance test, the contractor shall not be allowed in the building. The system shall respond as designed.

3.3 DEMONSTRATION

A. Training

Coordinate training requirements with the district.

1. Instructions to District Personnel

Provide the services of competent instructors who will give full instruction to designated personnel in operation, maintenance, calibration, configuration, and programming of the complete control system. Orient the training specifically to the system installed. Instructors shall be thoroughly familiar with the subject matter they are to teach. The District personnel designated to attend the training will have a high school education or equivalent. The number of training days of instruction furnished shall be as specified. A training day is defined as eight hours of instruction, including two 15-minute breaks and excluding lunch time; Monday through Friday. Provide a training manual for each student at each training phase which describes in detail the material included in each training program. Provide one additional copy for archiving. Provide equipment and materials required for classroom training. Provide a list of additional related courses, and offers, noting any courses recommended. List each training course individually by name, including duration, approximate cost per person, and location of course. Unused copies of training manuals shall be turned over to the District at the end of last training session.

2. Operating Personnel Training Program

Provide one 2 hour training session at the site at a time and place mutually agreeable between the Contractor and the District. Provide session to train 4 operation personnel in the functional operations of the system and the procedures that personnel will follow in system operation. This training shall include:

a. System overview

b. General theory of operation

c. System operation

d. Alarm formats

e. Failure recovery procedures

f. Troubleshooting

3. Engineering/Maintenance Personnel Training

Accomplish the training program as specified. Training shall be conducted on site at a location designated by the District. Provide a one day training session to train 4 engineering personnel in the functional operations of the system. This training shall include:

a. System overview

b. General theory of operation

c. System operation

d. System configuration

e. Alarm formats

f. Failure recovery procedures

g. Troubleshooting and repair

h. Maintenance and calibration

i. System programming and configuration

END SECTION 23 99 00

SECTION 26 00 00
BASIC ELECTRICAL MATERIALS AND METHODS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM D 709	(2001; R 2007) Laminated Thermosetting Materials

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE 100	(2000; Archived) The Authoritative Dictionary of IEEE Standards Terms
IEEE C2	(2007; TIA 2007-1; TIA 2007-2; TIA 2007-3; TIA 2007-4; TIA 2007-5; Errata 2006-1; Errata 2007-2; Errata 2009-3) National Electrical Safety Code
IEEE C57.12.28	(2005) Standard for Pad-Mounted Equipment - Enclosure Integrity

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA 250	(2008) Enclosures for Electrical Equipment (1000 Volts Maximum)

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2014) National Electrical Code

1.2 RELATED REQUIREMENTS

This section applies to certain sections of Division 11, EQUIPMENT, Divisions 22 and 23, PLUMBING and HEATING VENTILATING AND AIR CONDITIONING. This section applies to all sections of Division 26 and 33, ELECTRICAL and UTILITIES, of this project specification unless specified otherwise in the individual sections.

1.3 DEFINITIONS

a. Unless otherwise specified or indicated, electrical and electronics terms used in these specifications, and on the drawings, shall be as defined in IEEE 100.

b. The technical sections referred to herein are those specification sections that describe products, installation procedures, and equipment operations and that refer to this section for detailed description of submittal types.

c. The technical paragraphs referred to herein are those paragraphs in PART 2 - PRODUCTS and PART 3 - EXECUTION of the technical sections that describe products, systems, installation procedures, equipment, and test methods.

1.4 ELECTRICAL CHARACTERISTICS

Electrical characteristics for this project shall be 120/208volt, three phase, four wire, 60Hz. Final connections to the power distribution system shall be coordinated with the local utility company.

1.5 ADDITIONAL SUBMITTALS INFORMATION

Submittals required in other sections that refer to this section must conform to the following additional requirements as applicable.

1.5.1 Shop Drawings

Include wiring diagrams and installation details of equipment indicating proposed location, layout and arrangement, control panels, accessories, piping, ductwork, and other items that must be shown to ensure a coordinated installation. Wiring diagrams shall identify circuit terminals and indicate the internal wiring for each item of equipment and the interconnection between each item of equipment. Drawings shall indicate adequate clearance for operation, maintenance, and replacement of operating equipment devices.

1.5.2 Product Data

Submittal shall include performance and characteristic curves.

1.6 QUALITY ASSURANCE

1.6.1 Regulatory Requirements

In each of the publications referred to herein, consider the advisory provisions to be mandatory, as though the word, "shall" had been substituted for "should" wherever it appears. Interpret references in these publications to the "authority having jurisdiction," or words of similar meaning, to mean the Owner. Equipment, materials, installation, and workmanship shall be in accordance with the mandatory and advisory provisions of NFPA 70 unless more stringent requirements are specified or indicated.

1.6.2 Standard Products

Provide materials and equipment that are products of manufacturers regularly engaged in the production of such products which are of equal material, design and workmanship. Products shall have been in satisfactory commercial or industrial use for 2 years prior to bid opening. The 2-year period shall include applications of equipment and materials under similar circumstances and of similar size. The product shall have been on sale on the commercial market through advertisements, manufacturers' catalogs, or brochures during the 2-year period. Where two or more items of the same class of equipment are required, these items shall be products of a single manufacturer; however, the component parts of the item need not be the products of the same manufacturer unless stated in the technical section.

1.6.2.1 Alternative Qualifications

Products having less than a 2-year field service record will be acceptable if a certified record of satisfactory field operation for not less than 6000 hours, exclusive of the manufacturers' factory or laboratory tests, is furnished.

1.6.2.2 Material and Equipment Manufacturing Date

Products manufactured more than 3 years prior to date of delivery to site shall not be used, unless specified otherwise.

1.6.2.2 Hazardous Conditions

The contractor shall notify the engineer, architect, and owner of any conditions that are discovered during constructions that would potentially cause hazards to the building and its occupants. Examples of these conditions would be any code violations or improper installation of existing equipment.

1.7 WARRANTY

The equipment items shall be supported by service organizations which are reasonably convenient to the equipment installation in order to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.

1.8 POSTED OPERATING INSTRUCTIONS

Provide for each system and principal item of equipment as specified in the technical sections for use by operation and maintenance personnel. The operating instructions shall include the following:

a. Wiring diagrams, control diagrams, and control sequence for each principal system and item of equipment.

b. Start up, proper adjustment, operating, lubrication, and shutdown procedures.

c. Safety precautions.

d. The procedure in the event of equipment failure.

e. Other items of instruction as recommended by the manufacturer of each system or item of equipment.

Print or engrave operating instructions and frame under glass or in approved laminated plastic. Post instructions where directed. For operating instructions exposed to the weather, provide weather-resistant materials or weatherproof enclosures. Operating instructions shall not fade when exposed to sunlight and shall be secured to prevent easy removal or peeling.

1.9 MANUFACTURER'S NAMEPLATE

Each item of equipment shall have a nameplate bearing the manufacturer's name, address, model number, and serial number securely affixed in a conspicuous place; the nameplate of the distributing agent will not be acceptable.

1.10 FIELD FABRICATED NAMEPLATES

ASTM D 709. Provide laminated plastic nameplates for each equipment enclosure, relay, switch, and device; as specified in the technical sections or as indicated on the drawings. Each nameplate

inscription shall identify the function and, when applicable, the position. Nameplates shall be melamine plastic, 0.125 inch thick, white with black center core. Surface shall be matte finish. Corners shall be square. Accurately align lettering and engrave into the core. Minimum size of nameplates shall be one by 2.5 inches. Lettering shall be a minimum of 0.25 inch high normal block style.

1.11 WARNING SIGNS

Provide warning signs for the enclosures of electrical equipment including substations, pad-mounted transformers, pad-mounted switches, generators, and switchgear having a nominal rating exceeding 600 volts.

a. When the enclosure integrity of such equipment is specified to be in accordance with IEEE C57.12.28 or IEEE C57.12.29, such as for pad-mounted transformers, provide self-adhesive warning signs on the outside of the high voltage compartment door(s). Sign shall be a decal and shall have nominal dimensions of 7 by 10 inches with the legend "DANGER HIGH VOLTAGE" printed in two lines of nominal 2 inch high letters. The word "DANGER" shall be in white letters on a red background and the words "HIGH VOLTAGE" shall be in black letters on a white background. Decal shall be Panduit No. PPSO710D72 or approved equal.

b. When such equipment is guarded by a fence, mount signs on the fence. Provide metal signs having nominal dimensions of 14 by 10 inches with the legend "DANGER HIGH VOLTAGE KEEP OUT" printed in three lines of nominal 3 inch high white letters on a red and black field.

1.12 ELECTRICAL REQUIREMENTS

Electrical installations shall conform to IEEE C2, NFPA 70, and requirements specified herein.

1.13 INSTRUCTION TO PERSONNEL

Where specified in the technical sections, furnish the services of competent instructors to give full instruction to designated personnel in the adjustment, operation, and maintenance of the specified systems and equipment, including pertinent safety requirements as required. Instructors shall be thoroughly familiar with all parts of the installation and shall be trained in operating theory as well as practical operation and maintenance work. Instruction shall be given during the first regular work week after the equipment or system has been accepted and turned over to the Owner for regular operation. The number of man-days (8 hours per day) of instruction furnished shall be as specified in the individual section. When more than 4 man-days of instruction are specified, use approximately half of the time for classroom instruction. Use other time for instruction with equipment or system. When significant changes or modifications in the equipment or system are made under the terms of the contract, provide additional instructions to acquaint the operating personnel with the changes or modifications.

PART 2 PRODUCTS

2.1 FACTORY APPLIED FINISH

Electrical equipment shall have factory-applied painting systems which shall, as a minimum, meet the requirements of NEMA 250 corrosion-resistance test and any additional requirements specified in the technical sections for the environment where the equipment will operate.

PART 3 EXECUTION

3.1 FIELD APPLIED PAINTING

Paint electrical equipment as required to match finish of adjacent surfaces or to meet the indicated or specified safety criteria. Painting shall be as specified in architectural specifications.

3.2 FIELD FABRICATED NAMEPLATE MOUNTING

Provide number, location, and letter designation of nameplates as indicated. Fasten nameplates to the device with a minimum of two sheet-metal screws or two rivets.

3.3 WARNING SIGN MOUNTING

Provide the number of signs required to be readable from each accessible side, but space the signs a maximum of 30 feet apart.

END SECTION 26 00 00

SECTION 26 05 19
LOW-VOLTAGE ELECTRICAL CABLES

PART 1 GENERAL

1.1 SUMMARY

A. The Section includes the following:
   1. Building wire and cables rated 600 V and less.
   2. Connectors, splices and terminations rated 600 V and less.
   3. Sleeves and sleeve seals for cables.

1.2 REFERENCES

A. ANSI/NFPA 70 – National Electrical Code (NEC) 2014

B. NEMA WC 70 - Power Cable Rated 2000 V or Less for the Distribution of Electrical Energy (2009)

1.3 QUALITY ASSURANCE

A. Comply with NFPA 70.

1.4 COORDINATION

A. Set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

PART 2 PRODUCTS

2.1 CONDUCTORS AND CABLES

A. Copper Conductors only: Comply with NEMA WC 70.

B. Conductor Insulation: THHN/THWN for wires #2 and less; and XHHW-2 for wires outside of building envelope and larger than #2.

C. Armor Ground Type MC Cable: Comply with UL 1569 and UL 83.

2.2 CONNECTORS AND SPLICES

A. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type and class for application and service indicated.
   1. Spring Wire Connectors: Corrosion resistant, insulated steel, 105^{o}C.
   2. Connectors and Lugs shall be circumferential compression type.

B. MC Cable connectors shall comply with UL 514B. MC Cable fitting shall be listed for use with Interlocked Armor Ground MC Cable Type “MCI-A”. MC Cable fitting shall also be listed as being suitable for grounding for in circuits over and under 250 volts.

2.3 MC CABLE

A. Cable Assembly: Type THHN insulated copper conductors and an insulated grounding conductor. Minimum size shall be #12 AWG for lighting and power circuits.
   1. Cable Jacket color shall be:
      a. Black Coated for 120V Normal Power.
      b. Brown Coated for 277V Normal power.

B. Metal-Clad Sheath/Armor Assembly: The interlocking metal tape armor shall be aluminum and shall be listed as being suitable for grounding.

2.4 SLEEVES FOR CABLES

A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.

PART 3 EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

A. Feeders: Copper, Stranded for all AWG sizes.

B. Branch Circuits: Copper, Stranded for all AWG sizes.

C. Motors and equipment connections subject to vibration: Copper. No. 12 AWG and larger, stranded conductor, single conductor.

D. MC Cable may only be used at the contractor’s option for lighting branch circuits between fixtures and junction boxes. Install per manufacturer’s instructions.
   1. DO NOT USE for home runs, receptacles, above in-accessible ceilings, exposed in unfinished spaces, circuits crossing smoke or fire barriers, in exterior locations, or where exposed to view.
   2. Support MC cables above accessible ceilings from the building structure. DO NOT SUPPORT from cable tray, ductwork, equipment, or ceiling support wires.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

A. Service Entrance: Single conductors in raceway.

B. Exposed Feeders: Single conductors in raceway.

C. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspaces: Single conductors in raceway.

D. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Single conductors in raceway.

E. Exposed Branch Circuits: Single conductors in raceway.

F. Lighting Branch Circuits above accessible ceilings:
   1. Single conductors in raceway.
   2. Metal-clad cable, Type MC.

G. Branch Circuits Concealed in walls, Concrete, below Slabs-on-Grade, and Underground: Single conductors in raceway.

H. Class 1 and Class 2 Control Circuits: Single conductors in raceway.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

A. Conceal cables in finished walls, ceilings and floors, unless otherwise indicated. Neatly train and lace wiring inside boxes, equipment, and panelboards.

B. Use manufacturer-approved pulling compound of lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure valves.

C. Use pulling means, including fish tape, cable, rope and basket-weave wire/cable grips, that will not damage cables or raceway.

D. Install exposed conduits parallel and perpendicular to surfaces of exposed structure members, and follow surface contours where possible.

E. Support cables according to Section 260529 – Hangers and Supports for Electrical Systems.

F. Identify and color-code conductors and cables according to Section 260553 – Identification for Electrical Systems.

G. Provide Heat Shrink tubing equal to 3M FP-301VW for all existing wiring that shows signs of insulation damage or wear, and will be re-terminated to new panelboards or devices. Provide heat shrink to all exposed wiring and 2" into the associated raceway. Heat Shrink shall be color coded per Section 26 05 53.

3.4 ELECTRICAL CONTINUITY OF METAL RACEWAYS, CABLE ARMOR AND ENCLOSURES

A. General: Metal raceways, cable armor and other metal enclosures for conductors shall metallically joined together into a continuous electric conductor and shall be connected to all boxes, fittings, and cabinets or enclosures so as to provide an effective ground fault current path per Section 250.4 of the NEC.

3.5 VOLTAGE DROP REQUIREMENTS

A. Feeders: Feeders shall be sized for maximum voltage drop of 2%.

B. Branch circuits:

1. Do not use wire smaller than No. 12 AWG (unless otherwise noted) for branch circuit wiring, including motor circuits. All 20 amp, 120 volt and 277 volt branch circuit homeruns (to panelboard) serving receptacles, equipment and lighting shall be No. 10 AWG minimum to first outlet or light fixture.
2. Size 120V branch circuits for length of run on the following basis:
   a. 0 to 50 ft. run from panelboard to first outlet: No. 12 AWG minimum.
   b. 51 to 85 ft. run from panelboard; No. 10 AWG minimum.
   c. 86 to 135 ft. run from panelboard; No. 8 AWG minimum to first outlet.
   d. 136 to 225 ft. run: wiring shall be No. 6 AWG minimum to first outlet.
   e. For other branch circuits, size conductors so that voltage drop does not exceed 3%.

3.6 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are user. Install sleeves during erection of slabs and walls.

B. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.

C. Cut sleeves to length for mounting flush with both wall surfaces.

D. Extend sleeves installed in floors 2 inches above finished floor level.

E. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors to cable penetrations. Install sleeves and seal with firestop materials according to Section 078400 – “Firestopping”.

F. Roof-Penetration Sleeves: Seal penetration of individual cables with flexible boot-type flashing units applied in coordination with roofing work.

G. Aboveground Exterior-Wall Penetrations: Seal penetrations using sleeves and mechanical sleeve seals.

H. Underground Exterior-Wall Penetrations: Install cast-iron “wall pipes” for sleeves.

3.7 SLEEVE-SEAL INSTALLATION

A. Install to seal underground exterior-wall penetrations.

3.8 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assemble according to Section 07 84 00 – Firestopping.

3.9 FIELD QUALITY CONTROL

A. Tests and Inspections:
   1. After installing conductors and cables and before electrical circuitry has been energized, test service entrance and feeder conductors.

2. Perform the following visual and mechanical inspection and electrical tests:
    a. Compare cable data and wire sizes with drawings and specifications.
    b. Expect cables for damage and correct connections per one line diagrams.
    c. Verify tightness of connections, and test connections for high resistance.
    d. Inspect for correct phase arrangements and jacket insulation.

B. Test Reports: Record test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

C. Remove and replace malfunctioning units and retest as specified above.

END SECTION 26 05 19

SECTION 26 05 26
GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes methods and materials for grounding system and equipment, plus the following special applications: Underground distribution grounding.

1.2 REFERENCES

A. ANSI/NFPA 70 – National Electrical Code (NEC) 2014

B. UL 467 – Grounding and Bonding Equipment (2007)

1.3 QUALITY ASSURANCE

A. Electrical Components, Listed and labeled as defined in NFPA 70, Article 100.

B. Comply with UL 467 for grounding and bonding materials and equipment.

PART 2 PRODUCTS

2.1 CONDUCTORS

A. Insulated Conductors: Copper or tinned-copper wire or cable insulated for 600 V.

B. Bare Copper Conductors:
   1. Solid Conductors: ASTM B 3.
   2. Stranded Conductors: ASTM B 8.
   3. Tinned Conductors: ASTM B 33.

C. Bonding Conductor: #4 or #6 AWG, stranded.

D. Bonding Jumper: Copper tape, braided conductors with copper ferrules; 1-5/8” wide x 1/16” thick.

E. Grounding Bus: Rectangular bars of annealed copper, ¼” x 2” x 12”, unless otherwise indicated; with insulators.

2.2 CONNECTORS

A. Bolted Connectors:
   1. Copper or copper alloy, bolted pressure-type, with at least two bolts.
   2. Pipe Connectors: Clamp type, sized for pipe.

B. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conduits.

C. Compression Connectors: Irreversible type meeting IEEE Standard 837-2002, UL Listed.

PART 3 EXECUTION

3.1 APPLICATIONS

A. Conductors: All conductors to be stranded conductors unless otherwise indicated.

B. Underground: Install bare copper conductors, #3/0 AWG, minimum 30" below grade.

C. Isolated Ground: Green insulation with yellow stripe.

D. Grounding Bus: Install in electrical rooms, in rooms housing service equipment.

E. Conductor Terminations and Connections:
   1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
   2. Underground Connections: Welded connectors and as otherwise indicated.
   3. Connections to Structural Steel: Welded connectors.

3.2 EQUIPMENT GROUNDING

A. Install insulated equipment grounding conductors with all feeders and branch circuits.

B. Isolated Grounding Receptacles Circuits: Install an insulated equipment grounding conductor connected to the receptacle grounding terminal. Isolate conductor from raceway and from panelboard grounding conductor terminal of the applicable derived system or service.

3.3 INSTALLATION

A. Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

B. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance, except where routed through short lengths of conduit.
   1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
   2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install so vibration is not transmitted to rigidly mounted equipment.
   3. Use exothermic-welded connectors for outdoor locations, but if a disconnect-type connection is required, use a bolted clamp.

3.4 FIELD QUALITY CONTROL

A. Perform the following tests and inspections and prepare test reports:
   1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.

B. Report measured ground resistances that exceed the following values:
   1. Power and Lighting Equipment: 3 ohms.

C. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Project Manager promptly and include recommendations to reduce ground resistance.

END SECTION 26 05 26

DIVISION 26 - ELECTRICAL

SECTION 26 05 29
HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes Hangers and supports for electrical equipment and systems.

1.2 REFERENCES

A. ANSI/NFPA 70 – National Electrical Code (NEC) 2011

1.3 PERFORMANCE REQUIREMENTS

A. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.

B. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

1.4 QUALITY ASSURANCE

A. Comply with NFPA 70.

PART 2 PRODUCTS

2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.
   1. Metallic Coating: Hot-dip galvanized after fabrication and applied according to MFMA-4.
   2. Channel Dimensions: Selected for applicable load criteria.
   3. Fittings and Accessories: Products of channel and angle manufacturer and designed for use with those items.
   4. Fitting and Accessory Materials: Same as channels and angles, except metal items may be stainless steel.
   5. Rated Strength: Selected to suit applicable load criteria.

B. Raceway and Cable Supports: As described in NECA 1 and NECA 101.

C. Conduit and Cable Support Devices: Steel and malleable-iron hangers, clamps, and associated fittings, designed for type and sizes of raceway or cable to be supported.

D. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.

E. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars: black and galvanized.

F. Mounting, Anchoring and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:
   1. Power-Actuated Fasteners: Threaded-steel stud, for use in hardened Portland cement concrete, steel or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used. Approval from structural engineer shall be obtained prior to the use of power-actuated fasteners.
   2. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel, for use in hardened Portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.
      a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   3. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.
   4. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
   5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
   6. Toggle Bolts: All-steel springhead type.
   7. Hanger Rods: Threaded steel.

2.2 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

A. Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.

B. Materials: Comply with requirements in Division 05 Section “Metal Fabrications” for steel shapes and plates.

C. ASTM A 36A/36M steel plates, shapes, and bars; black and galvanized.

PART 3 EXECUTION

3.1 APPLICATION

A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.

B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT and RMC as required by NFPA 70. Minimum rod size will be ¼ inch in diameter.

C. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits. Secure raceways and cables to these supports with two-bolt conduit clamps for conduits 1 ¼ inch and larger, single-bolt conduit clamps for conduits 1 inch and smaller.

3.2 SUPPORT INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.

B. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.

C. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:
   1. To Wood: Fasten with lag screws or through bolts.
   2. To New Concrete: Bolt to concrete inserts.
   3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
   4. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches thick.
   5. To Steel: Welded threaded studs complying with AWS D1.1/D1.1M, with lock washers and nuts and Beam clamps (MSS Type 19, 21, 23, 25 or 27) complying with MSS SP-69.
   6. To Light Steel: Sheet metal screws.
   7. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers and other devices on slotted-channel racks attached to substrate.

D. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

A. Comply with installation requirements in Division 05 Section "Metal Fabrications" for site-fabricated metal supports.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment and elevation to support and anchor electrical materials and equipment.

C. Field Welding: Comply with AWS D1.1/D1.1M.

3.4 PAINTING

A. Touchup: Comply with requirements in Section 09 90 00 – “Paints and Coatings” for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.

B. Galvanized Surfaces: Clean welds, bolted connections and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END SECTION 26 05 29

DIVISION 26 - ELECTRICAL

SECTION 26 05 33
RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.

B. Related Sections include the following:
   1. Section 26 05 29 – Hangers and Supports for Electrical Systems.

1.2 REFERENCES

A. ANSI/NFPA 70 – National Electrical Code (NEC) 2014

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, and marked for intended use.

B. Comply with NFPA 70.

PART 2 PRODUCTS

2.1 METAL CONDUIT AND TUBING

A. Rigid Steel Conduit: ANSI C80.1.

B. IMC: ANSI C80.6.

C. EMT: ANSI C80.3.

D. FMC: Zinc-coated steel or aluminum.

E. LFMC: Flexible steel conduit with PVC Jacket.

F. Fittings for Conduit (Including all Types and Flexible and Liquidtight), EMT, and Cable: NEMA FB 1; listed for type and size raceway with which used, and for application and environment in which installed. Fittings for EMT: Steel Insulated Throat, set-screw or gland compression type.

G. Joint Compound for Rigid Steel Conduit: Listed for use in cable connector assemblies, and compounded for use to lubricate and protect threaded raceway joints from corrosion and enhance their conductivity.

2.2 NONMETALLIC CONDUIT

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

B. RNC: NEMA TC 2, Type EPC-40-PVC, unless otherwise indicated.

C. LFNC: UL 1660.

D. Fittings for RNC: NEMA TC 3; match to conduit or tubing type and material.

E. Fittings for LFNC: UL 514B.

2.3 BOXES, ENCLOSURES, AND CABINETS

A. Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.

B. Sheet Metal Outlet and Device Boxes: NEMA OS 1.

C. Cast-Metal Outlet and Device Boxes: NEMA FB 1, ferrous alloy, Type FD, with gasketed cover.

D. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

2.4 METALLIC RACEWAY

A. Legrand Wiremold AL2000 Base and Blank Cover.

B. Raceway shall be fog white or off white in color.

C. The raceway and all system components must be UL Listed in full compliance with their standard for surface metal raceways and fittings (UL-5). The snap together base and cover shall be manufactured of 6063-T5 extruded aluminum alloy, 0.060" thick throughout, with a satin anodized finish.

2.5 NONMETALLIC RACEWAY (CONTROL WIRING)

A. Acceptable Manufacturers
   1. Legrand-Wiremold Eclipse PN05 Series, Classroom
   2. Panduit LDPH5 Series, Classroom
   3. Legrand Wiremold 5040, 4” Raceway, Main Corridor Pathways
   4. Hubbell PB2 and PS2, Main Corridor Pathways
   5. Hubbell PW1, Classroom

B. Flexible Raceway shall be fog white or off white in color.

C. Non-metallic raceway shall meet the requirements:
   1. NEC Articles 770 and 800 for Telecommunications Cables.
   2. Raceway shall be UL Listed under UL 910 Standard for Plenum Application for Optical Fiber Raceway.

D. Flexible raceway shall be provided with a pull (mule) tape routed throughout the raceway containing footage markings.

E. All raceway fitting and accessories shall be manufactured by the same manufacturer as the non-metallic raceway.

PART 3 EXECUTION

3.1 RACEWAY APPLICATION

A. Comply with the following indoor applications, unless otherwise indicated:
   1. Exposed, in classrooms and corridors: Metallic and Non-Metallic Raceway.
   2. Exposed, utility areas, not subject to damage: EMT.
   3. Exposed and Subject to Physical Damage: Rigid steel conduit below switch height and EMT above switch height, except in equipment rooms, closets, chases and similar locations.
   4. Concealed in Ceiling and Interior Walls and Partitions: EMT (See Section 26 05 19 for acceptable use of MC cable.
   5. Connection to Vibrating Equipment: FMC, except use LFMC in damp or wet locations.
   6. Connections to lighting fixtures in accessible ceilings: FMC –Maximum 72" in length.
   7. Damp or Wet Locations: Rigid steel conduit between grade and 96" above grade; EMT with rain tight compression fittings above 96".
   8. Raceways for Concealed General Purpose Distribution of Optical Fiber or Communications Cable: EMT.
   9. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 3R in damp or wet locations.

B. Minimum Raceway Size: Minimum conduit size shall be ¾-inch trade size except for switch legs and control circuits may be ½ inch.

C. Homerun conduit size shall be 1" trade size minimum.

D. Minimum FMC size shall be ½", except that lighting fixture connections may be 3/8".

E. Raceway Fittings: Compatible with raceways and suitable for use and location. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings, unless otherwise indicated.

3.2 INSTALLATION

A. Comply with NECA 1 for installation requirements applicable to products specified in Part 2 except where requirements on Drawings or in this Article are stricter. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.

B. Keep raceways at least 6 inches away from parallel runs of flues and stream or hot-water pipes. Install horizontal raceway runs above water and steam piping.

C. Complete raceway installation before starting conductor installation.

D. Support raceways as specified in Specification Section 26 05 29 – Hangers and Supports for Electrical Systems.

E. Arrange stub-ups so curved portions of bends are not visible above the finished slab.

F. Install no more than the equivalent of three 90-degree bends in any conduit.

G. Conceal conduit within finished walls, ceilings and floors, unless otherwise indicated.

H. Raceways Embedded in Slabs:

1. Run conduit larger than 1 inch trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support.
2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
3. Change from PVC to EMT or rigid steel conduit before rising above the floor.

I. Where RNC conduit is installed, all 90 degree bends for conduit 1-1/2" and larger shall be made with a black mastic coated rigid steel conduit elbow.

J. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.

K. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire.

L. Install raceway sealing fittings at suitable, approved, and accessible locations and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points:
1. Where conduits pass from warm or cold locations, such as boundaries of refrigerated spaces.
2. Where otherwise required by NFPA 70.

M. Expansion-Joint Fittings for RNC: Install in each run of aboveground conduit that is located where environmental temperature change may exceed 30 deg F, and that has straight-run length that exceeds 25 feet. Install each expansion-joint fitting with position, mounting and piston setting selected according to manufacturer's written instructions for conditions at specific location at the time of installation.

N. Flexible Conduit Connections: Use maximum of 72 inches of flexible conduit for recessed and semi-recessed lighting fixtures, maximum of 36 inches of flexible conduit equipment subject to vibration, noise transmission or movement; and for transformers and motors. Use LFMC in damp or wet locations

O. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall.

3.3 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 07 – Firestopping.

3.4 PROTECTION

A. Provide final protection and maintain conditions that ensure coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.
1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
2. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

END SECTION 26 05 33

SECTION 26 05 53
IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Identification for raceways and metal-clad cable.
2. Identification for conductors and communication and control cable.
3. Underground-line warning tape.
4. Warning labels and signs.
5. Instruction signs.
6. Equipment identification labels.
7. Miscellaneous identification products.

1.2 QUALITY ASSURANCE

A. Comply with ANSI A13.1 and ANSI C2.

B. Comply with NFPA 70.

C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.

D. Comply with ANSI Z535.4 for safety signs and labels.

E. Comply with UL 969 for adhesive labels

1.3 COORDINATION

A. Coordinate identification names, abbreviations, colors and other features with requirements in the Contract Documents, Shop Drawings, manufacturer's wiring diagrams, and in the Operation and Maintenance Manual, and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout the Project.

B. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

C. Coordinate installation of identifying devices with location of access panels and doors.

D. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 PRODUCTS

2.1 CONDUCTORS AND CABLES

A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils thick by 1 to 2 inches wide.

B. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.

2.2 FLOOR MARKING TAPE

A. 2” wide, 5 Mil pressure sensitive vinyl tape, with black and white stripes and clear vinyl overlay.

2.3 UNDERGROUND-LINE WARNING TAPE

A. Description: Permanent, bright-colored, continuous-printed, polyethylene tape.

1. Not less than 6 inches wide by 4 mils thick.
2. Compounded for permanent direct-burial service.
3. Embedded continuous metallic strip or core.
4. Printed legend shall indicate type of underground line.

B. Color and Printing:

1. Comply with ANSI Z535.1 through Z535.5.
2. Inscriptions for Red-Colored Tapes: ELECTRIC LINE, HIGH VOLTAGE.
3. Inscriptions for Orange-Colored Tapes: TELEPHONE CABLE, CATV CABLE, COMMUNICATIONS CABLE, OPTICAL FIBER CABLE.

2.4 WARNING LABELS AND SIGNS

A. Comply with NFPA 70 and 29 CFR 1910.145.

B. Engraved, Laminated Acrylic or Melamine Label: Punched or drilled for screw mounting. White letters on a dark-gray background. Minimum letter height shall be 3/8 inch.

C. Warning label and sign shall include, but are not limited to, the following legends:

1. Multiple Power Source Warning: “DANGER – ELECTRICAL SHOCK HAZARD – EQUIPMENT HAS MULTIPLE POWER SOURCES”.

2.5 INSTRUCTION SIGNS

A. Engraved, laminated acrylic or melamine plastic, minimum 1/16 inch thick for signs up to 20 sq. in. and 1/8 inch thick for larger sizes.

1. Engraved legend with black letters on white face.
2. Punched or drilled for mechanical fasteners.
3. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

2.6 EQUIPMENT IDENTIFICATION LABELS

A. Engraved, Laminated Acrylic or Melamine Label: Punched or drilled for screw mounting. White letters on a dark-gray background. Minimum letter height shall be 3/8 inch.

2.7 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Paint: Paint materials and application requirements are specified in Section 099100 – "Paint and Coatings".

B. Fasteners for Labels and Signs: Self-tapping stainless steel screws, except contact type permanent commercial grade adhesive providing a permanent bond shall be used where screwed cannot or should not penetrate substrate.

C. Two-sided tape and dynamo tape adhesives are not acceptable.

PART 3 EXECUTION

3.1 APPLICATION

A. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service, Feeder, and Branch Circuits: Identify with paint as noted below.

1. All junction boxes for the shall be painted as follows:
    a. Telecommunications Systems - Blue
    b. Fire Alarm System – Red

B. Power-Circuit Conductor Identification: For primary and secondary conductors in pull boxes, junction boxes and manholes/handholes use color-coding conductor tape. Identify source and circuit number of each set of conductors. For single conductor cables, identify phase in addition to the above.

C. Branch-Circuit Conductor Identification: Where there are conductors for more than three branch circuits in same junction or pull box, use marker tape. Identify each ungrounded conductor according to source and circuit number.

D. At each junction box, the covers on junction boxes and pull boxes in areas that are not to be painted shall be marked with "Indelible Markers" to indicate the circuit number(s) of conductors in the box. In areas where exposed conduit and junction boxes are to be painted, indicate circuit number(s) of conductors in the box on the inside cover of the box.

E. Conductors to Be Extended in the Future: Attach marker tape to conductors and list source and circuit number.

F. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and communications cable. Install underground-line warning tape for both direct-buried cables and cables in raceway.

G. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Comply with 29 CFR 1910.145 and apply baked-enamel warning signs. Apply to exterior of door, cover, or other access.

1. Equipment with Multiple Power or Control Sources: Apply to door or cover of equipment including, but not limited to, the following:

a. Power transfer switches
b. Controls with external control power connections.

2. Equipment Requiring Workspace Clearance According to NFPA 70: Unless otherwise indicated, apply to door or cover of equipment but not on flush panelboards and similar equipment in finished spaces.

H. Instruction Signs:

1. Operating Instructions: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.

2. Emergency Operating Instructions: Install instruction signs with white legend on a red background with minimum 3/8-inch- high letters for emergency instructions at equipment used for power transfer load shedding.

I. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.

1. Labeling Instructions:
a. Indoor Equipment: Engraved, laminated acrylic or melamine label. Unless otherwise indicated, provide a single line of text with ½-inch high letters on 1-1/2-inch-high label; where 2 lines of text are required, use labels 2 inches high and greater.
b. Outdoor Equipment: Engraved, laminated acrylic or melamine label.
c. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.

2. Equipment to Be Labeled:
a. Panelboards, electrical cabinets, and enclosures.
b. Access doors and panels for concealing electrical items.
c. Electrical switchgear and switchboards.
d. Transformers.
e. Emergency system boxes and enclosures
f. Disconnect switches.
g. Enclosed circuit breakers.
h. Motor starters and VFDs.
i. Push-button stations.
j. Power transfer equipment.
k. Contactors.
l. Remote-controlled switches, dimmer modules, and control devices.
m. Power-generating units.
n. Fire-alarm control panel and annunciators.
o. Lighting Control Panels

J. Engraved laminate signs shall have lettering as follows:

1. Fire Alarm System – Red field with white lettering

2. Normal Power - White lettering in a black field.

K. Where the electrical system is comprised of normal power and emergency power, the equipment connected to the normal power system shall have engraved laminate signs with white lettering in a black field. Equipment connected to the emergency power system shall have engraved laminate signs with black lettering in a yellow field.

L. Panelboard identification shall indicate building name, panelboard designation, voltage and where fed from, i.e.:

WASHINGTON WES
PANEL WES-DPLA
120/208V, 3 PHASE, 4W
FED FROM WES-SBLA

M. Panelboards located in storage rooms shall have floor space per NEC-110 permanently marked and shall be identified as "Electrical Access - Not For Storage."

3.2 COVER PLATES

A. All wiring device cover plates shall have panel name and circuit number serving device clearly marked (e.g. “MMS-LA”) on the back of each faceplate with indelible marker.

3.3 PANELBOARD CIRCUIT DIRECTORIES

A. Install in each panelboard a typewritten directory accurately indicating rooms and equipment being served. Verify actual room names and numbers to be used. Also, provide a copy of typewritten panelboard directories in Owner's close-out manuals.

3.4 INSTALLATION

A. Verify identity of each item before installing identification products.

B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.

C. Apply identification devices to surfaces that require finish after completing finish work.

D. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.

E. Attach non-adhesive signs and plastic labels with screws and auxiliary hardware appropriate to the location and substrate.

F. Color-Coding for Phase and Voltage Level Identification, 600 V and Less: Use the colors listed below for ungrounded service, feeder, and branch-circuit conductors.

1. Color shall be factory applied or, for sizes larger than No. 12 AWG if authorities having jurisdiction permit, field applied.
2. Colors for 208/120-V Circuits:
   a. Phase A: Black.
   b. Phase B: Red.
   c. Phase C: Blue.

d. Neutral: White.

e. Ground: Green.

f. Isolated Ground: Green/Yellow Tracer.

3. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.

G. Underground-Line Warning Tape: During backfilling of trenches install continuous underground-line warning tape directly above line at 6 to 8 inches below finished grade. Use multiple tapes where width of multiple lines installed in a common trench or concrete envelope exceeds 16 inches overall.

H. Painted Identification: Prepare surface and apply paint according to Section 099100 – “Painting”.

END SECTION 26 05 53

SECTION 26 05 73
DEVICE COORDINATION STUDY

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes computer-based, arc flash, fault-current and overcurrent protective device coordination studies. Protective devices shall be set based on results of the protective device coordination study. A system study will be completed on the entire electrical distribution system, both new and existing.

1.2 REFERENCES

A. ANSI/NFPA 70 – National Electrical Code (NEC) (2014)

B. NFPA 70E – Standard for Electrical Safety in the Workplace (2015)

1.3 QUALITY ASSURANCE

A. Studies shall use computer programs that are distributed nationally and are in wide use. Software algorithms shall comply with requirements of standards and guides specified in this Section. Manual calculations are not acceptable.

B. Coordination-Study Specialist Qualifications: An entity experienced in the application of computer software used for studies, having performed successful studies of similar magnitude on electrical distribution systems using similar devices.

C. Comply with IEEE 242 for short-circuit currents and coordination time intervals.

D. Comply with IEEE 399 for general study procedures.

PART 2 PRODUCTS

2.1 COMPUTER SOFTWARE DEVELOPERS

A. Computer Software Developers: Subject to compliance with requirements, provide products by one of the following:
   1. ESA Inc.
   2. SKM Systems Analysis, Inc.

2.2 COMPUTER SOFTWARE PROGRAM REQUIREMENTS.

A. Comply with IEEE 399.

B. Analytical features of fault-current-study computer software program shall include "mandatory," "very desirable," and "desirable" features as listed in IEEE 399.

C. Computer software program shall be capable of plotting and diagramming time-current-characteristic curves as part of its output. Computer software program shall report device settings

and ratings of all overcurrent protective devices and shall demonstrate selective coordination by computer-generated, time-current coordination plots.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine Project overcurrent protective device submittals for compliance with electrical distribution system coordination requirements and other conditions affecting performance. Proceed with coordination study only after relevant equipment submittals have been assembled. Overcurrent protective devices that have not been submitted and approved prior to coordination study may not be used in study.

3.2 POWER SYSTEM DATA

A. Gather and tabulate the following input data to support coordination study:
   1. Product Data for overcurrent protective devices specified in other Division 26 Sections and involved in overcurrent protective device coordination studies. Use equipment designation tags that are consistent with electrical distribution system diagrams, overcurrent protective device submittals, input and output data, and recommended device settings.
   2. Impedance of utility service entrance.
   3. Electrical Distribution System Diagram: In hard-copy and electronic-copy formats, showing the following:
      a. Circuit-breaker and fuse-current ratings and types.
      b. Relays and associated power and current transformer ratings and ratios.
      c. Transformer kilovolt amperes, primary and secondary voltages, connection type, impedance, and X/R ratios.
      d. Generator kilovolt amperes, size, voltage, and source impedance.
      e. Cables: Indicate conduit material, sizes of conductors, conductor material, insulation, and length.
      f. Busway ampacity and impedance.
      g. Motor horsepower and code letter designation according to NEMA MG 1.
   4. Data sheets to supplement electrical distribution system diagram, cross-referenced with tag numbers on diagram, showing the following:
      a. Special load considerations, including starting inrush currents and frequent starting and stopping.
      b. Transformer characteristics, including primary protective device, magnetic inrush current, and overload capability.
      c. Motor full-load current, locked rotor current, service factor, starting time, type of start, and thermal-damage curve.
      d. Generator thermal-damage curve.
      e. Ratings, types, and settings of utility company's overcurrent protective devices.
      f. Special overcurrent protective device settings or types stipulated by utility company.
      g. Time-current-characteristic curves of devices indicated to be coordinated.
      h. Manufacturer, frame size, interrupting rating in amperes rms symmetrical, ampere or current sensor rating, long-time adjustment range, short-time adjustment range, and instantaneous adjustment range for circuit breakers.
      i. Manufacturer and type, ampere-tap adjustment range, time-delay adjustment range, instantaneous attachment adjustment range, and current transformer ratio for overcurrent relays.
      j. Panelboards, switchboards, motor-control center ampacity, and interrupting rating in amperes rms symmetrical.

3.3 FAULT-CURRENT STUDY

A. Calculate the maximum available short-circuit current in amperes rms symmetrical at circuit-breaker positions of the electrical power distribution system. The calculation shall be for a current immediately after initiation and for a three-phase bolted short circuit at each of the following:
   1. Switchgear and switchboard bus.
   2. Distribution panelboard.
   3. Branch circuit panelboard

B. Study electrical distribution system from normal utility power sources throughout electrical distribution system for project. Include studies of system-switching configurations and alternate operations that could result in maximum fault conditions. Initial fault calculation shall be completed and submitted prior to electrical equipment submittals.

C. Calculate momentary and interrupting duties on the basis of maximum available fault current.

D. Calculations to verify interrupting ratings of overcurrent protective devices shall comply with and IEEE 242.
   1. Low-Voltage Circuit Breakers: IEEE 1015 and IEEE C37.20.1.
   2. Low-Voltage Fuses: IEEE C37.46.

E. Study Report: Show calculated X/R ratios and equipment interrupting rating (1/2-cycle) fault currents on electrical distribution system diagram.

F. Equipment Evaluation Report:
   1. For 600-V overcurrent protective devices, ensure that interrupting ratings are equal to or higher than calculated 1/2-cycle symmetrical fault current.
   2. For devices and equipment rated for asymmetrical fault current, apply multiplication factors listed in the standards to 1/2-cycle symmetrical fault current.
   3. Verify adequacy of phase conductors at maximum three-phase bolted fault currents; verify adequacy of equipment grounding conductors and grounding electrode conductors at maximum ground-fault currents. Ensure that short-circuit withstand ratings are equal to or higher than calculated fault current.

3.4 COORDINATION STUDY

A. Perform coordination study using approved computer software program. Prepare a written report using results of fault-current study. Comply with IEEE 399.
   1. Calculate the maximum and minimum 1/2-cycle short-circuit currents.
   2. Calculate the maximum and minimum ground-fault currents.

B. Comply with IEEE 242 recommendations for fault currents and time intervals.

C. Transformer Primary Overcurrent Protective Devices:
   1. Device shall not operate in response to the following:
      a. Inrush current when first energized.
      b. Self-cooled, full-load current or forced-air-cooled, full-load current, whichever is specified for that transformer.
      c. Permissible transformer overloads according to IEEE C57.96 if required by unusual loading or emergency conditions.
   2. Device settings shall protect transformers according to IEEE C57.12.00, for fault currents.

D. Conductor Protection: Protect cables against damage from fault currents according to ICEA P-32-382, ICEA P-45-482, and conductor melting curves in IEEE 242. Demonstrate that equipment withstands the maximum short-circuit current for a time equivalent to the tripping time

of the primary relay protection or total clearing time of the fuse. To determine temperatures that damage insulation, use curves from cable manufacturers or from listed standards indicating conductor size and short-circuit current.

E. Coordination-Study Report: Prepare a written report indicating the following results of coordination study:
   1. Tabular Format of Settings Selected for Overcurrent Protective Devices:
      a. Device tag.
      b. Relay-current transformer ratios; and tap, time-dial, and instantaneous-pickup valves.
      c. Circuit-breaker sensor rating; and long-time, short-time, and instantaneous settings.
      d. Fuse-current rating and type.
      e. Ground-fault relay-pickup and time-delay settings.
   2. Coordination Curves: Prepared to determine settings of overcurrent protective devices to achieve selective coordination. Graphically illustrate that adequate time separation exists between devices installed in series, including power utility company's upstream devices. Prepare separate sets of curves for the switching schemes and for emergency periods where the power source is local generation. Show the following information:
      a. Device tag.
      b. Voltage and current ratio for curves.
      c. Three-phase and single-phase damage points for each transformer.
      d. No damage, melting, and clearing curves for fuses.
      e. Cable damage curves.
      f. Transformer inrush points.
      g. Maximum fault-current cutoff point.

F. Completed data sheets for setting of overcurrent protective devices.

3.5 ARC FAULT STUDY

A. An arc flash hazard analysis on the electrical distribution system shall be performed as per NFPA 70E regulations and NEC 110.16. The analysis includes the site data collection and verification of the electrical distribution system attributes that affect the incident energy available. Vinyl UV resistant arc flash labels would be installed on all applicable electrical enclosures. The labels shall clearly indicate the electrical hazards present in the electrical panels. The hazard labels list detailed information such as: The required safe work distance for each task, The Arc Flash hazard in cal/cm^2, The level and type of Personal Protective Equipment that must be worn when working in the enclosure live and Identification of the enclosure with a specific name.

END SECTION 26 05 73

SECTION 26 09 23
NETWORK LIGHTING CONTROL DEVICES

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. The lighting control system specified in this section shall provide time-based, sensor-based (both occupancy and daylight), and manual lighting control.
   2. The system shall be capable of turning lighting loads on/off as well as dimming lights (if lighting load is capable of being dimmed)
   3. All system devices shall be networked together enabling digital communication and shall be individually addressable.
   4. The system architecture shall be capable of enabling stand-alone groups (rooms) of devices to function in some default capacity even if network connectivity to the greater system is lost.
   5. The system architecture shall facilitate remote operation via a computer connection.
   6. The system shall not require any centrally hardwired switching equipment.
   7. The system shall be capable of wireless, wired, or hybrid wireless/wired architectures.

B. Related Sections include the following:
   1. Division 26 Section 262726 “Wiring Devices” for wall-box dimmers, wall-switch occupancy sensors, and manual light switches

1.2 REFERENCES

A. ANSI/NFPA 70 – National Electrical Code (NEC) 2011

B. ICC – International Energy Conservation Code (IECC) 2009

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, and marked for intended use.

1.4 COORDINATION

A. Coordinate layout and installation of ceiling-mounted devices with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, smoke detectors, fire-suppression system, and partition assemblies.

B. Coordinate lighting control components to form an integrated interconnection of compatible components.

C. Coordinate lighting controls with BAS (if necessary) either through IP based intercommunication of system or hardwired auxiliary relay outputs. Timeclock function for exterior lighting shall be through the BAS.

D. The installing contractor shall be responsible for a complete and functional system in accordance with all applicable local and national codes.

1.5 WARRANTY

A. All devices in lighting control system shall have a 5 year warranty.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturer: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following: Sensor Switch, Inc.

2.2 SYSTEM REQUIREMENTS

A. System shall have an architecture that is based upon three main concepts; 1) intelligent lighting control devices 2) standalone lighting control zones 3) network backbone for remote or time based operation.

B. Intelligent lighting control devices shall consist of one or more basic lighting control components; occupancy sensors, photocell sensors, relays, dimming outputs, manual switch stations, and manual dimming stations. Combining one or more of these components into a single device enclosure should be permissible so as to minimize overall device count of system.

C. System must interface directly with intelligent LED luminaires such that only CAT-5e cabling is required to interconnect luminaires with control components such as sensors and switches (see *Networked LED Luminaire* section)

D. Intelligent lighting control devices shall communicate digitally, require <4 mA of current to function (Graphic wall stations excluded), and posses RJ-45 style connectors.

E. Lighting control zones shall consist of one or more intelligent lighting control components, be capable of stand-alone operation, and be capable of being connected to a higher level network backbone.

F. Devices within a lighting control zone shall be connected with CAT-5e low voltage cabling in any order.

G. Lighting control zone shall be capable of automatically configuring itself for default operation without any start-up labor required.

H. Individual lighting zones must continue to provide a user defined default level of lighting control in the event of a system communication failure with the backbone network or the management software becoming unavailable.

I. Power for devices within a lighting control zone shall come from either resident devices already present for switching (relay device) or dimming purposes, or from the network backbone. Standalone “bus power supplies” shall not be required in all cases.

J. All switching and dimming for a specific lighting zone shall take place within the devices located in the zone itself (i.e. not in a remotely located devices such as panels) to facilitate system robustness and minimize wiring requirements. Specific applications that require centralized or remote switching shall be capable of being accommodated.

K. System shall have one or more primary wall mounted network control “gateway” devices that are capable of accessing and controlling connected system devices and linking into an Ethernet LAN.

L. System shall use “bridge” devices that route communication and distribute power for up to 8 directly connected lighting zones together for purposes of decreasing system wiring requirements.

M. System shall be capable of wirelessly connecting a lighting zone to a WiFi (802.11n) wireless data network for purposes of eliminating the “bridge” devices and all cabling that connects zones to bridge devices.

N. WiFi enabled devices shall be able to detect when WiFi network is down and revert to a user directed default state.

O. WiFi-enabled devices shall be capable of current monitoring

P. WiFi-enabled devices shall utilize WPA2 AES encryptio**n**

Q. WiFi-enabled devices shall be able to connect to 802.11b/g/n WiFi networks

R. WiFi-enabled devices shall have at least one local RJ-45 port for communicating with nonWiFi-enabled system devices

S. System shall have a web-based software management program that enables remote system control, status monitoring, and creation of lighting control profiles.

T. Individual lighting zones shall be capable of being segmented into several “local” channels of occupancy, photocell, and switch functionality for more advanced configurations and sequences of operation.

U. Devices located in different lighting zones shall be able to communicate occupancy, photocell, and switch information via either the wired or WiFi backbone.

V. System shall be capable of operating a lighting control zone according to several sequences of operation. System shall be able to change a spaces sequence of operation according to a time schedule so as to enable customized time-of-day, day-of-week utilization of a space. Note operating modes should be utilized only in manners consistent with local energy codes.
    1. Auto-On / Auto-Off (via occupancy sensors)
        a. Zones with occupancy sensors automatically turn lights on when occupant is detected.
        b. Zones with occupancy and/or photocell sensors turn lights off when vacancy or sufficient daylight is detected.
        c. Pressing a switch will turn lights off. The lights will remain off regardless of occupancy until switch is pressed again, restoring the sensor to Automatic On functionality.
    2. Manual-On / Auto-Off (also called Semi-Automatic)
        a. Pushing a switch will turn lights on.
        b. Zones with occupancy and/or photocell sensors turn lights off when vacancy or sufficient daylight is detected.
    3. Manual-On to Auto-On/Auto-Off
        a. Pushing a switch will turn lights on.
        b. After initial lights on, zones with occupancy and/or photocell sensors turn lights on/off according to occupancy/vacancy and/or daylight conditions.
        c. Sequence can be reset via scheduled (ex. daily each morning) events
    4. Auto-to-Override On
        a. Zones with occupancy sensors automatically turn lights on when occupant is detected.

b. Zone lighting then goes into an override on state for a set amount of time or until the next time event returns the lighting to an auto-off style of control.
c. Sequence can be reset via scheduled (ex. daily each morning) events

5. Manual-to-Override On
   a. Pushing a switch will turn lights on.
   b. Zone lighting then goes into an override on state for a set amount of time or until the next time event returns the lighting to an auto-off style of control.
6. Sequence can be reset via scheduled (ex. daily each morning) events
   a. Auto On / Predictive Off
   b. Zones with occupancy sensors automatically turn lights on when occupant is detected.
   c. Zones with occupancy and/or photocell sensors turn lights off when vacancy or sufficient daylight is detected.
   d. If switch is pressed, lights turn off and a short “exit timer” begins. After timer expires, sensor scans the room to detect whether occupant is still present. If no occupancy is detected, zone returns to auto-on. If occupancy is detected, lights must be turned on via the switch.
7. Multi-Level Operation (multiple lighting levels per manual button press)
   a. Operating mode designed specifically for bi-level applications
   b. Enables the user to cycle through the up to four potential on/off lighting states using only a single button.
   c. Eliminates user confusion as to which of two buttons controls which load
   d. Three different transition sequences are available in order to comply with energy codes or user preference)
   e. Mode available as a setting on all nLight devices that have single manual on/off switch (ex. nWSX, nPODM, nPODM-DX).
   f. Depending on the sequence selected, every button push steps through relays states according to below table
   g. In addition to achieving bi-level lighting control by switching loads with relays, the ability to command dimming outputs to “step” in a sequence that achieves bi-level operation is present.

	Alternating Sequence		Full On Sequence		3 Step On Sequence	
Sequence State #	Relay 1	Relay 2	Relay 1	Relay 2	Relay 1	Relay 2
1	On	Off	On	Off	On	Off
2	Off	On	-	-	Off	On
3	-	-	On	On	On	On
4*	Off	Off	Off	Off	Off	Off

(*step only present for devices without separate off button)

W. A taskbar style desktop application shall be available for personal lighting control.

X. An application that runs on “smart” handheld devices (such as an Apple® IPhone®) shall be available for personal lighting control.

Y. Control software shall enable logging of system performance data and presenting useful information in a web-based graphical format and downloadable to .CSV files.

Z. Control software shall enable integration with a BMS via BACnet IP.

AA. System shall provide the option of having pre-terminated plenum rated CAT-5e cabling supplied with hardware.

2.3 INDIVIDUAL DEVICE SPECIFICATIONS

A. Control Module (Gateway)

1. Control module shall be a device that facilitates communication and time-based control of downstream network devices and linking into an Ethernet.

2. Devices shall have a user interface that is capable of wall mounting, powered by low voltage, and have a touch screen.

3. Control device shall have three RJ-45 ports for connection to other backbone devices (bridges) or directly to lighting control devices.

4. Device shall automatically detect all devices downstream of it.

5. Device shall have a standard and astronomical internal time clock.

6. Device shall have one RJ-45 10/100 BaseT Ethernet connection.

7. Device shall have a USB port

8. Each control gateway device shall be capable of linking 1500 devices to the management software.

9. Device shall be capable of using a dedicated or DHCP assigned IP address.

10. Network Control Gateway device shall be the following Sensor Switch model Series:
nGWY2

B. Networked System Occupancy Sensors

1. Occupancy sensors system shall sense the presence of human activity within the desired space and fully control the on/off function of the lights.

2. Sensors shall utilize passive infrared (PIR) technology, which detects occupant motion, to initially turn lights on from an off state; thus preventing false on conditions. Ultrasonic or Microwave based sensing technologies shall not be accepted.

3. For applications where a second method of sensing is necessary to adequately detect maintained occupancy (such as in rooms with obstructions), a sensor with an additional “dual” technology shall be used.

4. Dual technology sensors shall have one of its two technologies not require motion to detect occupancy. Acceptable dual technology includes PIR/Microphonics (also known as Passive Dual Technology or PDT) which both looks for occupant motion and listens for sounds indicating occupants. Sensors where both technologies detect motion (PIR/Ultrasonic) shall not be acceptable.

5. All sensing technologies shall be acoustically passive meaning they do not transmit sounds waves of any frequency (for example in the Ultrasonic range), as these technologies have the potential for interference with other electronic devices within the space (such as electronic white board readers). Acceptable detection technologies include Passive Infrared (PIR), and/or Microphonics technology. Ultrasonic or Microwave based sensing technologies shall not be accepted.

6. Sensors shall be available with zero, one, or two integrated Class 1 switching relays, and up to one 0-10 VDC dimming output. Sensors shall be capable of switching 120 / 277 / 347 VAC. Load ratings shall be 800 W @ 120 VAC, 1200 W @ 277 VAC, 1500 W @ 347 VAC, and ¼ HP motor. Relays shall be dry contacts.
7. Sensors shall be available with one or two occupancy “poles”, each of which provides a programmable time delay.
8. Sensors shall be available in multiple lens options which are customized for specific applications.
9. Communication and Class 2 low voltage power shall be delivered to each device via standard CAT-5 low voltage cabling with RJ-45 connectors.
10. All sensors shall have two RJ-45 ports or capable of utilizing a splitter.
11. All sensors shall have the ability to detect when it is not receiving valid communication (via CAT-5 connections) and blink its LED in a pattern to visually indicate of a potential wiring issue
12. Every sensor parameter shall be available and configurable remotely from the software and locally via the device push-button.
13. Sensors shall be able to function together with other sensors in order to provide expanded coverage areas by simply daisy-chain wiring together the units with CAT-5 cabling.
14. Sensors shall be equipped with an automatic override for 100 hour burn-in of lamps. This feature must be available at any time for lamp replacements.
15. Wall switch sensors shall recess into single-gang switch box and fit a standard GFI opening.
16. Wall switch sensors must meet NEC grounding requirements by providing a dedicated ground connection and grounding to mounting strap. Line and load wire connections shall be interchangeable. Sensor shall not allow current to pass to the load when sensor is in the unoccupied (Off) condition.
17. Wall switch sensors shall have optional features for photocell/daylight override, vandal resistant lens, and low temperature/high humidity operation.
18. Wall switch sensors shall be available in four standard colors (Ivory, White, Light Almond, Gray) with Decora stainless steel coverplate.
19. Wall switch sensors shall be available with optional raise/lower dimming adjustment controls
20. Wall switch sensors shall be the following Sensor Switch model numbers, with device color and optional features as specified:

    nWSD or nWSX (PIR, 1 Relay)

    nWSD PDT or **nWSX PDT** (Dual Tech, 1 Relay)

    nWSD NL (PIR w/ Night Light, 1 Relay)

    nWSD PDT NL (Dual Tech w/ Night Light, 1 Relay)

    nWSX NL LV (PIR w/ Night Light, No Relay)

    nWSD PDT NL LV (Dual Tech w/ Night Light, No Relay)

    nWSD LV or **nWSX LV** (PIR, No Relay, Raise/Lower Dim Ctrl)

    nWSD PDT LV or **nWSX PDT LV** (Dual Tech w/ Night Light, No Relay, Raise/Lower Dim Ctrl)

21. Network system shall have sensors that can be embedded into luminaire such that only the lens shows on luminaire face.
22. Embedded sensors shall be capable of both PIR and Dual Technology occupancy detection
23. Embedded sensors shall have an optional photocell
24. Embedded sensors shall be the following Sensor Switch model number:

nES 7 (PIR, No Relay)
nES 7 ADCX (PIR w/ Photocell, No Relay)
nES PDT 7 (Dual Technology, No Relay)
nES PDT 7 ADCX (Dual Technology w/ Photocell, No Relay)

25. Network system shall also have ceiling, fixture, recessed, & corner mounted sensors available.
26. Fixture mount sensors shall be capable of powering themselves via a line power feed.
27. Sensors shall have optional features for photocell/daylight override, dimming control, and low temperature/high humidity operation.
28. Sensors with dimming can control 0 to 10 VDC dimmable ballasts by sinking up to 20 mA of Class 2 current (typically 40 or more ballasts).
29. Sensors shall be the following Sensor Switch model numbers, with device options as specified:

Model # Series	Occupancy Poles	# of Relays	Lens Type	Detection Technology
nCM(B) 9	1	-	Standard	PIR
nCM(B) 9 2P	2	-	Standard	PIR
nCMR(B) 9	1	1	Standard	PIR
nCMR(B) 9 2P	2	2	Standard	PIR
nCM(B) PDT 9	1	-	Standard	Dual
nCM(B) PDT 9 2P	2	-	Standard	Dual
nCMR(B) PDT 9	1	1	Standard	Dual
nCMR(B) PDT 9 2P	2	2	Standard	Dual
nCM(B) 10	1	-	Extended	PIR
nCM(B) 10 2P	2	-	Extended	PIR
nCMR(B) 10	1	1	Extended	PIR
nCMR(B) 10 2P	2	2	Extended	PIR
nCM(B) PDT 10	1	-	Extended	Dual
nCM(B) PDT 10 2P	2	-	Extended	Dual
nCMR(B) PDT 10	1	1	Extended	Dual
nCMR(B) PDT 10 2P	2	2	Extended	Dual
nWV 16	1	-	Wide View	PIR
nWV PDT 16	1	-	Wide View	Dual
nHW13	1	-	Hallway	PIR
nCM(B) 6	1	-	High Bay	PIR
nCMR(B) 6	1	1	High Bay	PIR
nCMR(B) 6 2P	2	2	High Bay	PIR
nCMR(B) 6 480	1	2	High Bay	PIR

Note: Recessed mount versions of the above ceiling(fixture) mount versions also shall be available (e.g. nCMR(B) 9 => nRMR 9)

30. System shall have WiFi enabled fixture mountable sensors available.
31. Embedded sensors shall have an optional photocell and 0-10 VDC dimming output
32. WiFi enable sensors shall be one of the Sensor Switch model numbers:

nCMRB 6 WIFI (PIR, w/ Relay)

nCMRB 10 WIFI (PIR, w/ Relay)
nCMRB 50 WIFI (PIR, w/ Relay)
nCMRB 9 WIFI (PIR, w/ Relay)

C. Networked System Daylight (Photocell and or Dimming) Sensors

1. Photocell shall provide for an on/off set-point, and a deadband to prevent the artificial light from cycling. Delay shall be incorporated into the photocell to prevent rapid response to passing clouds.
2. Photocell and dimming sensor's set-point and deadband shall be automatically calibrated through the sensor's microprocessor by initiating an "Automatic Set-point Programming" procedure. Min and max dim settings as well as set-point may be manually entered.
3. Deadband setting shall be verified and modified by the sensor automatically every time the lights cycle to accommodate physical changes in the space (i.e., furniture layouts, lamp depreciation, or lamp outages).
4. Dimming sensors shall control 0 to 10 VDC dimmable ballasts by sinking up to 20 mA of class 2 current (typically 40 or more ballasts).
5. Photocell and dimming sensors shall be equipped with an automatic override for 100 hour burn-in of lamps. This feature must be available at any time for lamp replacements. (Note: This function should be performed prior to any dimming of the lamps including the "auto set-point" setting.)
6. Combination units that have all features of on/off photocell and dimming sensors shall also be available.
7. A dual zone option shall be available for On/Off Photocell, Automatic Dimming Control Photocell, or Combination units. The second zone shall be capable of being controlled as an "offset" from the primary zone.
8. Line voltage versions of the above described photocell and combination photocell/dimming sensors shall be capable of switching both 120 VAC, 277 VAC, and 347 VAC. Load ratings shall be 800 W @ 120 VAC, 1200 W @ 277 VAC, 1500 W @ 347 VAC, and ¼ HP motor load. Relays shall be dry contacts.
9. Sensor shall be the following Sensor Switch model numbers, with device options as specified:

   nCM(B) PC (on/off))

   nCM(B) ADC (dimming)

   nCM(B) PC ADC (on/off, 0-10 VDC dimming)

   nCMR(B) PC (on/off, single relay)

   nCMR(B) PC ADC (on/off, 0-10 VDC dimming, single relay)

   Note: Recessed mount versions of the above ceiling(fixture) mount versions also shall be available (e.g. nCMR(B) PC => nRMR PC)

10. Network system shall have dimming photocells that can be embedded into luminaire such that only the lens shows on luminaire face.
11. Embedded sensors shall be the following Sensor Switch model number:

    nES ADCX (Dimming Photocell)

D. Networked System Power (Relay) Packs

1. Power Pack shall incorporate one or more Class 1 relays and contribute low voltage power to the rest of the system. Secondary Packs shall incorporate the relay(s), shall have an optional 2nd relay, 0-10 VDC dimming output, or line voltage dimming output, but shall not be required to contribute system power. Power Supplies shall provide system power only, but are not required to switch line voltage circuit. Auxiliary Relay Packs shall switch low voltage circuits only.
2. Power Packs shall accept 120 or 277 VAC (or optionally 347 VAC), be plenum rated, and provide Class 2 power to the system.
3. All devices shall have two RJ-45 ports.
4. Every Power Pack parameter shall be available and configurable remotely from the software and locally via the device push-button.
5. Power Pack shall securely mount to junction location through a threaded ½ inch chase nipple or be capable of being secured within a luminaire ballast channel. Plastic clips into junction box shall not be accepted. All Class 1 wiring shall pass through chase nipple into adjacent junction box without any exposure of wire leads. Note: UL Listing under Energy Management or Industrial Control Equipment automatically meets this requirement, whereas Appliance Control Listing does not meet this safety requirement.
6. When required by local code, Power Pack must install inside standard electrical enclosure and provide UL recognized support to junction box. All Class 1 wiring is to pass through chase nipple into adjacent junction box without any exposure of wire leads.
7. Power Packs and Power Supplies shall be available that are WiFi enabled.
8. Power (Secondary) Packs shall be available that provide up to 16 Amp switching of all lighting load types.
9. Power (Secondary) Packs shall be available that provide up to 5 Amps switching of all lighting load types as well as 0-10 VDC dimming or fluorescent ballasts/LED drivers.
10. Specific Secondary Packs shall be available that provide up to 5 Amps of switching as well as 0-10 VDC dimming of fluorescent ballasts/LED drivers.
11. Specific Secondary Packs shall be available that provide up to 5 Amps of switching and can dim 120 VAC incandescent lighting loads or 120/277 VAC line voltage dimmable fluorescent ballasts (2-wire and 3-wire versions).
12. Specific Secondary Packs shall be available that provide up to 5 Amps of switching and can dim 120/277 VAC magnetic low voltage transformers.
13. Specific Secondary Packs shall be available that provide up to 4 Amps of switching and can dim 120 VAC electronic low voltage transformers.
14. Specific Secondary Packs shall be available that provide up to 5 Amps of switching of dual phase (208/240/480 VAC) lighting loads.
15. Specific Secondary Packs shall be available that require a manual switch signal (via a networked Wall Station) in order to close its relay.
16. Specific Power/Secondary Packs shall be available that are UL924 listed for switching of Emergency Power circuits.
17. Specific Secondary Packs shall be available that control louver/damper motors for skylights.
18. Specific Secondary Packs shall be available that provide a pulse on/pulse off signal for purposes of controlling shade systems via relay inputs.
19. Power (Relay) Packs and Supplies shall be the following Sensor Switch model Series:

    nPP16 (Power Pack w/ 16A relay)

    nPP16 WIFI (Power Pack w/ 16A relay, WIFI enabled)

    nEPP5 D (Power Pack w/ 5A relay and 0-10VDC dimming output)

    nSP16 (Secondary Pack w/ 16A relay)

    nSP5 2P (Secondary Pack w/ two 5A relays)

nSP5 D (Secondary Pack w/ 5A relay and 0-10VDC dimming output)

nPP16 ER (UL924 Listed Secondary Pack w/ 16A relay for switching emergency power circuits)

nSP5 D ER (UL924 Listed Secondary Pack w/ 5A relay and 0-10VDC dimming output for switching emergency power circuits)

nSP5 PCD 2W (Secondary Pack w/ 5A relay and incandescent dimming or 2-wire line voltage fluorescent dimming output)

nSP5 PCD 3W (Secondary Pack w/ 5A relay and 3-wire line voltage fluorescent dimming output)

nSP5 PCD MLV (Secondary Pack w/ 5A relay and magnetic low voltage dimming output)

nSP5 PCD ELV 120 (Secondary Pack w/ 4A relay and electronic low voltage dimming output)

nSP5 480 (Secondary Pack w/ 5A relay for switching 208/240/480 VAC loads

nSP5 2P LVR (Louver/Damper Control Pack

nSHADE (Pulse On/Off Control Pack

nPS 80 (Auxiliary Bus Power Supply)

nPS 80 WIFI (Auxiliary Bus Power Supply, WiFi enabled)

nAR 40 (Low voltage auxiliary relay pack)

E. Networked System Relay & Dimming Panels
   1. Panel shall incorporate up to 4 normally closed latching relays capable of switching 120/277 VAC or up to 2 Dual Phase relays capable of switching 208/240/480 VAC loads.
   2. Relays shall be rated to switch up to a 30A ballast load at 277 VAC.
   3. Panel shall provide one 0-10VDC dimming output paired with each relay.
   4. Panel shall power itself from an integrated 120/277 VAC supply.
   5. Panel shall be capable of operating as either two networked devices or as one.
   6. Panel shall supply current limited low voltage power to other networked devices connected via CAT-5.
   7. Panel shall provide auxiliary low voltage device power connected wired directly to a dedicated terminal connection
   8. Power (Relay) Packs and Supplies shall be the following Sensor Switch model numbers:
      nPANEL 4 (Panel w/ four 120/277 VAC relays and four 0-10 VDC dimming outputs)

      nPANEL 2 480 (Panel w/ two dual phase relays (208/240/480 VAC) and two 0-10 VDC dimming outputs)

F. Networked Auxiliary Input / Output (I/O) Devices
   1. Devices shall be plenum rated and be inline wired, screw mountable, or have an extended chase nipple for mounting to a ½" knockout.
   2. Devices shall have two RJ-45 ports
   3. Communication and low voltage power shall be delivered to each device via standard CAT-5 low voltage cabling with RJ-45 connectors.

4. Specific I/O devices shall have a dimming control output that can control 0-10 VDC dimmable ballasts or LED drivers by sinking up to 20 mA of current (typically 40 or more ballasts).
5. Specific I/O devices shall have an input that read a 0-10 VDC signal from an external device.
6. Specific I/O devices shall have a switch input that can interface with either a maintained or momentary switch and run a switch event, run a local/remote control profile, or raise/lower a dimming output
7. Specific I/O devices shall sense state of low voltage outdoor photocells
8. Specific I/O devices shall enable RS-232 communication between lighting control system and Touch Screen based A/V control systems.
9. Specific I/O devices shall sense .
10. Auxiliary Input/Output Devices shall be the following Sensor Switch model numbers:

    nIO D (I/O device with 0-10 dimming output)

    nIO 1S or **nIO RLX** (I/O device with contact closure or 0-10VDC dimming input)

    nIO NLI (Input device for detecting state of low voltage outdoor photocell; sold in

    nIO PC KIT only)

    nIO X (Interface device for communicating with RS-232 enabled AV Touch Screens

G. Networked LED Luminaires
1. Networked LED luminaire shall have a mechanically integrated control device
2. Networked LED luminaire shall have two RJ-45 ports
3. Networked LED luminaire shall be able to digitally network directly to other network control devices (sensors, photocells, switches, dimmers)
4. Networked LED luminaire shall provide low voltage power to other networked control devices
5. System shall be able to turn on/off LED luminaire without using a relay
6. System shall be able to maintain constant lumen output over the specified life of the LED luminarie (also called lumen compensation) by varying the input control power (and thus saving up to 20% power usage).
7. System shall indicate (via a blink warning) when the LED luminaire has reached its expected life (in hrs).
8. LED Luminaires shall be the following Lithonia model families:

    RTLED

    TLED

    VLED

    ACLED

    AL LED

    WLED

    STLED

    MINO

H. Networked System Wall Switches & Dimmers
1. Devices shall recess into single-gang switch box and fit a standard GFI opening.
2. Devices shall be available with zero or one integrated Class 1 switching relay.

3. Communication and low voltage power shall be delivered to each device via standard CAT-5 low voltage cabling with RJ-45 connectors.
4. All sensors shall have two RJ-45 ports.
5. All devices shall provide toggle switch control. Dimming control and low temperature/high humidity operation are available options.
6. Devices shall be available in four colors (Ivory, White, Light Almond, Gray).
7. Devices with dimming control outputs can control 0-10 VDC dimmable ballasts by sinking up to 20 mA of current (typically 40 or more ballasts).
8. Devices with capacitive touch buttons shall provide audible user feedback with different sounds for on/off, raise/lower, start-up, and communication offline.
9. Devices with mechanical push-buttons shall provide tactile and LED user feedback.
10. Devices with mechanical push-buttons shall be made available with custom button labeling
11. Devices with a single on button shall be capable of selecting all possible lighting combinations for a bi-level lighting zone such that the user confusion as to which of two buttons (as is present in multi-button scenarios) controls which load is eliminated.
12. Wall switches & dimmers shall be the following Sensor Switch model numbers, with device options as specified:

    nPOD (single on/off, capacitive touch, audible user feedback)

    nPOD 2P (dual on/off, capacitive touch, audible user feedback)

    nPODR (single on/off, one relay, capacitive touch, audible user feedback)

    nPODM (single on/off, push-buttons, LED user feedback)

    nPODM 2P (dual on/off, push-buttons, LED user feedback)

    nPODM DX (single on/off, single dimming raise/lower, push-buttons, LED user feedback)

    nPODM 2P DX (dual on/off, dual dimming raise/lower, push-buttons, LED user feedback)

    nPODM 4P (quad on/off, push-buttons, LED user feedback)

    nPODM 4P DX (quad on/off, quad dimming raise-lower, push-buttons, LED user feedback)

I. Networked System Graphic Wall Station
1. Device shall have a 3.5” full color touch screen for selecting up to 8 programmable lighting control presets or acting as up to 16 on/off/dim control switches.
2. Device shall enable configuration of lighting presets, switched, and dimmers via password protected setup screens.
3. Device shall enable user supplied .jpg screen saver image to be uploaded.
4. Device shall surface mount to single-gang switch box
5. Device shall have a micro-USB style connector for local computer connectivity.
6. Device shall have two RJ-45 ports for communication
7. Device shall be the following Sensor Switch model number:
   nPOD GFX

J. Networked System Scene Controllers
1. Device shall have two to four buttons for selecting programmable lighting control profiles or acting as on/off switches.

2. Device shall recess into single-gang switch box and fit a standard GFI opening.
3. Devices shall provide LED user feedback.
4. Communication and Class 2 low voltage power shall be delivered to each device via standard CAT-5 low voltage cabling with RJ-45 connectors.
5. All sensors shall have two RJ-45 ports.
6. Device shall be capable of reprogramming other devices in its zone so as to implement user selected lighting scene.
7. Device shall be capable of selecting a lighting profile be run by the system's upstream Gateway so as to implement selected lighting profile across multiple zones (and not just its local zone).
8. Device shall have LEDs indicating current selection.
9. Scene Selector device shall be the following Sensor Switch model number:
   nPODM 2S (2 Scene, push-button)
   nPODM 4S (4 Scene, push-button)
   nPODM 4S DX (4 Scene, push-button, On/Off/Raise/Lower)
   nPODM 4L DX (4 Adjustable Presets, push-button, On/Off/Raise/Lower)

K. Communication Bridges
1. Device shall surface mount to a standard 4" x 4" square junction box.
2. Device shall have 8 RJ-45 ports.
3. Device shall be capable of aggregating communication from multiple lighting control zones for purposes of minimizing backbone wiring requirements back to Control Gateway.
4. Device shall be powered with Class 2 low voltage supplied locally via a directly wired power supply or delivered via a CAT-5 cabled connection.
5. Device shall be careful of redistributing power from its local supply and connect lighting control zones with excess power to lighting control zones with insufficient local power. This architecture also enables loss of power to a particular area to be less impactful on network lighting control system.
6. Communication Bridge devices shall be the following Sensor Switch model numbers:
   nBRG 8 (8 Ports)

2.4 LIGHTING CONTROL PROFILES

A. Changes to the operation of the system shall be capable of being made in real-time or scheduled via lighting control profiles. These profiles are outlines of settings that direct how a collection of devices function for a defined time period.

B. Lighting control profiles shall be capable of being created and applied to a single device, zone of devices, or customized group of zones.

C. All relays and dimming outputs shall be capable of being scheduled to track or ignore information regarding occupancy, daylight, and local user switches via lighting control profiles.

D. Every device parameter (e.g. sensor time delay and photocell set-point) shall be configurable via a lighting control profile.

E. All lighting control profiles shall be stored on the network control gateway device and on the software's host server.

F. Lighting control profiles shall be capable of being scheduled to run according to the following calendar options: start date/hour/minute, end date/hour/minute, and sunrise/sunset +/- timed offsets.

G. Sunrise/sunset times shall be automatically derived from location information using an astronomical clock.

H. Daylight savings time adjustments shall be capable of being performed automatically, if desired.

I. Lighting control profile schedules shall be capable of being given the following recurrence settings: daily, weekday, weekend, weekly, monthly, and yearly.

J. Software shall provide a graphical tool for easily viewing scheduled lighting control profiles.

2.5 MANAGEMENT SOFTWARE

A. Every device parameter (e.g. sensor time delay and photocell set-point) shall be available and configurable remotely from the software

B. The following status monitoring information shall be made available from the software for all devices for which it is applicable: current occupancy status, current PIR Status, current Microphonics Status, remaining occupancy time delay(s), current photocell reading, current photocell inhibiting state, photocell transitions time remaining, current dim level, device temperature, and device relay state(s).

C. The following device identification information shall be made available from the software: model number, model description, serial number, manufacturing date code, custom label(s), and parent network device.

D. A printable network inventory report shall be available via the software.

E. A printable report detailing all system profiles shall be available via the software.

F. Software shall require all users to login with a User Name and Password.

G. Software shall provide at least three permission levels for users.

H. All sensitive stored information and privileged communication by the software shall be encrypted.

I. All device firmware and system software updates must be available for automatic download and installation via the internet.

J. Software shall be capable of managing systems interconnected via a WAN (wide area network)

2.6 BMS COMPATIBILITY

A. System shall provide a BACnet IP gateway as a downloadable software plug-in to its management software. No additional hardware shall be required.

B. BACnet IP gateway software shall communicate information gathered by networked system to other building management systems.

C. BACnet IP gateway software shall translate and forward lighting relay and other select control commands from BMS system to networked control devices.

2.7 SYSTEM ENERGY ANALYSIS & REPORTING SOFTWARE

A. System shall be capable of reporting lighting system events and performance data back to the management software for display and analysis.

B. Intuitive graphical screens shall be displayed in order to facilitate simple viewing of system energy performance.

C. An “Energy Scorecard” shall be display that shows calculated energy savings in dollars, KWHr, or CO_2.

D. Software shall calculate the allocation of energy savings to different control measures (occupancy sensors, photocells, manual switching, etc).

E. Energy savings data shall be calculated for the system as a whole or for individual zones.

F. A time scaled graph showing all relay transitions shall be presented.

G. A time scaled graph showing a zones occupancy time delay shall be presented

H. A time scaled graph showing the total light level shall be presented.

I. User shall be able to customize the baseline run-time hours for a space.

J. User shall be able to customize up to four time-of-day billing rates and schedules.

K. Data shall be made available via a .CSV file

2.8 START-UP & SUPPORT FEATURES

A. To facilitate start-up, all devices daisy-chained together (using CAT-5) shall automatically be grouped together into a functional lighting control zone.

B. All lighting control zones shall be able to function according to default settings once adequate power is applied and before any system software is installed.

C. Once software is installed, system shall be able to auto-discover all system devices without requiring any commissioning.

D. All system devices shall be capable of being given user defined names.

E. All devices within the network shall be able to have their firmware reprogrammed remotely and without being physically uninstalled for purposes of upgrading functionality at a later date.

F. All sensor devices shall have the ability to detect improper communication wiring and blink its LED in a specific cadence as to alert installation/startup personnel.

2.9 CONDUCTORS AND CABLES

A. Power Wiring to Supply Side of Remote-Control Power Sources: Not smaller than No. 12 AWG. Comply with requirements in Specification Section 26 05 19 – Low-Voltage Electrical Power Conductors and Cables.

B. Classes 2 and 3 Control Cable: Multiconductor cable, Category 5e with solid-copper conductors not smaller than No. 23 AWG. Comply with requirements in Specification Section 26 05 19 - Low-Voltage Electrical Power Conductors and Cables.

C. Class 1 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 14 AWG. Comply with requirements in Specification Section 26 05 19 - Low-Voltage Electrical Power Conductors and Cables.

PART 3 EXECUTION

3.1 SENSOR INSTALLATION

A. Install and aim sensors in locations to achieve not less than 90 percent coverage of areas indicated. Do not exceed coverage limits specified in manufacturer's written instructions.

3.2 WIRING INSTALLATION

A. Wiring Method: Comply with requirements in Specification Section 260519 – Low- Voltage Electrical Cables. Minimum conduit size shall be ½ inch.

B. Wiring within Enclosures: Comply with NECA 1. Separate power-limited and nonpower- limited conductors according to conductor manufacturer's written instructions.

C. Size conductors according to lighting control device manufacturer's written instructions, unless otherwise indicated.

D. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

3.3 IDENTIFICATION

A. Identify components and power and control wiring according to Specification Section 260573 – Identification for Electrical Systems.

B. Identify circuits or luminaries controlled by occupancy sensors at each sensor.

3.4 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections and prepare test reports:

B. Lighting control devices that fail tests and inspections are defective work.

3.5 ADJUSTING

A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting sensors to suit occupied conditions. Provide up to two visits per building (total of 12) to Project during non-occupancy hours for this purpose.

3.6 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test and adjust field-assembled components and equipment installation, including connections and assist in field testing. Report results in writing.

B. Perform the following field tests and inspections and prepare test reports:
   1. After installing sensors, and after electrical circuitry has been energized, adjust and test for compliance with requirements.
   2. Operational Test: Verify operation of each lighting control device, and adjust time delays.
   3. Test for circuit continuity.
   4. Verify that the control module features are operational.
   5. Check operation of local override controls.
   6. Test system diagnostics by simulating improper operation of several components selected by Architect.

3.7 SOFTWARE INSTALLATION

A. Install and program system software with initial settings of adjustable values. Make backup copies of software and user-supplied values. Provide current licenses for software.

3.8 DEMONSTRATION

A. Coordinate demonstration of products specified in this Section with demonstration requirements for low-voltage, programmable lighting control system.

B. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain lighting control devices. At least 8 hours of training shall be included covering maintenance, troubleshooting, module replacement, adjustment, and software configuration.

END SECTION 26 09 23

SECTION 26 24 13
SWITCHBOARDS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI C12.15 (1990) Solid-State Demand Registers for Electromechanical Watthour Meters

ANSI C39.1 (1981; R 1992) Requirements for Electrical Analog Indicating Instruments

ASTM INTERNATIONAL (ASTM)

ASTM A123/A123M (2013) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

ASTM A153/A153M (2009) Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware

ASTM A167 (1999; R 2009) Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip

ASTM A653/A653M (2011) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

ASTM A780/A780M (2009) Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings

ASTM D149 (2009; R 2013) Dielectric Breakdown Voltage and Dielectric Strength of Solid Electrical Insulating Materials at Commercial Power Frequencies

ASTM D1535(2013) Specifying Color by the Munsell System

ASTM D709 (2013) Laminated Thermosetting Materials

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE 100 (2000; Archived) The Authoritative Dictionary of IEEE Standards Terms

IEEE 81 (2012) Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System

IEEE C12.16 (1991) Solid-State Electricity Meters

IEEE C2 (2012; Errata 2012; INT 1-4 2012; INT 5-6 2013) National Electrical Safety Code

IEEE C37.90.1 (2012) Standard for Surge Withstand Capability (SWC) Tests for Relays and Relay Systems Associated with Electric Power Apparatus

IEEE C57.12.28 (2005; INT 3 2011) Standard for Pad-Mounted Equipment - Enclosure Integrity

IEEE C57.12.29 (2005) Standard for Pad-Mounted Equipment - Enclosure Integrity for Coastal Environments

IEEE C57.13 (2008; INT 2009) Standard Requirements for Instrument Transformers

INTERNATIONAL ELECTRICAL TESTING ASSOCIATION (NETA)

NETA ATS (2013) Standard for Acceptance Testing Specifications for Electrical Power Equipment and Systems

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

ANSI C12.1 (2008) Electric Meters Code for Electricity Metering

ANSI/NEMA PB 2.1 (2007) General Instructions for Proper Handling, Installation, Operation and Maintenance of Deadfront Distribution Switchboards Rated 600 V or Less

NEMA C12.4 (1984; R 2011) Registers - Mechanical Demand

NEMA ICS 6 (1993; R 2011) Enclosures

NEMA LI 1 (1998; R 2011) Industrial Laminating Thermosetting Products

NEMA PB 2 (2011) Deadfront Distribution Switchboards

NEMA ST 20 (1992; R 1997) Standard for Dry-Type Transformers for General Applications

NEMA/ANSI C12.10 (2011) Physical Aspects of Watthour Meters - Safety Standards

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 (2014; AMD 1 2013; Errata 2013; AMD 2 2013) National Electrical Code

UNDERWRITERS LABORATORIES (UL)

UL 198M (2003; Reprint Feb 2013) Standard for Mine-Duty Fuses

UL 4248 (2007) UL Standard for Safety Fuseholders

UL 467 (2007) Grounding and Bonding Equipment

UL 489 (2013) Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures

UL 891 (2005; Reprint Oct 2012) Switchboards

1.1 RELATED WORK AND REQUIREMENTS

A. Section 260553 – Identification for Electrical Systems

B. Section 260573 – Overcurrent Protective Device Coordination Study

C. Section 262816 – Enclosed Switches and Circuit Breakers

D. Section 264300 – Surge Protection Devices

1.2 SUMMARY

A. Section Includes:

1. Service and distribution switchboards rated 600 V and less.
2. Disconnecting and overcurrent protective devices.
3. Instrumentation.
4. Control power.
5. Accessory components and features.
6. Identification.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers qualified as defined in NEMA PB 2.1 and trained in electrical safety as required by NFPA 70E. Documentation of qualification shall be provided upon owner request.

B. Electrical Components, Devices and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Comply with NEMA PB 2.

D. Comply with NFPA 70.

E. Comply with UL 891.

1.4 DELIVERY, STORAGE AND HANDLING

A. Deliver switchboards in sections or lengths that can be moved past obstructions in delivery path unless otherwise noted in purchase order.

B. Handle and prepare switchboards for installation according to NEMA PB 2.1.

1.5 PROJECT CONDITIONS

A. Installation Pathway: Remove and replace access fencing, doors, lift-out panels, and structures to provide pathway for moving switchboards into place.

B. Environmental Limitations:

1. Rate equipment for continuous operation under the following conditions unless otherwise indicated:
   a. Ambient Temperature: Not exceeding 104 deg F.
   b. Altitude: Not exceeding 6600 feet.

1.6 COORDINATION

A. Coordinate layout and installation of switchboards and components with other construction trades and adjacent surfaces.

B. Maintain required workspace clearances and required clearances for equipment access doors and panels and per NEC.

C. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03 - Concrete.

1.7 SUBMITTALS FOR REVIEW/RECORD

A. Product Data: For each type of switchboard, overcurrent protective device, transient voltage suppression device, ground-fault protector, accessory, and component indicated. Include dimensions and manufacturers technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.

B. Shop Drawings: For each switchboard and related equipment.

1. Detail enclosure types for types other than NEMA 250, Type1.
2. Detailed bus configuration, current, and voltage ratings.
3. Detail short-circuit current ratings of switchboards and overcurrent protective devices.
4. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
5. Include time-current coordination curves for each type and rating of overcurrent protective device included in switchboards.
6. Include schematic and wiring diagrams for power, signal, and control wiring.

1.8 SUBMITTALS FOR RECORD ONLY

A. Test Reports: See Project Specification Section 269100 – Field Acceptance Reports

1. Manufacturer Test Report
2. Switchboard Installation Checklist
3. Infrared Scanning via FLIR Camera Software

B. As-built Drawings: Including final Switchboard Schedules

C. O&M Data

PART 2 PRODUCTS

2.1 MANUFACTURED UNITS

A. Manufacturer: The listing of a manufacturer as "acceptable" does not imply automatic approval. It is the sole responsibility of the Contractor to ensure that any submittals made are for products that meet or exceed the specifications included here.

1. Square D; Schneider Electric.
2. Eaton Electrical, Inc.; Cutler-Hammer.
3. Equivalent units and manufacturers must meet all performance criteria, and must be approved by the School District during bidding phase.

B. Front-Connected, Front-Accessible Switchboards:

1. Main Devices: Fixed, individually mounted.
2. Branch Devices: Panel mounted.
3. Sections front and rear aligned flush.

C. Main-Bus Continuous: Ampacities and short circuit ratings as indicated on the drawings.

D. Each switchboard, is a complete unit, including main circuit breaker and branch breakers. It shall be given a single withstand circuit rating by the manufacturer. The withstand short circuit rating shall certify that all equipment is capable of withstanding the stress of a fault equal to the interrupting rating of the least overcurrent protective device contained herein. Such rating shall be established by actual historic tests by the manufacturer on equipment constructed similarly to the subject switchboard. If requested, the test data shall be furnished to the engineer with or before the submittal of approval drawings.

E. Indoor Enclosures: Steel, NEMA 250, Type 1.

1. The switchboard framework shall consist of steel channels welded or bolted to the frame to rigidly support the entire shipping section for moving on rollers and floor mounting. The framework is to be formed, code gauge steel, rigidly welded and bolted together to support all coverplates, bussing, and component devices during shipping and installation.
2. Each switchboard section shall have an individual removable plate for installation and termination of conduit. All front plates used for mounting meters, selector switches, or other front mounted devices shall be hinged with all wiring installed and laced with flexibility on the hinged side. All closure plates shall be screw removable.

F. Enclosure Finish for Indoor Units: Factory-applied finish in manufacturer's standard gray finish over a rust-inhibiting primer on treated metal surface.

G. Barriers: Between adjacent switchboard sections.

H. Bus Transition and Incoming Pull Sections: Matched and aligned with basic switchboard.

I. Hinged Front Panels: Allow access to metering and accessory compartments.

J. Buses and Connections: Three phase, four wire unless otherwise indicated.

1. Phase- and Neutral-Bus Material: Hard-drawn copper of 98 percent conductivity, silver-plated or tin-plated with copper feeder circuit-breaker line connections. The bussing shall be

of sufficient cross sectional area to continuously conduct rated full load current and meet UL Standard 891 temperature rise requirements.

2. Ground Bus: Minimum-size required by UL 891, hard-drawn copper of 98 percent conductivity, equipped with compression connectors for feeder and branch-circuit ground conductors. For busway feeders, extend insulated equipment grounding cable to busway ground connection and support cable at intervals in vertical run.

3. Main Phase Buses and Equipment Ground Buses: Uniform capacity for entire length of switchboard's main and distribution sections. Provide for future extensions from both ends.

4. Neutral Buses: 100 percent of the ampacity of phase buses unless otherwise indicated, equipped with compression connectors for outgoing circuit neutral cables. Brace bus extensions for busway feeder neutral bus.

5. The bus bars shall be rigidly braced to comply with the integrated rating of the switchboard.

6. The main horizontal bus bars between sections shall be located at the back of the switchboard to permit a maximum of available conduit area. The horizontal bus bar supports, connections and joints are to be bolted with grade 5 carriage bolts and Belleville washers to minimize maintenance requirements.

K. Future Devices: Equip compartments with mounting brackets, supports, bus connections, and appurtenances at full rating of circuit-breaker compartment. Furnish spare circuit breakers as indicated in the specifications and drawings.

2.2 TRANSIENT VOLTAGE SUPPRESSION DEVICES

A. Surge Protection Device Description: Provide for switchboards as shown on the one line diagram. Refer to Section 264313 – Surge Protection Devices.

2.3 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

A. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, with interrupting capacity to meet available fault currents.

1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.

2. Electronic trip circuit breakers with RMS sensing; field-replaceable rating plug or field-replicable electronic trip; and the following field-adjustable settings:
   a. Instantaneous trip.
   b. Long- and short-time pickup levels.
   c. Long- and short-time time adjustments.
   d. Ground-fault pickup level, time delay, and I^2t response.

3. Molded-Case Circuit-Breaker (MCCB) Features and Accessories:
   a. Standard frame sizes, trip ratings, and number of poles.
   b. Circuit breakers shall be equipped with individually insulated, braced and protected connectors. The front faces of all circuit breakers shall be flush with each other. Large permanent, individual circuit numbers shall be affixed to each breaker in a uniform position (or equip each breaker with a circuit card holder and neatly printed card identifying the circuit). Tripped indication shall be clearly shown by the breaker handle taking a position between ON and OFF. A trip button shall be provided for mechanically tripping the circuit breaker. This allows maintenance checks on the breaker, control circuits, alarm devices, and other associated equipment.

c. Lugs: Compression or mechanical style, suitable for number, size, trip ratings, and conductor material.

d. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads.

e. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.

f. Zone-Selective Interlocking: Integral with electronic trip unit; for interlocking ground-fault protection function.

g. Auxiliary Contacts (as noted on plans): One SPDT switch with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts, "b" contacts operate in reverse of circuit-breaker contacts.

2.4 INSTRUMENTATION

A. Multifunction Digital-Metering Monitor: Microprocessor-based unit suitable for three- or four-wire systems and with the following features:

1. Provide stand alone, microprocessor based, three-phase power metering device, with six digit LED display and RS485 communications port. The meter shall support Modbus RTU, Modbus TCP, BACnet/IP, and SNMP protocols. The meter shall provide 24 meter values including historical demand and consumption data. Mount meter recessed in front of switchboard. Display and control unit flush or semi flush mounted in instrument compartment door.

2.5 CONTROL POWER

A. Control power shall be provided through an integral control power transformer.

2.6 ACCESSORY COMPONENTS AND FEATURES

A. Provisions for future breakers. Provisions for future breakers shall be such that no additional connectors will be required to add breakers.

2.7 IDENTIFICATION

A. Service Equipment Label: NRTL labeled for use as service equipment for switchboards with one or more service disconnecting and overcurrent protective devices.

B. See Project Specification Section 260553 Identification for Electrical Systems.

PART 3 EXECUTION

3.1 EXAMINATION

A. Receive, inspect, handle, and store switchboards according to NEMA PB 2.1.

B. Examine switchboards before installation. Reject switchboards that are moisture damaged or physically damaged.

C. Examine elements and surfaces to receive switchboards for compliance with installation tolerances and other conditions affecting performance of the Work.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install switchboards and accessories according to NEMA PB 2.1, in accordance with manufacturer's written instructions, and in accordance with recognized industry practices.

B. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from switchboard units and components.

C. Operating Instructions: Frame and mount the printed basic operating instructions for switchboards, including control and key interlocking sequences and emergency procedures.

D. Install filler plates in unused spaces of panel-mounted sections.

E. Install overcurrent protective devices, transient voltage suppression devices, and instrumentation. Set field-adjustable switches and circuit-breaker trip ranges.

3.3 CONNECTIONS

A. All conductors and bus connections shall be torqued to manufacturer's connections.

3.4 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with requirements for identification specified in Section 260553 - Identification for Electrical System.

B. Switchboard Nameplates: Label each switchboard compartment with a nameplate complying with requirements for identification specified in Section 260553 - Identification for Electrical System.

C. Device Nameplates: Label each disconnecting and overcurrent protective device and each meter and control device mounted in compartment doors with a nameplate complying with requirements for identification specified in Section 260553 – Identification for Electrical System.

3.5 FIELD QUALITY CONTROL

A. Acceptance Testing Preparation:

1. Test insulation resistance for each switchboard bus, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

B. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
3. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.
4. Perform the following infrared scan tests and inspections and prepare reports:

a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each panelboard. Remove front panels so joints and connections are accessible to portable scanner.

b. Instruments and Equipment: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

C. Switchboard will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports, including a certified report that identifies switchboards included and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.6 ADJUSTING

A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.

B. Set field-adjustable circuit-breaker trip ranges as specified in Section 260573 – Overcurrent Protective Device Coordination Study.

3.7 PROTECTION

A. Temporary Heating: Apply temporary heat, to maintain temperature according to manufacturer's written instructions, until switchboard is ready to be energized and placed into service.

3.8 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain switchboards, overcurrent protective devices, instrumentation, and accessories.

END SECTION 26 24 13

SECTION 26 24 16
PANELBOARDS

PART 1 GENERAL

1.1 RELATED WORK AND REQUIREMENTS

A. Section 260553 – Identification for Electrical Systems

B. Section 260573 – Overcurrent Protective Device Coordination Study

1.2 SUMMARY

A. Section Includes:
   1. Distribution panelboards.
   2. Lighting and appliance branch-circuit panelboards.
   3. Disconnecting and Overcurrent Protective Devices.

1.3 REFERENCES

A. ELECTRONIC INDUSTRIES ALLIANCE (EIA)
   1. EIA 416(1974; R 1981) Filters for Radio Interference
   2. EIA/IS 46 (1987) Test Procedure for Resistance to Soldering (Vapor Phase Technique) for Surface Mount Devices

B. NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)
   1. NEMA 250 (2008) Enclosures for Electrical Equipment (1000 Volts Maximum)
   2. NEMA PB 1 (2011) Panelboards

C. NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)
   1. NFPA 70 (2014) National Electrical Code

D. UNDERWRITERS LABORATORIES (UL)
   1. UL 489 (2009; Reprint Jun 2011) Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures
   2. UL 67 (2009; Reprint Sep 2010) Standard for Panelboards

1.4 QUALITY ASSURANCE

A. Electrical Components, Devices and Accessories: Listed and labeled as defined in NFPA 70, and marked for intended location and application.

B. Comply with NEMA PB 1.2 and PB 1.2.

C. National Electrical Contractor's Association (NECA).

D. Underwriter's Laboratory Inc. (UL) Standards 50, 67, 869, and 468A.

1.5 DELIVERY, STORAGE AND HANDLING

A. Remove loose packing and flammable materials from inside panelboards.

B. Do not store panelboards exposed to weather.

C. Handle and prepare panelboards for installation according to NEMA PB 1.

D. Protect panelboards against damage from work of other trades.

1.6 PROJECT CONDITIONS

A. Environmental Limitations:

1. Do not deliver or install panelboards until spaces are enclosed and weather-tight, wet work in spaces is complete and dry, work above panelboards is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

1.7 COORDINATION

A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

B. Coordinate sizes and locations of concrete bases with freestanding panelboards with actual equipment provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

1.8 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Keys: Two spares for each type of panelboard cabinet lock.
2. Circuit Breakers Including GFCI and Ground Fault Equipment Protection (GFEP) Types: spares for each panelboard as shown on one of the Panel Schedules.

PART 2 PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PANELBOARDS

A. Enclosures: Flush and surface mounted cabinets. Refer to panel schedule and floor plans for types of panel cabinets required.

1. Indoor Dry and Clean Locations: NEMA 250, type 1.
2. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover.
3. Finishes:

a. Panels and Trim: Steel, factory finished immediately after cleaning and pre-treating with manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat.
b. Back Boxes: Galvanized steel.

4. Directory Card: Inside panelboard door, mounted in transparent card holder.

B. Incoming Mains Location: Top or bottom. Mains location is at the contactor's option as project conditions dictate, unless specifically indicated otherwise on the drawings.

C. Phase, Neutral, and Ground Buses:
1. Material: Hard-drawn copper, 98 percent conductivity.
2. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment grounding conductors; bonded to box.
3. Isolated Ground Bus: Adequate for branch-circuit isolated ground conductors; insulated from box.

D. Conductor Connectors: Suitable for use with conductor material and sizes.
1. Material: Hard-drawn copper, 98 percent conductivity.
2. Main and Neutral Lugs: Compression type.
3. Ground Lugs and Bus-Configured Terminators: Compression type. Lugs shall be of sizes as required to accept feeders as indicated on the drawings.
4. Feed-Through Lugs: Compression type, suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.
5. Subfeed (Double) Lugs: Compression type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.

E. Future Devices: Mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.

F. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals.

2.2 DISTRIBUTION PANELBOARDS

A. Basis-of-Design Product: Subject to compliance with requirements, provide distribution panelboards or comparable product by one of the following. The listing of a manufacturer as "acceptable" does not imply automatic approval. It is the sole responsibility of the Contractor to ensure that any submittals made are for products that meet or exceed the specifications included here.
1. Eaton Electrical Inc.; Cutler-Hammer.
2. Schneider Electric; Square D, Inc.
3. Equivalent units and manufacturers must meet all performance criteria, and must be approved by the School District during bidding phase.

B. Panelboards: NEMA PB 1, power and feeder distribution type.

C. Doors: Secured with vault-type latch with tumbler lock; keyed alike. For doors more than 36 inches high, provide two latches, keyed alike.

D. Mains: Circuit breaker or main lugs only as indicated on the one line diagram and the Panel Schedules.

E. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes 125 A and Smaller: bolt-on circuit breakers.

F. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes Larger Than 125 A: Bolt-on circuit breakers or plug-in circuit breakers, where individual positive-locking device requires mechanical release for removal.

2.3 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Cutler Hammer series panelboards or comparable product by one of the following. The listing of a manufacturer as “acceptable” does not imply automatic approval. It is the sole responsibility of the Contractor to ensure that any submittals made are for products that meet or exceed the specifications included here.
   1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
   2. Schneider Electric; Square D, Inc.

B. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.

C. Mains: Circuit breaker or main lugs only as indicated on the one line diagram or on the Panel Schedule.

D. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.

E. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.

2.4 DISCONNECTION AND OVERCURRENT PROTECTIVE DEVICES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Square D; a brand of Schneider Electric.
   2. Eaton Electrical Inc.; Cutler-Hammer Business Unit.

B. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, with interrupting capacity to meet available fault currents.
   1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
   2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
   3. Electronic trip circuit breakers with rms sensing; field-replaceable rating plug or field-replicable electronic trip; and the following field-adjustable settings:
      a. Instantaneous trip.
      b. Long- and short-time pickup levels.
      c. Long- and short-time time adjustments.
      d. Ground-fault pickup level, time delay, and I2t response.

4. GFCI Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).
5. Ground-Fault Equipment Protection (GFEP) Circuit Breakers: Class B ground-fault protection (30-mA trip).
6. Molded-Case Circuit-Breaker (MCCB) Features and Accessories:
   a. Standard frame sizes, trip ratings, and number of poles.
   b. Lugs: Compression style, suitable for number, size, trip ratings, and conductor materials.
   c. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge (HID) lighting circuits.

C. Circuit Breakers for Multi-wire Circuits. Multi-wire branch circuits shall have a means to simultaneously disconnect all ungrounded conductors by approved circuit breaker handle ties.

PART 3 EXECUTION

3.1 EXAMINATION

A. Receive, inspect, handle, and store switchboards according to NEMA PB 1.1.

B. Examine panelboards before installation. Reject panelboards that are damaged or rusted or have been subjected to water saturation.

C. Examine elements and surfaces to receive panelboards for compliance with installation tolerances and other conditions affecting performance of the Work.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install panelboards and accessories according to manufacturer's written instructions, according to NEMA PB 1.1, and in accordance with recognized industry practices.

B. Support panel cabinets independently to structure with no weight bearing on conduits.

C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from panelboards.

D. Mount so that top breaker is not higher than 6'-0" AFF, unless otherwise indicated.

E. Mount panelboard cabinet plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush and tight with wall finish and mating with back box.

F. Adjacent panel cabinets shall be of same physical size and mounted in horizontal alignment.

G. Install overcurrent protective devices and controllers not already factory installed. Set field-adjustable circuit-breaker trip ranges.

H. Install filler plates in unused spaced.

I. Arrange conductors in gutters into groups and bundle and wrap with wire ties after completing load balancing.

3.3 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with Section 260553 - Identification for Electrical System.

B. Create a directory to indicate installed circuit loads after balancing panelboard loads; incorporate Owner's final room designations. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable. Verify actual room names and numbers to be used.

C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Section 260553 - Identification for Electrical Systems.

D. Device Nameplates: Label each branch circuit device in distribution panelboards with a nameplate complying with requirements for identification specified in Section 260553 – Identification for Electrical System.

3.4 FIELD QUALITY CONTROL

A. Acceptance Testing Preparation:

1. Megger check and test insulation resistance for each panelboard bus, component, connection supply, feeder, and control circuit. Do not megger check solid state components.
2. Test continuity of each circuit.

B. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

C. Panelboards will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports, including a certified report that identifies panelboards included and that describes scanning results. Include notation of deficiencies detected, remedial action taken and observations after remedial action.

E. Touch up paint scratched and marred surfaces to match original finish.

3.5 ADJUSTING

A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.

B. Set field-adjustable circuit-breaker trip ranges as indicated.

C. Load Balancing: After Substantial Completion, but not more than 60 days after Final Acceptance, measure load balancing and make circuit changes.

1. Measure as directed during period of normal system loading.

2. Perform load-balancing circuit changes outside normal occupancy/working schedule of the facility and at time directed. Avoid disrupting critical 24-hour services such as fax machines and on-line data processing, computing, transmitting, and receiving equipment.
3. After circuit changes, recheck loads during normal load period. Record all load readings before and after changes and submit test records.
4. Tolerance: Difference exceeding 10 percent between phase loads, within a panelboard, is not acceptable. Rebalance and recheck as necessary to meet this minimum requirement.

3.6 PROTECTION

A. Temporary Heating: Apply temporary heat to maintain temperature according to manufacturer's written instructions.

END SECTION 26 24 16

SECTION 26 27 26
WIRING DEVICES

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Receptacles, receptacles with integral GFCI, and associated device plates.
   2. Isolated-ground receptacles.
   3. Wall-switches.

1.2 REFERENCES

A. ANSI/NFPA 70 – National Electrical Code (NEC) 2011

1.3 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of wiring device and associated wall plate through one source from a single manufacturer. Insofar as they are available, obtain all wiring devices and associated wall plates from a single manufacturer and one source.

B. Electrical Components, Devices and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a qualified testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with NFPA 70.

PART 2 PRODUCTS

2.1 DEVICE COLORS

A. Color: Wiring device catalog numbers in Section Text do not designate device color.
   1. Wiring Devices Connected to Normal Power System: As selected by Architect, unless otherwise indicated or required by NFPA 70 or device listing.
   2. Isolated-Ground Receptacles: As specified above with Orange triangle on face.

2.2 GENERAL

A. Provide factory-fabricated wiring devices in type, color, and electrical rating for service indicated.

B. See Symbol Schedule on drawings for identification of device type.

C. Terminal screws shall be back and side wired and accept #14, 12, and #10 AWG stranded or solid wire.

D. A full wrap-around bridge strap shall be provided with locking tabs to secure receptacle face.

E. Receptacle face shall be impact resistant nylon.

2.3 STRAIGHT BLADE RECEPTACLES

A. Heavy-Duty, Simplex: Provide single heavy duty type receptacles, 2 pole, 3 wire, grounding, with green hexagonal equipment ground screw, 20 ampere, 125 volts, with NEMA configuration 5-20R unless otherwise indicated.

Pass & Seymour	Hubbell	Leviton
5361	HBL5361	5361

B. Heavy-Duty Duplex: Provide heavy duty duplex receptacles, 2 pole, 3 wire, grounding, 20 ampere, 125 volts, with NEMA configuration 5-20R unless otherwise indicated.

Pass & Seymour	Hubbell	Leviton
5362	HBL5362	5362

C. Ground-Fault Circuit Interrupters: Provide ground fault circuit interrupter, with heavy duty duplex receptacles, capable of being installed in a 2-1/2 inch deep outlet box without adapter. Shall be grounding type UL-rated Class A, Group 1, rated 20 amperes, 120 volts, 60 Hz; with solid-state ground fault sensing and signaling; with 5 millamperes ground fault trip level. Equip with NEMA configuration 5-20R receptacle.

1. Test and reset buttons shall match color of face.
2. GFCI receptacles shall meet 2003 UL requirements.
3. If critical components within receptacle are damaged and the ground fault protection is lost, power to receptacle shall be automatically disconnected within the device.

Pass & Seymour	Hubbell	Leviton
2094	GFR5352	8899

D. Duplex Convenience Isolated Ground Receptacles: Provide single heavy duty type receptacles, 2 pole, 3 wire, grounding, with green hexagonal equipment ground screw, 20 ampere, 125 volts, with NEMA configuration 5-20R unless otherwise indicated. Device color shall match non isolated ground receptacles and have an orange triangle on the device.

Pass & Seymour	Hubbell	Leviton
IG6300	IG5362	5362IG

2.4 SWITCHES

A. General:

1. Switches shall be rated for 20 amperes, 120/277 volts AC, and shall be manufacturer's specification grade toggle switch with thermoplastic abuse resistant toggle, quiet action, and heavy duty contact arm.
2. Switches shall have quiet action mechanism with silver alloy contacts for longevity.
3. Terminal screws shall be back and side wire and accept #14, 12, and 10 AWG stranded or solid wire.
4. Switches shall have a backwire pressure plate ground screw mechanism accepting #14, 12, and 10 AWG stranded or solid wire.

B. Single pole:

Pass & Seymour	Hubbell	Leviton
PS20AC1	HBL1221	1221-2

C. Three Way:

Pass & Seymour	Hubbell	Leviton
PS20AC3	HBL1223	1223-2

D. Four Way:

Pass & Seymour	Hubbell	Leviton
PS20AC4	HBL1224	1224-2

E. Key Switch – add suffix 'KL' to above part numbers.

F. See Section 260923 Network Lighting Control Devices for low voltage lighting control switches.

2.5 WIRING DEVICE ACCESSORIES

A. Wall Plates:

1. Provide wall plates for single and combination wiring devices, of types, sizes, and with ganging and cutouts as indicated. Select plates which mate and match wiring devices to which attached. Construct with metal screws for securing plates to devices; screw heads colored to match finish of plates; wall plates colored to match wiring devices. Provide plates possessing the following additional construction features:
   a. Material and Finish:
      1) Stainless Steel (0.04 inch thick type 302 satin finished)
      2) Nylon, smooth - color to match device
2. Device plates for surface mounted Type FS or FD boxes: Type FSK galvanized steel covers.
3. Device plates for surface mounted, 4 in. square boxes: 1/2 in. raised galvanized steel covers.

B. Weatherproof Covers:

1. Weatherproof covers for all 125-250 volt, 15 and 20 ampere receptacles installed outdoors in a wet location shall be weatherproof, NEMA 3R, with hinged outlet enclosure rated for rain proof protection while outlet is in use. The unit shall be furnished with a neoprene gasket between the mounting surface and the enclosure, and between the mounting plate and the hinged cover to assure proper seal. Shall be equal to Pass & Seymour, Die Cast with GFI mounting plate, Catalog # WIUFC10S.
2. Weatherproof covers for all other receptacles shall be cast aluminum with a gasketed cover. Shall be equal to Hubbell CWP26H (standard flush box) or Hubbell WPFS26 (surface FS box).

PART 3 EXECUTION

3.1 INSTALLATION

A. Comply with NECA 1, including the mounting heights listed in that standard, unless otherwise noted.

B. All exterior receptacles shall be GFI type mounted in weatherproof boxes.

C. Ground receptacles with the insulated green ground wire from device ground screw to a bolted outlet box connection. Isolated ground receptacles shall have the second ground wire (green with yellow tracer) ground the receptacle.

D. The Contractor shall check the switch location against the Architectural plans and shop drawings to be certain that switches are on the strike side of the door, regardless of swing shown on drawings. Edge of plate shall be not more than 12" from door frame.

E. Ground-fault circuit interrupter type receptacles may provide GFI protection for downstream receptacles on same circuit only where located in same room as other receptacles.

3.2 FIELD QUALITY CONTROL

A. Coordination with Other Trades:
1. Take steps to insure that devices and their boxes are protected. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of the boxes.
2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
4. Install wiring devices after all wall preparation, including painting, is complete.

B. Conductors:
1. Do not strip insulation from conductors until just before they are spliced or terminated on devices.
2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.

C. Device Installation:

1. Replace all devices that have been in temporary use during construction or that show signs that they were installed before building finishing operations were complete.
2. Keep each wiring device in its package or otherwise protected until it is time to connect connectors.
3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
4. Connect devices to branch circuits using pigtails that are not less than 6 inches in length.
5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, 2/3 to 3/4 of the way around terminal screw.
6. Use a torque screwdriver when a torque is recommended or required by the manufacturer.
7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
8. Tighten unused terminal screws on the device.
9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device mounting screws in yokes, allowing metal-to-metal contact.

D. Receptacle Orientation: Install ground pin of vertically mounted receptacles down, and on horizontally mounted receptacles to the right.

E. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.

F. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top bottom. Group adjacent switches under single, multi-gang wall plates where devices permit.

3.3 IDENTIFICATION

A. Comply with Section 260553 - Identification for Electrical Systems. For receptacles, identify panelboard and circuit number from which served on device plate.

3.4 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

1. Test instruments: Use instruments that comply with UL 1436.
2. Test receptacles with Hubbell 5200, Woodhead 1750, or equal, for correct polarity, proper ground connection, and wiring faults.
3. Test straight blade for the retention force of the grounding blade according to NFPA 99. Retention force shall be not less than 4 oz.

END SECTION 26 27 26

SECTION 26 28 16
ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 GENERAL

1.1 RELATED WORK AND REQUIREMENTS

A. Section 26 05 53 - Identification for Electrical Systems

B. Section 26 05 73 - Overcurrent Protective Device Coordination Study

C. Section 26 28 13 – Fuses

D. Section 26 29 13 - Enclosed Controllers

1.2 SUMMARY

A. Section Includes:

1. Fusible switches.
2. Non-fusible switches.
3. Molded-case circuit breakers (MCCB's).
4. Molded-case switches.
5. Enclosures.

1.3 PROJECT CONDITIONS

A. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:

1. Ambient Temperature: Not less than minus 22 deg F and not exceeding 104 deg F.
2. Altitude: Not exceeding 6600 feet.

1.4 COORDINATION

A. Coordinate layout and installation of switches, circuit breakers, and components with equipment served and adjacent surfaces with all trades. Maintain required workspace clearances and required clearances for equipment access doors and panels.

1.5 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.
2. Provide spare fuse cabinets, Bussmann type SFC, to store all spare fuses. Locate cabinets as directed by the Owner.

3. Fuse Pullers: Provide two for each size and type.

1.6 SUBMITTALS FOR REVIEW/RECORD

A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include dimensioned elevations, sections, weights, and manufacturer's technical data on features, performance, electrical characteristics, ratings, and finishes.

1. Enclosure types and details for types.
2. Current, horsepower, and voltage ratings.
3. Short-circuit current rating.
4. Features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.

1.7 SUBMITTALS FOR RECORD ONLY

A. Test Reports: See Project Specification Section # 26 91 00

1. Megger Test Report: Only Service Entrance, >400A, or <400A Critical Applications
2. Infrared Scanning via FLIR Camera Software

B. O&M Data

PART 2 PRODUCTS

2.1 FUSIBLE SWITCHES

A. Manufacturer: The listing of a manufacturer as "acceptable" does not imply automatic approval. It is the sole responsibility of the Contractor to ensure that any submittals made are for products that meet or exceed the specifications included here.

1. Square D; a brand of Schneider Electric.
2. Eaton Electrical, Inc.; Cutler-Hammer Business Unit.
3. Equivalent units and manufacturers must meet all performance criteria, and must be approved by the School District during bidding phase.

B. Type HD, Heavy Duty, Single Throw, 240 and 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate specified fuses, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

C. Accessories:

1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
2. Neural Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
3. Class R Fuse Kit: Provides rejection of other fuse types when Class R fuses are specified.
4. Auxiliary Contact Kit: Two NO/NC (Form "C") auxiliary contact(s), arranged to activate before switch blades open.

5. Hookstick Handle: Allows use of a hookstick to operate the handle.
6. Lugs: Set screw type, suitable for number, size, and conductor material.

2.2 NON-FUSIBLE SWITCHES

A. Manufacturer: The listing of a manufacturer as "acceptable" does not imply automatic approval. It is the sole responsibility of the Contractor to ensure that any submittals made are for products that meet or exceed the specifications included here.
   1. Square D; a brand of Schneider Electric.
   2. Eaton Electrical, Inc.; Cutler-Hammer Business Unit.
   3. Siemens Energy & Automation, Inc.

B. Type HD, Heavy Duty, Single Throw, 240 and 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

C. Accessories:
   1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
   2. Neural Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
   3. Isolated Ground Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
   4. Auxiliary Contact Kit: Two NO/NC (Form "C") auxiliary contact(s), arranged to activate before switch blades open.
   5. Hookstick Handle: Allows use of a hookstick to operate the handle.
   6. Lugs: Set screw type, suitable for number, size, and conductor material.

2.3 MOLDED-CASE CIRCUIT BREAKERS

A. Manufacturer: The listing of a manufacturer as "acceptable" does not imply automatic approval. It is the sole responsibility of the Contractor to ensure that any submittals made are for products that meet or exceed the specifications included here.
   1. Square D; a brand of Schneider Electric.
   2. Eaton Electrical, Inc.; Cutler-Hammer Business Unit.
   3. Siemens Energy & Automation, Inc.

B. General Requirements: Comply with UL 489, NEMA AB 1, and NEMA AB 3, with interrupting capacity to comply with available fault currents indicated on the drawings.

C. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits in each pole. Adjustable magnetic trip setting for circuit-breaker frame sizes 150 A and larger, adjustable from the front.

D. Construct with over center, trip-free toggle type operating mechanisms with quick make, quick break action and positive handle trip indication. Construct breakers for mounting and operating in

any physical position and operating in ambient temperature of 40 degrees C. Provide breakers with mechanical screw type removable connector lugs. AL/CU rated. Lugs shall be adequate to accept wire size indicated on the drawings.

E. Electronic Trip (shunt trip) Circuit Breakers: Field-replaceable rating plug, RMS sensing, with the following field-adjustable settings:

1. Instantaneous trip.
2. Long- and short-time pickup levels.
3. Long- and short-time time adjustments.
4. Ground-fault pickup level, time delay, and I^2t response.

F. Integrally Fused Circuit Breakers: Thermal-magnetic trip element with integral limiter- style fuse listed for use with circuit breaker and trip activation on fuse opening or on opening of fuse compartment door.

G. Ground-Fault, Circuit-Interrupter (GFCI) Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA or more trip and hold below 4mA of ground fault current). One way circuit length shall not exceed 250 feet. If length exceeds 250 feet, notify engineer in writing prior to installing circuit.

H. Where required to achieve system coordination with upstream and downstream overcurrent devices, solid-state circuit breakers shall be provided. All electronics shall be self-contained and require no external relaying, power supply, or accessories. Printed circuit cards shall be treated to resist moisture absorption, fungus growth, and signal leakage. All electronics shall be housed in an enclosure which provides protection against arcs, magnetic interference, dust, and other contaminants. Solid-sate sensing shall measure true RMS current with error less than one percent on systems with distortions through the 13th harmonic. Peak or average actuating devices are not acceptable. Current sensors shall be toroid construction, encased in a plastic housing, filled with epoxy to protect against damage and moisture and shall be integrally mounted on the breaker. Where indicated on the drawings, circuit breaker frames shall be rated for 100 percent continuous duty. Circuit breakers shall have tripping features as described below;

1. Longtime current pick up.
2. Adjustable long time delay.
3. Short time current pick up.
4. Adjustable short time delay.
5. Short time I square times t switch.
6. Instantaneous current pick up.
7. Ground fault current pick up, adjustable from 20 percent to 60 percent of sensor rating, but in no case greater than 1200 amperes. Sensing of ground fault current at the main bonding jumper or ground strap shall not be permitted. Provide ground fault only where indicated on the drawings.
8. Overload and short circuit and ground fault trip indicators shall be provided.

I. Interrupting ratings shall be as follows, unless otherwise indicated on drawings. Circuit breakers shall be fully rated for available fault current. Series rating is not acceptable.

J. Features and Accessories:

1. Standard frame sizes, trip ratings, and number of poles.
2. Lugs: Set screw type, suitable for number, size, trip ratings, and conductor material.
3. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge lighting circuits.
4. Ground-Fault Protection: Comply with UL 1053; integrally mounted, self- powered for solid state type trip units and remote-mounted and powered for magnetic type trip units with mechanical ground-fault indicator; relay with adjustable pickup and time-delay settings, push-to-test feature, internal memory, and shunt trip unit; and three-phase, zero-sequence current transformer/sensor.
5. Shunt Trip: Trip coil energized from separate circuit, with coil-clearing contact. Voltage as shown on project drawings.
6. Under-voltage Trip: Set to operate at 35 to 75 percent of rated voltage without intentional time delay.
7. Auxiliary Contacts: Two SPDT switches with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts, "b" contacts operate in reverse of circuit-breaker contacts.
8. Alarm Switch: One NC contact that operates only when circuit breaker has tripped.

2.4 MOLDED-CASE SWITCHES

A. Basis-of-Design Product: Subject to compliance with requirements, provide Square D I- Line Style switches or comparable product by one of the following. The listing of a manufacturer as "acceptable" does not imply automatic approval. It is the sole responsibility of the contractor to ensure that any submittals made are for products that meet or exceed the specifications included here.
   1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
   2. Siemens Energy & Automation, Inc.

B. General Requirements: MCCB with fixed, high-set instantaneous trip only and short- circuit withstand rating equal to equivalent breaker frame size interrupting rating.

C. Features and Accessories:
   1. Standard frame sizes and number of poles.
   2. Lugs: Set screw type, suitable for number, size, trip ratings, and conductor material.
   3. Ground-Fault Protection: Comply with UL 1053; remote-mounted and powered type with mechanical ground-fault indicator; relay with adjustable pickup and time-delay settings, push-to-test feature, internal memory, and shunt trip unit; and three-phase, zero-sequence current transformer/sensor.
   4. Shunt Trip: Trip coil energized from separate circuit, with coil-clearing contact.
   5. Under-voltage Trip: Set to operate at 35 to 75 percent of rated voltage without intentional time delay.
   6. Auxiliary Contacts: Two SPDT switches with "a" and "b" contacts; "a" contacts mimic switch contacts, "b" contacts operate in reverse of switch contacts.
   7. Alarm Switch: One NO contact that operates only when switch has tripped.

2.5 ELEVATOR/LIFT DISCONNECT SWITCHES

A. Elevator disconnect switches shall consist of a single NEMA enclosure that houses the elevator disconnecting means as well as necessary relays, control transformers, auxiliary contacts, and other accessories as shown on the drawings and as described herein. Ampere rating shall be as required by the main feeder overcurrent protective device as shown on the one line diagram. Additional features shall be as follows.

1. Horsepower rated fusible disconnect switch with shunt trip capabilities.
2. Fuses, sized as required by the elevator manufacturer.
3. Control power transformer, 100 VA minimum with primary and secondary fusing. Primary voltage shall match elevator feeder voltage, secondary voltage shall be 120 volts AC.
4. An isolated relay, 3PDT contacts rated at 10 amps, 120 volts. Coil voltage shall be 120 volts AC.
5. Key to test switch.
6. Green “on” pilot light.
7. Full capacity neutral lug.
8. Mechanically interlocked auxiliary contact, 1 pole, normally closed.
9. Fire alarm voltage monitoring relay.
10. NEMA 1 enclosure.

2.6 ENCLOSURES

A. Enclosed Switches and Circuit Breakers: NEMA AB 1, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.

1. Indoor, Dry and Clean Locations: NEMA 250, Type 1.
2. Outdoor Locations: NEMA 250, Type 3R.
3. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Non-corrosive Liquids: NEMA 250, Type 12.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install individual wall-mounted switches and circuit breakers with tops at uniform height (as noted on project drawings) unless otherwise indicated.

B. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

C. Install fuses in fusible devices.

1. Examine fusible equipment for size and type of fuse to ensure selective coordination. Provide fuses of size and type as required by equipment manufacturer.

2. Install fuses only after fault and coordination study has been finalized.

3. Fuses shall not be installed until equipment is ready to be energized. If fuse size is too small to physically fit in disconnect switch, provide fuse reduction kit.

D. Circuit breakers and molded case switches shall be factory installed in enclosures.

E. Install in accordance with manufacturer's written instructions, applicable requirements of NEC and NECA's "Standard of Installation" and in accordance with recognized industry practices.

F. Comply with NECA 1.

3.3 IDENTIFICATION

A. Comply with requirements in Section 26 05 53 - Identification for Electrical Systems.

1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.

2. Label each enclosure with engraved metal or laminated-plastic nameplate.

3.4 FIELD QUALITY CONTROL

A. Perform tests and inspections to verify that installation has been performed as noted in installation section above.

B. Acceptance Testing Preparation:

1. Test insulation resistance for each enclosed switch and circuit breaker, component, connecting supply, feeder, and control circuit.

2. Test continuity of each circuit.

C. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.

2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

3. Perform the following infrared scan tests and inspections and prepare reports:

a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each enclosed switch and circuit breaker. Remove front panels so joints and connections are accessible to portable scanner.

b. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each enclosed switch and circuit breaker 11 months after date of Substantial Completion.

c. Instruments and Equipment: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

4. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.

D. Enclosed switches and circuit breakers will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports, including a certified report that identifies enclosed switches and circuit breakers and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

F. Test and/or permanently record the following:

1. Fuses:
   a. Equipment nameplate requirement.
   b. Actual fuse rating.
2. Circuit Breakers:
   a. Nameplate data.
   b. Actual trip settings.

3.5 ADJUSTING

A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.

B. Set field-adjustable circuit-breaker trip ranges as specified in Section 26 05 73 – Overcurrent Protective Device Coordination Study. Adjustable settings on circuit breakers shall be set to provide selective coordination, proper operation, and compliance with NEC.

END SECTION 26 28 16

SECTION 26 29 13
ENCLOSED CONTROLLERS

PART 1 GENERAL

1.1 RELATED WORK AND REQUIREMENTS

A. Section 26 05 19 – Low-Voltage Electrical Power Conductors and Cables

B. Section 26 05 53 - Identification for Electrical Systems

C. Section 26 05 73 - Overcurrent Protective Device Coordination Study

D. Section 26 28 13 – Fuses

E. Section 26 28 16 - Enclosed Switches and Circuit Breakers

1.2 SUMMARY

A. The Section includes ac, enclosed controllers rated 600 V and less, of the following types: Across-the-line, manual and magnetic controllers.

1.3 DELIVERY, STORAGE AND HANDLING

A. Store enclosed controllers indoors in clean, dry space with uniform temperature to prevent condensation. Protect enclosed controllers from exposure to dirt, fumes, water, corrosive substances, and physical damage.

B. Do not store in areas subject to weather.

C. Protect motor starters against damage from work of other trades.

1.4 COORDINATION

A. Coordinate layout and installation of enclosed controllers with other construction including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

B. Coordinate features of enclosed controllers and accessory devices with pilot devices and control circuits to which they connect.

C. Coordinate features, accessories, and functions of each enclosed controller with ratings and characteristics of supply circuit, motor, required control sequence, and duty cycle of motor and load.

D. Coordinate control requirements with Building Automation System (BAS) Contractor.

1.5 SUBMITTALS FOR REVIEW/RECORD

A. Product Data: For each type of enclosed controller. Include dimensions and manufacturer's technical data on features, performance, electrical characteristics, ratings, and finishes. Additionally, provide the following:

1.6 SUBMITTALS FOR RECORD ONLY

A. Test Reports: BAS Controls Contractor Reports

B. As-Built Drawings – Additionally, include the following:

1. Load-Current and Overload-Relay Heater List: Compile after motors have been installed and arranged to demonstrate that selection of heater suits actual motor nameplate full-load currents.

2. Load-Current and List of Settings of Adjustable Overload Relays: Compile after motors have been installed and arrange to demonstrate that dip switch settings for motor running overload protection suit actual motor to be protected.

C. O&M Data

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following. The listing of a manufacturer as "acceptable" does not imply automatic approval. It is the sole responsibility of the Contractor to ensure that any submittals made are for products that meet or exceed the specifications included here.

1. Square D.

2. Cutler-Hammer

3. Equivalent units and manufacturers must meet all performance criteria, and must be approved by the School District during bidding phase.

B. Division 23 Contractor shall furnish all motor starters for mechanical equipment. Division 26 Contractor shall install and wire all motor starters.

2.2 ACROSS-THE-LINE ENCLOSED CONTROLLERS

A. Magnetic Controller: NEMA ICS 2, Class A, full voltage, non-reversing, across the line, unless otherwise indicated.

1. Control Circuit: 120 V; obtained from integral control power transformer.

2. Provide other accessories as indicated elsewhere in this specification.

B. Combination Magnetic Controller: Factory-assembled combination controller and disconnect switch.

1. Circuit-Breaker Disconnecting Means: NEMA AB 1, motor-circuit protector with field-adjustable, short-circuit trip coordinated with motor locked-rotor amperes.

2. Circuit breaker interlocked with cover, mounted in common enclosure, of types, ratings, and NEMA sizes required to match motor horsepower.

3. Equip starters with block type manual reset overload relays and with circuit breaker.

4. Provide operating handle for disconnect switch mechanism with indication and control of switch position, with enclosure door either opened or closed, and capable of being locked in OFF position, with a padlock.

5. Starter characteristics shall be the same as specified for magnetic controllers.

6. Provide other accessories as indicated elsewhere in this specification.

2.3 ENCLOSURES

A. Description: Flush- or surface-mounting cabinets as indicated. Provide flush enclosures where starters are located in finished spaces and surface enclosures where starters are located in unfinished areas.

1. Indoor Locations: NEMA 250, Type 12 (unless otherwise noted on project drawings).
2. Outdoor Locations: NEMA 250, Type 3R. Code gauge steel with rust inhibiting primary coat and baked enamel finish.

2.4 ACCESSORIES

A. All magnetic combination non-reversing starters shall be provided with the following. Devices shall be factory installed in controller enclosure, unless otherwise indicated.

1. Overload Relay: Provide three phase solid state overload relay with inherent phase loss and unbalance protection. Size from motor nameplate full load amperage. Unit to be equal to Square D type Motor Logic, Class 20.
2. Provide three phase bi-metallic overload relay with inherent phase loss and unbalance protection. Overload relay shall have automatic resetting capability. Size from motor nameplate full load amperage. Unit to be equal to Square D, Class 20.
3. Push-Button Stations, Pilot Lights, and Selector Switches: NEMA ICS 2, heavy-duty, oil-tight type.
   a. Pilot lights, transformer type - “red” mounted on door to indicate motor running.
   b. Selector switch, 3 position (Hand-Off-Automatic), manual return. Where noted on drawings, starters for exhaust fans shall have a 2 position selector switch, off-automatic.
4. Legend plates, standard, with legends as indicated.
5. Provide on normally open and two normally closed auxiliary contacts.
6. Control circuits:
   a. Voltage not to exceed 120V.
   b. Control transformer mounted in starter enclosure.
   c. Primary fusing
   d. One fuse on secondary conductor
   e. One secondary conductor grounded
   f. Transformer sized for device accessories connected thereto and 25% extra capacity minimum. Minimum size shall be 50 VA.
   g. All starters with control circuits which derive their power from a source other than from the starter itself shall be complete with an auxiliary control circuit disconnect (ACCD) to de-energize the circuit whenever the door or cover to the starter is opened. In the case of combination starters, an auxiliary contact or fourth pole may be added to the disconnect switch in lieu of the ACCD.
7. Phase-Failure and Under voltage Relays: Solid-state sensing circuit with isolated output contacts for hard-wired connection. Provide adjustable under voltage setting.

2.5 SHORT CIRCUIT RATING

A. Short Circuit Rating: The short circuit current rating of the combination starter shall be the same as the upstream overcurrent protection device protecting the starter.

2.6 FACTORY FINISHES

A. Finish: Manufacturer's standard paint applied to factory-assembled and -tested enclosed controllers before shipping.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine areas and surfaces to receive enclosed controllers for compliance with requirements, installation tolerances, and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install in accordance with manufacturer's written instructions, applicable requirements of NEC and NECA's "Standard of Installation" and in accordance with recognized practices.

B. Install by mounting firmly to wall or structural surface.

C. For control equipment at walls, bolt units to wall or mount on lightweight structural-steel channels bolted to wall. For controllers not at walls, provide freestanding racks complying with Section 26 05 29 - Hangers and Supports for Electrical Systems.

D. Enclosed Controller Fuses: Install fuses in each fusible switch. Comply with requirements in Section 26 28 13 - Fuses.

3.3 IDENTIFICATION

A. Identify enclosed controller, components, and control wiring according to Section 26 05 53 - Identification of Electrical Systems.

3.4 CONTROL WIRING INSTALLATION

A. Control wiring, regardless of voltage, shall be the responsibility of the contractor supplying the motor, unless specifically noted otherwise. See project drawings.

3.5 CONNECTIONS

A. Conduit installation requirements are specified in other Division 26 Sections. Drawings indicate general arrangement of conduit, fittings, and specialties.

B. Ground equipment according to Section 26 05 26 - Grounding and Bonding for Electrical Systems.

3.6 FIELD QUALITY CONTROL

A. Prepare for acceptance tests as follows:

1. Megger check of phase-to-phase and phase-to-ground insulation levels. Do not megger check solid state equipment.
2. Test continuity of each circuit.
3. Test each motor and permanently record the following information. Provide schedule with close-out documents.
    a. Motor identification per motor schedule.
    b. Nameplate data.
    c. Overcurrent protection thermal unit - type and size.
    d. Protective relay (if any) setting.
    e. Motor starter overcurrent protective device (if any) - type and size.
    f. Voltage and current phase readings.
    g. Direction of rotation.
    h. Motor starter short circuit rating.
4. Test insulation resistance for each enclosed controller element, bus, and component, connecting supply, feeder, and control circuit.
5. Perform each electrical test and visual and mechanical inspection, stated in NETA ATS, "Motor Control - Motor Starters." Certify compliance with test parameters.
6. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

3.7 ADJUSTING AND CLEANING

A. Adjust covers and operating mechanisms for free mechanical movement.

B. Tighten wire and cable connections.

C. Verify overcurrent protection thermal unit size with motor nameplate to provide proper operation and compliance with NEC.

D. Touch up paint scratched and marred surfaces to match original finish.

END SECTION 26 29 13

SECTION 26 43 13
SURGE PROTECTION DEVICES

PART 1 GENERAL

1.1 SUMMARY

A. The Section includes SPDs for low-voltage power equipment.

B. Provide a complete Surge Protection system as described herein and as documented on the Contract Documents.

C. Provide surge suppression at each building service entrance switchboard or panelboard, and at other locations as indicated on the Contract Drawings.

D. Modes of Protection:

1. SPD units shall provide Line to Line, Line to Neutral, Line to Ground, and Neutral to Ground protection. Reduced mode devices are not acceptable.
2. "Per Phase" ratings are determined by multiplying the kA per mode times the number of discrete modes of protection (directly connected mov's), minus the value for the Neutral to ground mode, divided by the number of phases.
3. Per Phase = (kA per mode minus the N-G mode) X (# of modes) / # of phases.

1.2 COORDINATION

A. Coordinate location of field-mounted surge suppressors to allow adequate clearances for maintenance.

1.3 WARRANTY

A. The manufacturer shall provide unlimited free replacement of the entire SPD (not just modules, components or sub-assemblies) for all inoperable SPD during the warranty period. Minimum warranty period shall be 10 (ten) years. Acceptable manufacturers listed above that do not meet the 10 year warranty as standard shall submit a letter extending the warranty with the product submittal.

1.4 SUBMITTALS FOR REVIEW/RECORD

A. Product Data (Including checklist at the end of this Specification)

1.5 SUBMITTALS FOR RECORD ONLY

A. Test Reports: SPD Inspection Checklist

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturer to be as noted on project drawings or by an acceptable manufacturer. The listing of a manufacturer as "acceptable" does not imply automatic approval. It is the sole responsibility of the Contractor to ensure that any submittals made are for products that meet or exceed the specifications included herein. Subject to compliance with requirements, provide products by the following manufacturer(s) or "prior-approved" equal as described above:

1. Surge Suppression Inc.
2. Control Concepts Inc.
3. Emerson Network Power
4. Equivalent units and manufacturers must meet all performance criteria, and must be approved by the School District during bidding phase.

2.2 GENERAL REQUIREMENTS

A. SPD devices shall be rated for the class of service necessary for the application. Protection shall be provided L-N, L-G, L-L & N-G (Per IEEE Std. 1100-1999 8.6.1 & NEMA LS-1 2.2.7) for all applications.

B. Branch panel units must incorporate "True" sine-wave tracking directly connected protection elements for each and every mode within the electrical system to which it is connected. Products utilizing basic EMI/RFI filter performance specifically will not be considered acceptable as equal to sine-wave tracking and therefore are not to be submitted. Products displaying this capability in any less than ALL MODES will be deemed unacceptable (e.g. L-N only, L-L only or L-G only). Sine-wave tracking capability must be demonstrated by furnishing an ANSI/IEEE Category A, 2kV, 67A, 100kHz Ringwave test as defined in ANSI/IEEE C62, at the 270 degree phase angle, with the "let-through voltage" not to exceed 60V in all modes of the device at the voltage rated for the project. Manufacturers not providing this documentation or meeting this requirement for branch panel locations will be deemed unacceptable.

C. SPD devices shall be designed for AC power systems with a minimum of AC follow current after operation. The surge current rating must be sufficient to meet the requirement of the application at clamp levels below the damage level of the equipment installed.

D. Manufacturer shall provide permanently-connected devices parallel mounted to the service entrance, distribution, and branch panels, and series connected devices as required for individual equipment protection as indicated on Contract Drawings. SPD device drawings shall be made available upon request.

E. SPD circuitry shall include only solid-state clamping components to limit the surge voltage and divert the surge current. SPD components that "crowbar" (e.g. spark gaps, gas tubes, SCR's, etc.) shall not be accepted.

F. Modes: The SPD system shall provide protection for all 10 modes. True distinct and independent protection circuitry for each mode is preferred but not required. Reduced mode SPD with only 3, 4 or 7 dedicated, distinct, independent protection modes are not acceptable and are not to be submitted.

G. Fusing

1. The SPD shall provide as a minimum, over-current, over temperature protection in the form of component-level thermal fusing to ensure safe failure and prevent thermal runaway. Surge protective devices shall contain short circuit current safety fusing within each device where no upstream circuit breaker is specified, per over-current protection requirements of the NEC 2008.
2. The fusing mechanisms employed must effectively coordinate their performance in conjunction with the high current abnormal over-voltage testing under UL 1449 2nd Edition as defined above.
3. The Surge Protection Device (SPD) shall be of a parallel design using fast-acting transient energy protection that will divert and dissipate the surge energy.
4. The SPD shall be self-restoring and fully automatic with a total response time not to exceed 1 nanosecond.
5. The maximum continuous operating voltage shall be capable of sustaining 115% of nominal RMS voltage continuously without degrading in accordance with NEMA LS-1, 1992.
6. The SPD shall be UL listed at or above the available fault current level (shown on project drawings) at the point of SPD application, per UL 1449 3rd Edition, as amended. The SPD shall be marked with the short circuit current rating. The SPD short circuit rating shall be, as a minimum, the same rating as the power distribution equipment to which it is connected.
7. Circuit Configuration: The circuit configuration of the suppression units shall be bi-directional, thermal stress reducing, totally encapsulated, custom parallel and solid state.

H. Features

1. Surge protective devices shall provide on-board visual status of their operational readiness by indicator lights and one set of NO/NC Form C dry relay contacts for remote alarm capabilities.
2. Surge protective devices shall provide an audible alarm to indicate when SPD has failed or lost a phase of protection. Alarm shall have a push-to-test and mute button to ensure the integrity of the alarming system.

I. Maintenance Restrictions: No suppression unit shall be supplied which requires scheduled preventive- maintenance or replacement parts. Units requiring functional testing, special test equipment, or special training to monitor surge protection device (SPD) status are not acceptable. SPD devices shall require no routine maintenance. SPD devices are considered non-repairable items and shall be fully replaced upon failure.

J. Enclosures: Unless otherwise noted, NEMA 12 (or better) enclosures for indoor installations and NEMA 4X or better enclosures for outdoor/wet locations shall be utilized.

PART 3 EXECUTION

3.1 INSTALLATION OF SURGE PROTECTION DEVICES

A. Install devices at service entrance on load side, with ground lead bonded to service entrance ground.

B. Install devices for panelboard and auxiliary panels with conductors or buses between suppressor and points of attachment as short and straight as possible. Do not exceed manufacturer's

recommended lead length. Do not bond neutral and ground. Provide multipole, circuit breaker as a dedicated disconnect for suppressor, unless otherwise indicated.

3.2 PLACING SYSTEM INTO SERVICE

A. Do not energize or connect service entrance equipment and/or panelboards to their sources until surge protection devices are installed and connected.

3.3 FIELD QUALITY CONTROL

A. Electrical Service, Distribution Panels, Branch Panelboards, and Motor Control Centers:

1. Provide surge suppressor at each building service entrance and at other panelboard and motor control center locations as indicated on the drawings. The SPD shall be located immediately adjacent to the switchboard or panelboard being protected (close-nipple to panelboards). [The SPD may not be located integral within the switchboard or panelboard(s) unless the switchgear manufacturer providing such products expressly meets or exceeds ALL parameters of this specification for the SPD devices not meeting or exceeding the performance of this specification will be deemed unacceptable.
2. Install the SPD with #10 AWG minimum conductors to a 30-amp breaker in panel per manufacturer's installation instructions (unless otherwise noted on project drawings). The phase and neutral conductors serving the SPD shall be twisted together (one twist per 12" of lead length) to reduce the SPD system input impedance and kept at the minimum length. The SPD shall be installed in strict accordance with the manufacturer's recommended practices and in compliance with N.E.C. requirements. If the SPD manufacturer requires larger size conductors and breaker, Contractor shall provide conductors and breaker size per manufacturer's requirements. No. 10 conductors and 30 amp breaker size are based on Surge Suppression Inc. requirements. If Contractor chooses to use an alternate manufacturer, Contractor shall provide conductors and breaker size per manufacturer's requirements at no additional cost.
3. If lead lengths exceed 18" the Contractor responsible for installation must contact the surge suppression manufacturer for installation assistance.

B. When installing a series connected SPD, bind the supply side conductors separately from the load side conductors.

END SECTION 26 43 13

SECTION 26 51 00
INTERIOR LIGHTING

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Interior luminaires, lamps, and ballasts.
   2. Emergency lighting units.
   3. Exit signs.

B. Related Sections include the following:
   1. Division 26 Section "Lighting Control Devices" for automatic control of lighting, including time switches, photoelectric relays, occupancy sensors, and multi-pole lighting relays and contactors.
   2. Division 26 Section "Network Lighting Controls" for manual or programmable control systems with low-voltage control wiring or data communication circuits.

1.2 REFERENCES

A. ASTM INTERNATIONAL (ASTM)
   1. ASTM A1008/A1008M (2013) Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardened
   2. ASTM A123/A123M (2013) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
   3. ASTM A368 (1995; R 2013) Standard Specification for Stainless Steel Wire Strand
   4. ASTM A467/A467M (2007; R 2012) Standard Specification for Machine Coil Chain
   5. ASTM A47/A47M (1999; R 2009) Standard Specification for Ferritic Malleable Iron Castings
   6. ASTM A580/A580M (2013b) Standard Specification for Stainless Steel Wire
   7. ASTM A641/A641M (2009a) Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire
   8. ASTM A653/A653M (2013) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
   9. ASTM B164 (2003; R 2008) Standard Specification for Nickel-Copper Alloy Rod, Bar, and Wire
   10. ASTM B26/B26M (2012) Standard Specification for Aluminum-Alloy Sand Castings
   11. ASTM B633 (2013) Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel
   12. ASTM E2129 (2010) Standard Practice for Data Collection for Sustainability Assessment of Building Products

B. ILLUMINATING ENGINEERING SOCIETY OF NORTH AMERICA (IES)

1. IES HB-10 (2011) IES Lighting Handbook

C. INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

1. IEEE C2 (2012; Errata 2012; INT 1-4 2012; INT 5-7 2013) National Electrical Safety Code
2. IEEE C62.41.1 (2002; R 2008) Guide on the Surges Environment in Low-Voltage (1000 V and Less) AC Power Circuits
3. IEEE C62.41.2 (2002) Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and Less) AC Power Circuits
4. IEEE Stds Dictionary (2009) IEEE Standards Dictionary: Glossary of Terms & Definitions

D. NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

1. NEMA 250 (2008) Enclosures for Electrical Equipment (1000 Volts Maximum)

E. NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

1. NFPA 70 (2014; AMD 1 2013; Errata 1 2013; AMD 2 2013; Errata 2 2013) National Electrical Code
2. NFPA 90A (2012) Standard for the Installation of Air Conditioning and Ventilating Systems

F. U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)

1. Energy Star (1992; R 2006) Energy Star Energy Efficiency Labeling System (FEMP)

G. UNDERWRITERS LABORATORIES (UL)

1. UL 1029 (1994; Reprint Dec 2013) High-Intensity-Discharge Lamp Ballasts
2. UL 1598 (2008; Reprint Oct 2012) Luminaires
3. UL 844 (2012) Standard for Luminaires for Use in Hazardous (Classified) Locations
4. UL 935 2001; Reprint Dec 2013) Standard for Fluorescent-Lamp Ballasts

H. INTERNATIONAL CODE COUNCIL (ICC)

1. International Energy Conservation Code (IECC) 2009

1.3 QUALITY ASSURANCE

A. Equivalency of luminaires is determined by Engineer and includes the following data for comparative purposes.

1. Efficiency.
2. Efficacy.
3. Distribution.
4. Construction.
5. Design compatibility.
6. Manufacturer reliability based upon past performances.

B. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by manufacturers' laboratories that are accredited under the National Volunteer Laboratory Accreditation Program for Energy Efficient Lighting Products.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100 by a testing agency acceptable to authorities having jurisdiction, and marked for intended location and application.

D. Comply with NFPA 70.

E. FM Global Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class, division, and group of hazard by FM Global.

F. Mockups: Provide interior luminaires for room or module mockups, complete with power and control connections.

1. Obtain Architect's approval of luminaires for mockups before starting installations.

1.4 COORDINATION

A. Coordinate layout and installation of luminaires and suspension system with other construction that penetrates ceilings or is supported by them, including HVAC equipment, fire-suppression system, and partition assemblies.

1.5 WARRANTY

A. Special Warranty for Emergency Lighting Batteries: Manufacturer's standard form in which manufacturer of battery-powered emergency lighting unit agrees to repair or replace components of rechargeable batteries that fail in materials or workmanship within specified warranty period.

1. Warranty Period for Emergency Lighting Unit Batteries: Five years from date of Substantial Completion. Full replacement warranty shall apply for the full five years.

B. Special Warranty for Drivers: Manufacturer’s standard form in which driver manufacturer agrees to repair or replace ballasts that fail in materials or workmanship within specified warranty period.

1. Warranty Period for LED Drivers: Five years from date of Substantial Completion.

C. Special Warranty for LED Fixtures: Manufacturer's standard form, made out to Owner and signed by lamp manufacturer agreeing to replace lamps that fail in materials or workmanship, f.o.b. the nearest shipping point to Project site, within specified warranty period indicated below.

1. Warranty Period: Two year(s) from date of Substantial Completion.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide product indicated on Drawings where only one manufacturer is listed, provide one of the products indicated on Drawings where multiple manufacturers are listed. All fixtures shall be Digitial Lighting Consortium (DLC) certified and approved for the Illinois Department of Commerce & Economic Opportunity energy grant program.

2.2 GENERAL REQUIREMENTS FOR LUMINAIRES AND COMPONENTS

A. Provide luminaires of the size, type and rating indicated in “Lighting Fixture Schedule”, complete with, but not necessarily limited to, lamps, lampholders, reflectors, ballasts, drivers, starters, wiring and any other accessories required for a complete working installation.

B. Luminaire catalog numbers do not necessarily include all accessories and are intended to serve as a guide in defining types and manufacturers of luminaire only.

C. The contractor shall ensure that the luminaire is UL listed for the ambient conditions where installed. Extra compensation will not be permitted for failure to coordinate luminaires with their ambient conditions.

1. Luminaires located exterior to the building and/or in unconditioned damp spaces and under cover from direct weather exposure shall be UL listed as “Suitable for Damp Locations” unless noted otherwise.
2. Luminaires located exterior to the building and/or in unconditioned wet spaces and in direct contact with the weather or in washdown areas shall be UL listed as “Suitable for Wet Locations” unless noted otherwise.

D. Luminaires installed with direct contact with insulation shall have an “IC” rating for direct contact with insulation. Verify if luminaires will be in contact with insulation prior to installation. Notify Architect/Engineer of any conflicts.

E. Gasketing material shall be vinyl or other non-aging type material as approved by Engineer.

F. Metal Parts: Free of burrs and sharp corners and edges.

G. Sheet Metal Components: Steel, unless otherwise indicated. Form and support to prevent warping and sagging.

H. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.

I. Diffusers, Covers, and Globes:

1. Acrylic Luminaire Diffusers: Plastic for clear lenses and diffusers shall be formed of colorless 100% virgin acrylic, as manufactured by Atohaas, DuPont or equally acceptable manufacturer. The quality of the raw material must meet or exceed IES, SPI, and NEMA Specifications and shall not exceed a yellowness factor of 3 after 2,000 hours of exposure in the Fade-meter or as tested by an independent testing laboratory. Acrylic plastic lenses and diffusers shall be properly cast, molded or extruded as specified, and shall remain free of any dimensional instability, discoloration, embrittlement, or loss of light transmittance for at least 10 years.
   a. Lens Thickness: At least 0.125 inch (3.175 mm) minimum unless different thickness is indicated.
   b. UV stabilized.
2. Glass: Glass used for lenses, refractors, and diffusers in incandescent luminaires shall be tempered for high impact and heat resistance; where clear glass has been specified, the glass shall be crystal clear in quality with a transmittance of not less than 88%. Where luminaire glass lenses are specified glass lenses shall be provided and plastic lenses shall not be substituted.

J. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps and ballasts. Labels shall be located where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.

2.3 LED LUMINAIRES

A. LED luminaires shall provide a continuous and controllable light source. Lamp output and dimensions shall be in accordance with contract drawings and specifications. LED luminaire lumen output will be in accordance with the specifications and shall not depreciate more than 20% after 10,000 hours of use. Rated lumen output for LED luminaires to operate in ambient temperature of minus 4°F / -20°C to 122°F / +50°C. Luminaires to have minimum life of 50,000 hours.

B. All LEDs used in the LED luminaires will be of high brightness and proven quality. All LEDs shall be driven digitally with pulse width modulation control to prolong life and maintain consistency of lumen output.

C. All connections to luminaires will be reverse polarity protected and provide high voltage protection in the event connections are reversed or shorted during the installation process.

D. Fuse Protections: All power supply outputs will be either fuse protected or PTC-protected as per Class 2 UL listing. All luminaires will have built-in fuse protection. All power supplies will provide for knockouts for conduit connections or clamp-style connection for the low-voltage wiring.

2.4 LED DRIVERS (POWER SUPPLIES)

A. All LED drivers to be compatible with LEDs. All LED luminaires and drivers (power supplies) shall be furnished by single manufacture to insure compatibility.

B. Electric Characteristics (at 77°F (25°C) ambient temperature).
   1. Input Voltage Range - 108V to 132V.
   2. Efficiency Minimum - 80%.
   3. Output Current Regulation Range (+/-) 5%A.
   4. Total Harmonic Distortion (THD) - 20% maximum.
   5. Power Factor - 0.9 minimum.
   6. Crest Factor (LED Current) - 1.5 maximum.
   7. FCC Class B for Conducted EMI.
   8. FCC Class A for Radiated EMI.
   9. Drivers life - 50,000 hours minimum.

2.5 EXIT SIGNS

A. Description: Comply with UL 924; for sign colors, visibility, luminance, and lettering size, comply with authorities having jurisdiction.

B. Internally Lighted Signs:
   1. Lamps for AC Operation: LEDs, 50,000 hours minimum rated lamp life.
   2. AC/Battery Powered Exit Signs: Integral automatic charger in a self-contained power pack.
      a. Battery: Sealed, maintenance-free, nickel-cadmium type.
      b. Charger: Fully automatic, solid-state type with sealed transfer relay.

c. Operation: Relay automatically energizes lamp from battery when circuit voltage drops to 80 percent of nominal voltage or below. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
d. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
e. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.

2.6 LUMINAIRE SUPPORT COMPONENTS

A. Comply with Division 26 Section "Hangers and Supports for Electrical Systems" for channel- and angle-iron supports and nonmetallic channel and angle supports.

B. Wires: ASTM A 641/A 641M, Class 3, soft temper, zinc-coated steel, 12 gauge (2.68 mm), minimum.

C. Wires for Humid Spaces: ASTM A 580/A 580M, Composition 302 or 304, annealed stainless steel, 12 gauge (2.68 mm), minimum.

D. Rod Hangers: 3/16-inch (5-mm) minimum diameter, cadmium-plated, threaded steel rod.

PART 3 EXECUTION

3.1 INSTALLATION

A. Verify adequacy of headroom and non-interference with other equipment such as ducts, pipes and openings. Report to Architect/Engineer any conflict between these plans and electrical documents.

B. Install luminaires in mechanical and unfinished areas after ductwork and piping installation. Adjust luminaire locations to provide the best lighting for equipment access and service locations. Locate luminaires 8’-6” (2600 mm) above floor or at suitable locations within space or on walls but not lower than 7’-0” (2200mm).

C. Adjustable luminaires shall be aimed as directed by Architect/Interior Designer/Engineer.

D. Special care shall be taken to assure light-tight joints between recessed luminaires and ceiling systems.

E. Install luminaires in a workmanlike manner. Care shall be taken in placement of luminaire outlets and surface-mounted luminaires to maintain alignment, spacing, layout, and general arrangement shown on drawings. Contractor may vary these dimensions slightly in order to clear obstructions. Any major changes in the arrangement must be approved by Engineer.

F. Luminaires: Set level, plumb, and square with ceilings and walls. Install lamps in each luminaire.

G. Coordinate with trades so luminaires are properly aligned with items such as diffusers, grilles, and speakers.

H. If necessary, relocate luminaires as directed by engineer so there will be no conflict with other equipment.

I. Make luminaire holes for wire entrance with knock-out punches or hole saw, remove burrs. Do not cut holes with tinsnips.

J. Connect wiring according to Division 26 Section 260519 "Low-Voltage Cables."

K. Clean luminaires of dirt and debris prior to acceptance.

L. Maintain clearance as required in Section 410-66 of the NEC and other NFPA sections. Notify Engineer of any conflict, prior to rough-in.

M. Comply with all relevant Federal, State, Local and Agency guidelines when disposing of lighting waste.

3.2 IDENTIFICATION

A. Install labels with panel and circuit numbers on concealed junction and outlet boxes. Comply with requirements for identification specified in Division 26 Section 260533 "Identification for Electrical Systems".

3.3 FIELD QUALITY CONTROL

A. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery and retransfer to normal.

B. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

END SECTION 26 51 00

SECTION 26 91 00
FIELD ACCEPTANCE REPORTS

PART 1 GENERAL

1.1 SUMMARY

A. The requirements of this Section apply to, and are a component part of, the 26, 27 and 28 series project specifications, as noted in individual specifications.

1.2 SUBMITTALS FOR REVIEW/RECORD

A. Submit all field acceptance reports noted in this specification according to the requirements of the individual specifications. Submission should be under each respective specification section, as required, and not this Section.

PART 2 EXECUTION

2.1 INSTALLATION CHECKLISTS / ACCEPTANCE TESTS / REPORTS

A. Complete all as noted, per individual 26, 27 and 28 series project specifications, in Attachment A.

2.2 TEST REPORT AND CHECKLIST COMPLETION LOG

A. Maintain and complete log provided in Attachment A

ATTACHMENT A

CABLE REEL INSPECTION

TO BE COMPLETED IF:

Any visible signs of defect when received (Attach Photos)
- - OR - -
Manufacturer's certified test report is NOT included with cable upon delivery
- - OR - -
Difference between ordered cable and received cable

Basic Reel Info	
Cable ID	
Manufacturer's Name	
Conductor Material	
Conductor Size	
Insulation Type	
Insulation Thickness	
Jacket Thickness	
Temperature Rating	
Length of Cable	
Voltage Class	
Shielded/Non-Shielded	
Date of Manufacture	
Inspection Date	
Inspector Identity	

Fill out available info via reel label or cable jacket.

Date:
Checked By:
Notes:

COVER SHEET

TO BE COMPLETED FOR: *(check one)*

□ **Factory Test Report**

□ **Vendor Start-Up / Field Test Report**

□ **Other:_____.**

Product Information	
Specification Section	
Job Name and Number	
Date	
Foreman	
Equipment ID	
Equipment Type	
Manufacturer	
One-Line Sheet	

Notes:

DELTA-WYE TRANSFORMER ACCEPTANCE TEST

CUSTOMER:
SUBSTATION/LOCATION:
MANUFACTURER:
SERIAL NUMBER:
VOLTAGE RATIO:
COOLING CLASS
WINDING TEMPERATURE: °C

KVA SIZE:
DEGREE C RISE:
PERCENT IMPEDANCE:
DRY [ ] LIQUID FILLED [ ]
GALLONS OF FLUID:
AMBIENT TEMPERATURE: °C
TESTED BY & DATE :

MECHANICAL INSPECTION	AS FOUND	AS LEFT
GENERAL CLEANLINESS		
TEMPERATURE GAUGE		
PRESSURE GAUGE		
LIQUID LEVEL GAUGE		

CONDITIONS RATINGS
A-EXCELLENT B-GOOD
C-FAIR D-POOR
E-REQUIRES REPLACEMENT
NA-NOT APPLICABLE

Remove all shipping wire, blocking devices, shipping braces and tags [ ]

Check that frame is physically connected to ground conductors [ ]

inspect all electrical connections that are accessible and relays, meters, alarms for proper mounting [ ]

X WHEN ITEM IS COMPLETE

INSULATION RESISTANCE IN [X] megohms [ ] microamps @__5__KV DC	X - GND	H - GND	X - H

TURNS RATIO CONNECTION	TAP	CALCULATED TURN RATIO	MEASURED TURN RATIO
$\frac{H_1 - H_3}{X_1 - X_0}$	A		
	B		
	C		
	D		
	E		
$\frac{H_2 - H_1}{X_2 - X_0}$	A		
	B		
	C		
	D		
	E		
$\frac{H_3 - H_2}{X_3 - X_0}$	A		
	B		
	C		
	D		
	E		

COMMENTS:

GROUNDING & BONDING INSTALLATION CHECKLIST

Job Name	Job Number	Building Name
PM	Foreman	QA/QC Inspector
Date	ID	One Line Sheet

ID	NOTES:	YES	NO	N/A	INITIALS
1	Is the system in compliance with drawings, specifications, and NFPA 70 NEC Article 250?				
2	Have physical and mechanical conditions been inspected for continuity?				
3	Are the bolted connections torqued per specification? *(NETA Table 100.12.1)*				
4	Are all conduits properly bonded?				
5	Are the grounding system's electrical and mechanical connections free of corrosion?				
6	Is the Megger Test complete and acceptable? *(NETA Table 100.1)*				
7	Has the Point-to-Point Test been completed to determine the resistance between the main grounding system and all major electrical equipment frames, system neutral, and derived neutral points?				
8	Is the resistance between the main grounding electrode and ground under 5 ohms?				
9	Have the measurements been recorded on the grounding riser one-line for record under As-Builts?				

NOTES: Provide reasoning or actions to be taken for items with "Negative" responses.

LOW-VOLTAGE CABLE CHECKLIST

Job Name	Job Number	Building Name
PM	Foreman	QA/QC Inspector
Date	Circuit ID	Cable Type
Voltage Rating	Current Rating	One Line Sheet

ID	DESCRIPTION	YES	NO	N/A	INITIALS
1	Is the cable marking sufficient for the voltage application?				
2	Is the conductor material and size per the drawings?				
3	Is the bending radius acceptable? *(NETA Table 100.22)*				
4	Is the Megger Test complete and acceptable? *(NETA Table 100.1)*				
5	Are the bolted connections torqued per specification? *(NETA Table 100.12.1)*				
6	Are all phase IDs and cable IDs securely in place and acceptable?				
7	Are termination cabinets clean and free of debris?				

NOTES: ***(Provide reasoning or actions to be taken for items with "Negative" responses)***

MEGGER TEST REPORT

Job # and Name	Date	Panel
Description	Conductor Size	Raceway Type
Cable Length	Insulation Type	Pipe #

TEST RESULTS

Megger Test Voltage:	**1000 V**
PHASE A to GROUND	Ω
PHASE B to GROUND	Ω
PHASE C to GROUND	Ω
PHASE A to PHASE B	Ω
PHASE A to PHASE C	Ω
PHASE B to PHASE C	Ω
PHASE A to NEUTRAL	Ω
PHASE B to NEUTRAL	Ω
PHASE C to NEUTRAL	Ω
NEUTRAL to GROUND	Ω

*Fill out what applies

NOTES:

TESTED BY: _____

PANELBOARD INSTALLATION CHECKLIST

Job Name	Job Number	Building Name
PM	Foreman	QA/QC Inspector
Date	Equipment ID	Manufacturer
Voltage Rating	Current Rating	One Line Sheet

ID	DESCRIPTION	YES	NO	N/A	INITIALS
1	Is the unit free of visible damage?				
2	Does the equipment nameplate data match the drawings and specifications?				
3	Is the unit properly labeled with ID tags and warnings?				
4	Are all conductors labeled correctly?				
5	Is the panel installed per drawings?				
6	Is the circuit directory installed and complete?				
7	Are the breakers correctly sized and located per the drawings?				
8	Have all breakers been manually operated and function correctly?				
9	Are the trip units set per the coordination study if required?				
10	Are feeder wires, neutral, and ground sized per plan and specifications?				
11	Has the continuity been checked phase to ground?				
12	Is the unit properly grounded and bonded?				
13	Are bolted connections torqued per specifications? *(NETA Table 100.12.1*)				
14	Is the interior clean and free of debris?				
15	Has the unit been completely closed? *(all covers and filler plates installed and KOs sealed)*				
16	Are all wires correctly phased? *(A-B-C left to right)*				
17	Is the Megger Test complete and acceptable? *(NETA Table 100.1)*				

NOTES: ***(Provide reasoning or actions to be taken for items with "Negative" responses)***

SWITCHBOARD INSTALLATION CHECKLIST

Job Name	Job Number	Building Name
PM	Foreman	QA/QC Inspector
Date	Equipment ID	Manufacturer
Voltage Rating	Current Rating	One Line Sheet

ID	DESCRIPTION	YES	NO	N/A	INITIALS
1	Is the unit free of visible damage?				
2	Does the equipment nameplate data match the drawings and specifications?				
3	Is the unit properly labeled with ID tags and warnings?				
4	Are all conductors labeled correctly?				
5	Is the switchboard installed per drawings?				
6	Have all lifting hardware and packing supports been removed?				
7	Are the field installed sections correctly bolted together per manufacturer's specifications?				
8	Are all bus ties, including the ground, correctly installed and torqued to manufacturer's specifications?				
9	Are the breakers correctly sized and located per the drawings?				
10	Have all breakers been manually operated and function correctly?				
11	Are the trip units set per the coordination study if required?				
12	Are feeder wires, neutral, and ground sized per drawings and specifications?				
13	Has the continuity been checked phase to ground?				
14	Is the unit properly grounded and bonded?				
15	Are bolted connections torqued per specifications? *(NETA Table 100.12.1*)				
16	Is the interior clean and free of debris?				
17	Has the unit been completely closed? *(all covers and filler plates installed and KOs sealed)*				
18	Are all wires correctly phased? *(A-B-C left to right)*				

ID	DESCRIPTION	YES	NO	N/A	INITIALS
19	Is the Megger Test complete and acceptable? *(NETA Table 100.1)*				
20	Are all low-voltage cables installed per drawings and specifications?				
21	Do the indicating lamps and mechanical interlocks function properly?				

NOTES: ***(Provide reasoning or actions to be taken for items with "Negative" responses)***

Job # and Name: **Specification Section:**

TEST REPORT & CHECKLIST COMPLETION LOG

DATE	TYPE OF REPORT	DESCRIPTION OF ITEM	FILLED OUT BY	FOREMAN'S NOTES/DATE SUBMITTED

TRANSFORMER INSTALLATION CHECKLIST

Job Name	Job Number	Building Name
PM	Foreman	QA/QC Inspector
Date	Equipment ID	Manufacturer
Voltage Rating	kVA Rating	One Line Sheet

ID	DESCRIPTION	YES	NO	N/A	INITIALS
1	Is the unit free of visible damage?				
2	Does the equipment nameplate data match the drawings and specifications?				
3	Are all conductors labeled correctly?				
4	Is the transformer and pad installed per drawings?				
5	Are all conduit stub-ups in the correct size and location per drawings?				
6	Is the transformer properly anchored per the project seismic requirements and manufacturer's specifications?				
7	If installed, have any of the impact indicators been triggered?				
8	Are feeder wires, neutral, and ground sized per drawings and specifications?				
9	Has the continuity been checked phase to ground?				
10	Is the unit properly grounded and bonded?				
11	Are bolted connections torqued per specifications? *(NETA Table 100.12.1*)				
12	Is the interior clean and free of debris?				
13	Has the unit been completely closed? *(all covers and filler plates installed and KOs sealed)*				
14	Are all wires, primary and secondary, correctly phased? *(A-B-C left to right)*				
15	Are the taps set as specified or in the normal position?				
16	Has the Transformer Acceptance Test been completed, including the Insulation Resistance and Turns Ratio tests?				

MEDIUM-VOLTAGE TRANSFORMERS ONLY					
ID	**DESCRIPTION**	**YES**	**NO**	**N/A**	**INITIALS**
17	Are all low-voltage cables installed per drawings and specifications?				
18	Do all the doors freely open and close?				
19	Is the unit secured with a locking device?				

NOTES: ***(Provide reasoning or actions to be taken for items with "Negative" responses)***

END OF SECTION 26 91 00